RECEIVED
Nov. 27, 2024
DIVISION OF OIL, GAS AND MINING

Form MR-REV-att (DOGM – Revise/Amend Change Form)
(Revised September 14, 2005)

Application for Mineral Mine Plan Revision or Amendment

Operator: Milford Mining Company Utah LLC

Mine Name: Milford Copper Operation **File Number: M/** 001 /0067

Provide a detailed listing of all changes to the mining and reclamation plan that will be required as a result of this change. Individually list all maps and drawings that are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise or amend the existing Mining and Reclamation Plan. **Include page, section and drawing numbers as part of the description.**

DETAILED SCHEDULE OF CHANGES TO THE MINING AND RECLAMATION PLAN

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☒ REPLACE	☐ REMOVE	Replace whole NOI with updated Milford Mining Company Utah LLC NOI
☐ ADD	☒ REPLACE	☐ REMOVE	Rename mine from Hidden Treasure to Milford Copper Operation
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
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☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments and obligations, herein.

BRENDAN MOSELEY
Print Name

CEO
Sign Name, Position

11/18/24
Date

Return to:

State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801
Phone: (801) 538-5291 Fax: (801) 359-3940

FOR DOGM USE ONLY:
File #: M/ /
Approved:
Bond Adjustment: from ($)
to $

O:\FORMS\MR-REV-att.doc

STATE OF UTAH

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
1594 West North Temple Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801
Telephone: (801) 538-5291 Fax: (801) 359-3940

U.S. BUREAU OF LAND MANAGEMENT
Cedar City Field Office
176 East D.L. Sargent Drive
Cedar City, UT 84721
Phone: (435) 865-3000

Joint form for submitting a NOTICE OF INTENTION TO COMMENCE LARGE MINING OPERATIONS to the Utah Division of Oil, Gas and Mining, and a PLAN OF OPERATIONS to the United States Department of the Interior, Bureau of Land Management (BLM)

The informational requirements in this form are based on provisions of the Mined Land Reclamation Act, Title 40-8, Utah Code Annotated 1953, General Rules and Rules of Practice and Procedures.

> **This form applies only to mining operations which disturb or will disturb more than five acres in an incorporated area or ten acres in an unincorporated area at any given time (UDOGM), or exceed 5 acres of surface disturbance (BLM).**

"MINING OPERATIONS" means those activities conducted on the surface of the land for the exploration for, development of, or extraction of a mineral deposit, including, but not limited to, surface mining and the surface effects of underground and in situ mining, on-site transportation, concentrating, milling, evaporation, and other primary processing.

"Mining operation" does not include: the extraction of sand, gravel, and rock aggregate; the extraction of oil and gas as defined in Chapter 6, Title 40; the extraction of geothermal steam; smelting or refining operations; off-site operations and transportation; or reconnaissance activities which will not cause significant surface resource disturbance or involve the use of mechanized earth-moving equipment such as bulldozers or backhoes.

Cultural Resources: To fulfill its obligations under Utah Code Annotated 9-8-404, the Division needs cultural resource (archaeology) information. The amount and type of information required will depend on the mine location, the history of previous disturbance, and other factors. Please contact the Division for further information.

MILFORD MINING COMPANY
UTAH

NOTICE OF INTENTION
TO CONDUCT LARGE MINING OPERATIONS

MILFORD MINING COMPANY UTAH, LLC
MILFORD COPPER OPERATION
LARGE MINE PERMIT M/001/0067

August 2024

Submitted By:
Milford Mining Company Utah, LLC
1208 South 200 West
P.O. Box 827
Milford, Utah 84751

To:
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

Prepared By:
Milford Mining Company Utah, LLC

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R647-4-104 Owner/Operator

Confidential Information Disclaimer

Section *40-8-13(2)* of the *Mined Land Reclamation Act* and *R647-4-115* of the *Mineral Mining Rules* provides for maintenance of confidentiality concerning certain portions of this report. Please check to see that any information desired to be held confidential is so labeled and included on separate sheets or maps. *Only information relating to the location, size or nature of the deposit may be protected as confidential*.

Confidential Information as defined in R647-4-115 Enclosed: **Yes**

Background

Milford Mining Company Utah, LLC (The Operator) owns and controls approximately 1,280 acres of private land, 700 acres of State School Trust land, and about 9,460 acres of BLM unpatented mining claims within the 11,440-acre mine permit area, which is located seven miles northwest of Milford in Beaver County, Utah (Figure1).

Mining in the Milford District dates back to 1872, with intermittent production of copper as well as iron and tungsten. The area has been developed over the years under a series of owner/operators including, most recently, Nevada Star Resource Corporation (Nevada Star), Western Utah Copper Company (WUCC), CS Mining, LLC (CSM), and Tamra Mining Company, LLC (TMC). The following is a summary of the operation from 1998 to current:

- **August 1998:** the Utah Division of Oil, Gas and Mining (DOGM) issued tentative approval to Nevada Star under DOGM permit M/001/039 for the OK Mine Project, which consisted of a 57-acre heap leach pad, the re-mining and processing of stockpiled copper ore, mining and deepening of the OK pit, and development of the Mary I pit directly to the east of the OK pit. The total affected acreage under that plan was 277 acres. Bonding was not provided under this permit.
- **2002**: Nevada Star requested that DOGM convert the permit back to a Small Mine Operation (SMO) permit. DOGM did so on November 12, 2002, converting the Large Mine Operation (LMO) permit under M/001/039 to S/001/039 with a small mine status and limitations.
- **June 2002**: WUCC submitted a Notice of Intent (NOI) to Commence Small Mining Operations for the Hidden Treasure/Maria, S/001/0061. This was submitted to allow construction of the processing pad for the WUCC concentrator. However, later in June 2002, DOGM issued a Cessation Order for the operations due to WUCC going outside of the 5-acre permit boundary.
- **2002:** WUCC submitted a NOI for Large Mine Operations (LMO) for an underground mine at

the Maria and for construction of the concentrator, M/001/0059. This LMO was never activated, and the Serial Number closed out on June 29, 2005, along with the Small Mine Operations: S/001/0060, S/001/0061, and S/001/0054.

- **May 2005:** WUCC submitted an NOI LMO for the Milford Copper Operations (MCO) formerly known as the the Hidden Treasure Mine M/001/0067. This received tentative approval from DOGM on September 19, 2005. DOGM also approved the transfer of the Small Mine Permit S/001/0039 from Nevada Star to WUCC, who then transferred this Small Mine Permit to the tentatively approved Milford Copper Operations LMO M/001/0067. The Milford Copper Operations LMO was approved June 8, 2007.
- **2010:** WUCC declared Chapter 11 bankruptcy, after which CSM acquired the property in November 2011.
- **December 16, 2011:** DOGM approved the transfer from WUCC to CSM of the MCO M/001/0067, and the Bawana Low Grade Ore Piles, S/001/0076.
- **January 3, 2012:** DOGM approved an amendment to the NOI LMO M/001/0067, allowing CSM to begin construction of the flotation tailings pond.
- **On August 8, 2012:** DOGM approved the amendment to the LMO M/001/0067 for the addition of the Bawana Mine Extension and for the placement of tails in the flotation tailings pond. This amendment also includes variances for open pit high walls and impoundments.
- **Since August 2012:** numerous amendments have been submitted by CSM, including:
- **September 4, 2012:** Variance approval for highwall variance and impoundment variance.
- **November 1, 2013:** Conditional approval for Sunrise haul road.
- **January 1, 2014:** Conditional approval for mining activities in the Sunrise Mine area.
- **March 19, 2014:** Notice of Tentative approval for the Revision of the LMO for the Milford Copper Operations.
- **September 17, 2014:** Conditional approval to begin construction of the ITDF.
- **October 8, 2014:** Conditional approval of the revised NOI for LMO, Milford Copper Operations.
- **April 10, 2015:** Conditional approval for the Maria pit expansion
- **July 10, 2015:** Conditional approval for the Copper Ranch Mini Pit
- **September 4, 2015:** Conditional approval for the Copper Ranch Intermediate Pit
- **June 2016:** CSM declared Chapter 11 bankruptcy. During the bankruptcy process, CSM continued to amend the NOI in order to continue operations.
- **August 28, 2017:** TMC acquired the property.
- **Since 2019:** TMC shuts down the MCO and enters a period of care and maintenance.
- **July 2023** The Operator (MMCU) acquired the property.

This NOI, dated **August 2024**, is the latest submittal for the Milford Copper Operations.

Owner Operator Information

Mine Name: Milford Copper Operations (MCO)

Name of Permittee/ Operator/ Applicant: Milford Mining Company Utah, LLC

Type of Business: Corporation registered to do business in the State of Utah

Entity #: 13248802-0161

Registered Agent Information:
Registered Agents Inc.
Phone: (801)-208-8385
Fax: (435) 387-5156
Email: service@llcagent.com

Permanent Address:
1208 S. 200 W., P.O. Box 827
Milford, UT 84751
Phone: 435-387-2000
Fax: 435-387-2567

Company Principals and Company Representative:
Principals: Brendan Moseley

On-Site Representative: Brendan Moseley, CEO
Address:
1208 S. 200 W., P.O. Box 827
Milford, UT 84751
Phone :435-387-2000
Fax :435-387-2567
E-mail address : brendan.moseley@milfordmining.com

Location of Operation:
Beaver County, Utah
T. 27 S. R. 11 W., SLBM
Parts of Sections 5-8, 15-17, 20-23, 26-28, and 34.
T. 26 S., R. 11 W., SLBM
Part of Section 31

Ownership of the Surface and Mineral Rights:

Table 1: Ownership of Surface and Mineral Rights

Surface Owner	Mineral Owner	Address
Milford Mining Company Utah, LLC.	Same	PO Box 827 Milford UT 84751
Beverly Bealer Prodzinski	Same	PO Box 271 Milford UT 84751
D. Carrol McCully	Same	PO Box 1108 Beaver UT 84713
AJL Corporation (John Bogdanich)	Same	PO Box 1692 Kilgore TX 75663
BLM	Same	440 W 200 S Ste 500 Salt Lake City UT 84101
Sate of Utah (SITLA)	Same	675 E 500 S Ste 500 Salt Lake City UT 84102

BLM Lease or Project File Number(s):

Table 2: BLM Lease or Project Number

(Complete List can be downloaded from the BLM's LR-2000)

Agency	Lease or Claim Number	Agency	Lease or Claim Number
BLM – Placer Claims	Bingham 10, 12, 14, 33	BLM – Lode Claims	UMC355031
BLM – Placer Claims	UMC401581	BLM – Lode Claims	UMC355033
BLM – Placer Claims	UMC401583	BLM – Lode Claims	UMC355035
BLM – Placer Claims	UMC402036	BLM – Lode Claims	UMC355074
BLM – Lode Claims	Rocky 11-14, 23-32, 44, 58, 61	BLM – Lode Claims	UMC355076
BLM – Lode Claims	RTL 17-19, 21-27, 29, 31, 33	BLM – Lode Claims	UMC355078
BLM – Lode Claims	Blu 2, 4, 6, 8, 10, 16, 18, 20, 22, 24	BLM – Lode Claims	UMC355080
BLM – Lode Claims	SOK 40-42, 55	BLM – Lode Claims	UMC355082
BLM – Lode Claims	Quag 25, 26, 38, 39	BLM – Lode Claims	UMC358572
BLM – Lode Claims	QF 5-7	BLM – Lode Claims	UMC358574
BLM – Lode Claims	KB 16, 17	BLM – Lode Claims	UMC413071-413073
BLM – Lode Claims	BF 1-3	BLM – Lode Claims	UMC413086
BLM – Lode Claims	UMC355101-355104	BLM – Lode Claims	UMC356294
BLM – Lode Claims	UMC355000-355009	BLM – Lode Claims	UMC356295
BLM – Lode Claims	UMC355116	BLM – Lode Claims	UMC356307
BLM – Lode Claims	UMC355012	BLM – Lode Claims	UMC356308
BLM – Lode Claims	UMC355016	BLM – Lode Claims	UMC408346-408348
BLM – Lode Claims	UMC355133-355135	BLM – Lode Claims	UMC355275
BLM – Lode Claims	UMC355025-355029	BLM – Lode Claims	UMC355276
BLM – Project #	UTU-082071	BLM – Lode Claims	UMC417665-417667
BLM – Project #	UTU-091507		

SITLA Lease or Project File Number(s):

SITLA Ore Transfer Station (ML-49556)

Other Federal, State, or Local Authorizations / Permits (*43 CFR 3809.401(b)*)

Table 3: Federal, State, and Local Authorizations

Agency	Authorization or Permit Number	Type of Authorization/Permit
DOGM	S/001/0282	LM-SMO Essex Tailings Project
BLM	DOI-BLM-UT-C010-2014-0061-EA	Milford Operations Area Project Expansion EA
BLM	DOI-BLM-UT-C010-2013-0053-EA	Sunrise Mine EA
BLM	DOI-BLM-UT-C010-2012-0020-EA	Hidden Treasure Mine EA
BLM	DOI-BLM-UT-C010-2009-0054-EA	Sunrise Exploration Permit EA
BLM	DOI-BLM-UT-C010-2009-0061-EA	Bawana Stockpile Removal EA
BLM	DOI-BLM-UT-C010-2009-0027	Copper Ranch Exploration
BLM	EA UT-040-06-34	Candy B Exploration
DAQ	DAQE-GN142190005-23	Air Quality Permit
DWQ	UGW010014	Tailings Facilities, Process Water Ponds
DEQ	UTRI00264	MSGP for SWPPP

Adjacent Land Owners: *BLM, SITLA*

Have the land, mineral, and adjacent landowners been notified in writing?

All lands adjacent to the OK operation are owned or leased by The Operator. Lands in and surrounding the Rocky Range mining area are either owned or leased (McCulley and Wood) by The Operator or managed by the BLM, who have been notified. In addition, the mine haul road goes through a State section, however this haul road is within the 100-foot County right-of-way. The County has been notified.

Does the Permittee/ Operator have legal right to enter and conduct mining operations on the land covered by this notice?

Yes

R647-4-105 Maps, Drawings, and Photographs

The maps included in this document are those required under R647-4-105 and show the following features from aerial photogrammetry and topography:

- Property boundaries
- Pre-act disturbed boundaries
- Access routes
- Existing and proposed impact areas
- Existing and proposed surface facilities
- Reclamation treatments

There are no perennial streams, springs, other bodies of water, landing strips, or oil and gas pipelines within 500 feet of the proposed mining operations.

Roads, buildings, electrical transmission lines, water wells and other existing surface facilities are shown on one or more maps.

A number of areas that were disturbed by previous operators prior to the implementation of the Utah Mined Land Reclamation Act will not be used by The Operator and therefore, The Operator is not responsible for their reclamation. These areas are outlined in **Figures 1, 2, and 9**.

Figures submitted as part of this NOI are updated figures. In the case of conflicts between previously submitted maps, figures, or tables, the information presented in this NOI takes precedence. Figures that were submitted as part of previous NOI submittals and are referenced in this revision are noted as **Previously Submitted.**

Photo List for the MCO:

Photo 2: MMCU - General Area Mill Site
Photo 2A: MMCU - Detailed Mill Site
Photo 3: MMCU - Copper Ranch Complex
Photo 4: MMCU - Rocky Range Pits & Facilities
Photo 5: Mine Ops – Truck Shop

Supplemental Information:

Supplemental Information including Air Quality Permit, Ground Water Discharge Permit, Construction Permits, and other supporting documentation has been provided to the Division in PDF Form in the Appendices. Information that has been previously submitted to the Division is considered supplemental to this NOI. In case of conflict, information submitted to the Division as part of this renewal supersedes previous NOI submissions.



LEGEND

Locations	
1	East ITDF
2	West ITDF (Proposed)
3	Trench for Tails and Return Line
4	Excavated Tails (E. Stockpile)
5	Excavated Tails (N. Stockpile)
6	Float Tails Pond
7	Decantation Ponds
8	MMCU Laboratory
9	MMCU Mill Site
10	Process Water Tank
11	Run of Mill (ROM) Pad
12	Fresh Water Tank
13	Bone Yard

Milford Mining Company Utah - General Area Mill Site

1208 S 200 W PO 827, Milford, UT 84751	Date: 10/3/2024	CK. BY: RClark	REVISION:
DWG. NO.: Photo #2	Scale: 1:10,000	DR. BY: GGuzzle	0
File: Environmental\1 - DOGM\NOI's\LMO\NOI Working\2024\MMCU 2024 Edits_Figures			

MILFORD MINING COMPANY
UTAH

LEGEND

Locations	
1	Run of Mill (ROM) Pad
2	Crushed Ore Pad
3	Grind and Float Circuit
4	Concentration Storage – Site Warehouse
5	North & South Thickeners
6	Clarifier
7	Leach and Tails Neutralization Tanks
8	Counter Current Decanters (CCD's)
9	Pregnant Leach Solution (PLS) Ponds
10	Raffinate (Raff.) Ponds
11	Solvent Extraction (SX) Plant
12	Electrowinning (EW) Facility
13	Copper Cathode Storage Yard
14	Mill Maintenance Laydown Yard
15	Mill Management Office
16	PNT 3 – Plant Management Office
17	Process Water Tank
18	Fresh Water Tank
19	Mill Boneyard
20	Tails Booster Station
21	Sulfuric Acid Offloading
22	Sulfuric Acid Storage Tanks

650ftus

Milford Mining Company Utah - Detailed Mill Site

1208 S 200 W PO 827, Milford, UT 84751	Date: 10/3/2024	CK. BY: RClark	REVISION:
DWG. NO.: Photo #2a	Scale: 1:2,600	DR. BY: GGuzzle	0
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MILFORD MINING COMPANY
UTAH

LEGEND



Locations	
1	Ore Stockpile
2	Topsoil Pile
3	Copper Ranch Mini Dump
4	Copper Ranch Open Pit
5	Copper Ranch Dump

1000ftus

Milford Mining Company Utah - Copper Ranch Complex

1208 S 200 W PO 827, Milford, UT 84751	Date: 10/3/2024	CK. BY: KSchuerg	REVISION:
DWG. NO.: Photo #4	Scale: 1:10,000	DR. BY: GGuzzle	0
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MILFORD MINING COMPANY
UTAH



LEGEND

Locations	
1	SITLA Ore Transfer Station
2	SITLA Top Soil Stockpile
3	Hidden Treasure Dump
4	Hidden Treasure Top Soil
5	Hidden Treasure Pit
6	Ready Line
7	PNT 2 Operator Office
8	Alluvial Stockpile
9	Maria Pit
10	Maria Dump
11	Bawana Dump
12	Bawana Pit
13	Old Hickory Box Cut
14	Montreal Mine & Dump
15	Sunrise Pit
16	Sunrise Dump
17	Niagara (Proposed)
18	Copper Peak
19	Candy B (Proposed)

3000ftus

Milford Mining Company Utah - Rocky Range Pits & Facilities

1208 S 200 W PO 827, Milford, UT 84751	Date: 10/3/2024	CK. BY: KSchuerg	REVISION:
DWG. NO.: Photo #4	Scale: 1:10,000	DR. BY: GGuzzle	0
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MILFORD MINING COMPANY
UTAH

LEGEND



Locations	
1	Truck Shop Sub Station
2	Fuel Depot
3	Truck Shop
4	Equipment Parking
5	Truck Shop Storage
6	Truck Shop Fresh Water Tank
7	Exploration PNT
8	Mine Operations (PNT-1)
9	Employee Parking
10	Guard Shack

500ftus

Mine Operations and Truck Shop

1208 S 200 W PO 827, Milford, UT 84751	Date: 10/3/2024	CK. BY: KSchuerg	REVISION:
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MILFORD MINING COMPANY
UTAH

R647-4-106 Operations Plan

106.1 Type of Mineral to be Mined

The materials to be mined are copper sulfide (chalcopyrite, bornite, chalcocite) and copper oxide (chrysocolla, malachite) ores. Copper concentrates contain gold and silver credits as well as minor amounts of molybdenite.

The planned mining operations will not produce or cause the generation of deleterious or acid-forming materials. Mill tails are acidic, the addition of Lime Kiln Dust (LKD), or Quick Lime will be added to the mill tailings in order to ensure the mill tails discharge is a minimum of 5.5pH.

The characteristics of the ore, waste rock, and tailings are described in **Section 106.4** below. Should deleterious or acid-forming materials be unexpectedly encountered, they will be properly identified, managed, and reclaimed.

106.2 Type of Mining Operation to be Conducted

This section will provide the Division with a narrative description of the type of operations to be conducted. This includes the mining and processing methods to be used on-site, and identification of any deleterious or acid-forming materials present or to be left on the site as a result of mining or mineral processing.

The Operator employs the following methods of mining and ore processing:

- Rock will be liberated from active open pits by drilling and blasting the material,
- Ore and Waste rock will be removed by loading 45- and 70-ton haul trucks via loader, dozer, and/or excavator/shovel.
- Waste rock from both open pits and underground mining will be placed in designated waste dumps or will be used to backfill existing pits.
- Ore will be sent to the on-site processing facilities, where the ore will undergo crushing and grinding, flotation of sulfide concentrates, acid leaching of oxide copper ore followed by solvent extraction and electro-winning (SX/EW) and production of copper cathode.
- Copper concentrates are sold to a toll smelter, copper cathode is sold to end users or metal traders.
- Mill tailings are pumped to tailings storage facilities approved by the Utah Division of Water Quality under its Ground Water Discharge Protection program.

The Operator is interested in expanding its operations to include underground mining. This will likely be performed by contract miners. Engineering and planning have not occurred, and no firm dates have been set.

106.2.1 Open Pit and Underground Mine Construction

Unless otherwise specified in the Appendix sections of this NOI, open pits located within the MCO will be excavated as follows:

- 20-foot cuts with 60-foot vertical increment between catch benches.
- Assuming a typical 67° bench face angle, the typical catch benches will be 35 feet wide in order to maintain a 45° overall slope for a wall without ramp.
- For a wall which includes a ramp, the ramp will be treated as a catch bench, and individual catch bench width may be reduced while honoring the 45° overall slope requirement.
- If the Operator proposes to construct pits with overall pit slopes greater than 45°, a variance request will be submitted along with the supporting geotechnical, geological, and hydrologic information to support the variance request.

Underground mine designs will be provided once engineering studies have been performed.

106.2.2 Waste Dump Construction

Waste dumps located within the MCO will be constructed as follows:

- lifts of approximately 70 vertical feet with angle-of-repose (37 degrees) slopes.
- Terraces of approximately 50-ft wide will be left in place between each lift of waste rock.
- The overall slope from crest of the constructed 70-ft lift to the toe of the 50-ft terrace is 25 degrees.
- The tops of the dumps will be graded to 3-4% in order to allow dumps to divert water and prevent infiltration, which will minimize potential for migration deleterious elements.
- The proposed design will allow for a maximum angle of 2.5:1 to be achieved upon final grading during reclamation.
- The maximum number of lifts for each dump will be determined based upon the surrounding terrain. For more information on specific waste dump heights, refer to **Table 15** in **Section 106.9.1**.

Historically (circa 2017) TMC obtained permission to dispose of excess tails water from the ITDF. The following outlines the significant dates and events:

- November 9, 2017 DOGM Authorized the Operator to dispose up to 5 Million Gallons of neutralized (pH between 7 and 9) tails water on preidentified dumps.
- February 7, 2018 DOGM Authorized the Operator to dispose up to 40 Million Gallons of neutralized (pH between 7 and 9) tails water on waste dumps.
- Between November 9, 2017 and October 30th, 2018, the Operator Disposed of a total of 35 Million Gallons of Tails Solution on Copper Ranch, Hidden Treasure and Sunrise Dumps.

- September 28th, 2018 The Operator Sampled Hidden Treasure and Sunrise dumps. The samples showed high salt content due to tails water discharge.
- October 30th, 2018 The Operator ceased all dumping of tails solution on dumps.

Due to the high salinity of the tails water additional material is required to be placed on top of these dumps. Adjustments to the reclamation were made and can be found in **Section 110**, although, as the Operator intends to increase the waste dump sizes shown above; the adjustments to reclamation may not apply as new lifts or benches are deposited. Updates will be given to the Division accordingly.

106.2.3 Material Haulage

Ore and waste will be hauled to the respective areas by use of designated haulage roads, some of which are considered County Roads. The Operator has an agreement with Beaver County for sole use of the County roads during the life of the operation. **Figure 1** shows designated haulage roads used to move material around the MCO.

Haulage roads are constructed to meet Mine Safety and Health Administration (MSHA) standards for the type and size of equipment used within the MCO.

106.2.4 Processing Activities – Crushing and Grinding (Appendix A)

A *general* process description of the crushing and grinding circuit is provided below.

- Ore from the active pits is transported to the ore pad next to the jaw crusher and ore sorting machine.
- A series of crushers reduce the ore prior to grinding; sizing is dependent on ore type and target throughputs.
- The ore stockpile will be loaded onto trucks and transported to the existing mill fine ore stockpile, Northwest of the mill building.
- The crush ore is ground in one of three ball mills final grind size is dependent on ore type.
- Tailings for reprocessing may be introduced to the mill feed but are typically fed directly to the leach circuit.
- The current capacity of the grinding/crushing circuit is ~2,000 tons depending on ore characteristics.

Future expansion of the crushing and grinding circuit has been discussed but there are currently no plans to do so.

106.2.5 Processing Activities – Flotation & Magnetite Separation

A general process description of Flotation and Magnetite Separation is provided below;

- If the ore is high in magnetite (Mag), Mag separators may be employed to remove the magnetite prior to entering the flotation circuit.
- Mag Concentrate is stored south of the flotation facilities (**Figure 2 and Photo 2**)
- The ground ore is transported via pumps to the conditioning tank and flotation cells where reagents are added separating copper sulfide minerals from copper oxide minerals and gang materials.
- The copper sulfide minerals are transported to subsequent flotation cells where they are further concentrated.
- The ore concentrate is pressed in a filter press until a relative moisture of 20% to 30% is obtained.
- The dried concentrate is stored inside the mill until it is sold to copper smelters.
- Flotation may occur prior to leach.
- Magnetite may be fed through the leach circuit, sold as concentrate or used for construction activities.

Additional Notes on flotation:

Flotation utilizes Reagents listed on **Table 4** in Section **106.2.7**, flotation tails may be fed through the leach circuit or fed directly to the tailings pond.

Precious metals are collected through flotation and are sold with the copper concentrate.

Characterization of the magnetite is described in more detail in **Section 106.4**.

106.2.6 Processing Activities – Acid Leach Circuit & SX/EW (Appendix B)

A general process overview of the Acid Leach Circuit & SX/EW is provided below:

- Depending on the ore characteristics the ore may be flotation tails or may be fed into the leach circuit directly from the grind circuit.
- Copper ore (Oxide and Sulfide) is mixed with Sulfuric Acid in the leach tanks forming a solution rich in Copper Sulfate known as Pregnant Leach Solution (PLS)
- The PLS is separated from the mill tails through one of four counter current decantation circuits (CCDs). The mill tails are sent to mill tails facilities.
- The PLS solution is stored in the PLS pond until it is pumped in to the Solvent Extraction (SX)

plant.

- The PLS is mixed with an organic solvent similar to kerosene, transferring the copper from the PLS to the organic solution. PLS solution stripped of its copper is known as Raffinate (Raff).
- Raff is stored in the Raff pond and is reused in the CCD's and the Leach Tanks.
- The Copper bearing Organic is mixed with Lean Electrolyte in order to form Rich Electrolyte.
- The Rich Electrolyte is mixed with Lean Electrolyte to form Commercial Electrolyte. This commercial electrolyte is pumped into the Electrowinning (EW) Plant.
- Commercial electrolyte flows into cells with stainless steel cathodes and lead anodes. A current is applied, and the copper is plated onto the cathode.
- Cathodes are periodically stripped; the copper cathode is typically 99.99% pure and is sold to metal brokers.

Wastes and Tails are disposed in the following ways:

- Leach or Flotation tails are mixed with Lime Kiln Dust (LKD) prior to being pumped to a tail's disposal facility or pond. The site's ground water discharge permit specifies a pH range of 5.5 to 8.0 for tails disposed of in the tails pond.
- Only mill tails and neutralized acid are permitted to be disposed of in tailings disposal facilities.
- SX/EW Waste products are stored onsite until disposed of by a licensed third-party environmental remediation group.
- Waste products from the SX/EW fall into one of three categories, lead sulfide sludge, solvent crud, and acidic soil (in the event of a spill).

106.2.7 Reagents Used During Processing

A list of reagents used during processing is listed in **Table 4.**

The Operator uses sulfuric acid in the acid leach circuit and for stripping copper from the solvent prior to electrowinning which is handled as follows:

- Two large sulfuric acid tanks store acid used in the process.
- Secondary containment for this facility has the capacity to contain 110 percent of the total volume of the largest tank.
- Appropriate spill containment is provided in all mill facility components that use sulfuric acid.

The solvent extraction circuit uses a kerosene-like organic mixture to separate copper acid solution that is recovered by the CCD circuit.

All chemicals are handled in accordance with guidance provided by the manufacturer. In addition:

- Containment of solvents and reagents used in the agitated leach circuit are composed of 80-mil high-density polyethylene (HDPE) liner, which was approved for use by DWQ (**Appendix**).
- Flotation reagents are kept in isolated locations within the fully contained mill, and inadvertent spills will be fully contained within the concrete mill foundation.
    - Any spills will be immediately cleaned up in accordance with manufacturers' guidelines as outlined in the sites SPCC.
- Reagents and solvents used in the milling process are recycled back through the circuits as much as feasibly possible. Trace amounts of reagents and solvents may end up in the tails.

Table 4: Reagents used in Ore Processing

Trade/Common Name	Industrial ID	Circuit	Notes
Bentonite Clay, F1 Clay	Same	Solvent Extraction	Crud treatment of organic phase
KAX 51	Potassium Amyl Xanthate	Flotation	Primary sulfide collector
Flomin 4343	Sodium alkyl monothiophosphate	Flotation	Secondary mineral collector
MX-935/MX-945	Modified dithiophosphate mixture	Flotation	Secondary mineral collector/PGM collector
Flomin F500 frother	Methyl isobutyl carbinol	Flotation	Frothing agent
Zalta 1505 Flocculent	Anionic polyacrylamide, dry	CCD	Flocculent
Amerifloc 489 Coagulant	Polymer mixture	CCD	Coagulant for colloidal silica control
TPH 3403 Flocculent	Anionic polyacrylamide, dry	CCD	Flocculent
Drewfloc 304	Anionic polyacrylamide, dry	CCD	Flocculent
Acorga M5574	Salicyladoxime derivative	Solvent Extraction	Extractant
Concentrated Sulfuric Acid	Same	Leach	Acid for copper leaching
Cobalt Sulfate	Same	EW	Copper smoothing
Guar gum	Same	EW	Copper smoothing
Ferrous Sulfate	Same	EW	Iron balance
Garnet Sand	Same	Solvent Extraction	Filter media
Anthracite	Same	Solvent Extraction	Filter media
LKD	Lime Kiln Dust	Leach Tailings	pH modifier

106.2.8 Tailings Storage – Flotation Tailings Pond (Appendix A)

Mill Tails are currently being stored in the Flotation Tails Pond (FTP) which is directly south of the mill facilities (**Figure 2, Photo 2**). This facility was constructed by TMC in May 2018 and sits within the footprint of the old Flotation Tails Facility. A raise was constructed on the FTP, being completed in November 2018 to further extend its service life.

The tails from the old Flotation Tails Facility (decommissioned February 2015) contain a substantial amount of acid soluble copper ore and were moved for later processing. (**Photo 2**) These tails also contain significant amounts of acid consuming minerals, and will be processed during times when Sulfuric Acid prices allow for economic processing. A date by which the tails will be consumed cannot be provided at this time. Characteristics of the flotation tails are provided in **Section 106.4** of this NOI.

The two decantation ponds at the base of the FTP (**Photo 2**) have been used to store freshwater pumped from the wells. This water was used to wet materials and suppress dust during the construction of the current FTP.

The FTP is near capacity and will only provide a few weeks of additional tails storage. When the FTP is closed, water will be evaporated off either by natural evaporation or by forced evaporation. The area, including the decantation ponds, will be reclaimed as described in **Section 110.2.5**

Area's where tails have been stored for later processing will be reclaimed as outlined in **Section 110.2.2**

Construction of the Flotation Tails facility and its raise was overseen by GEM Engineering. Engineering details and as-built drawings can be found in the **Appendix**.

106.2.9 Tailings Storage – ITDF

The Intermediate Tailings Disposal Facility (ITDF) is located in two small canyons east of the process facilities (**Figure 2, Photo 2**). The construction of the facility began with the East ITDF embankment to 5,820' which was completed in February 2015. The remaining facility will be built through a series of phased construction projects as outlined in the table below.

Table 5: ITDF Phased Construction (volumes are approximate)

Phase	Embankment Volume (yd^3)	Added Storage Volume (yd^3)
West Starter to 5820	123,215	300,000
West Expansion to 5840	217,621	400,000
East ITDF to 5840	445,441	1,332,000
East & West ITDF to 5860	110,000	1,800,000
Total	**1,056,276**	**4,132,000**

As of May 2018, the East ITDF facility was filled to capacity. No additional tails or water will be placed in the East ITDF until it is raised to the 5,840' elevation. Currently MMCU is working on completing the construction of the East ITDF 5,840' lift.

The Operator has made the following commitments regarding the future expansion and use of the ITDF Facilities;

- Tails placed in the ITDF will have a pH of no less than 5.5 or no greater than 8.0. (Lime or LKD will be used to neutralize tails)
- The ITDF Monitoring well is sampled quarterly, a second monitoring well will eventually be installed at the toe of the West ITDF Embankment upon construction and design.
- 2ft Freeboard will be maintained in all current and future tails facilities.
- No more than a combined 50 acre-feet of water will be stored in the Operators tails ponds.
- As part of the construction of the East ITDF the operator will address the following:
    - Installation of drains in the East ITDF to drain in situ water from the tails stacked to 5820'. All future impoundments will include provisions to drain in situ water.
    - The Operator will install, repair, and test liner for all future impoundment facilities or as directed by the Utah Division of Water Quality.
    - All future tails impoundments will be lined with a minimum 60mil HDPE.

Any variances from the above commitments will be formally requested from DOGM and DWQ.

The tailings impoundments are each approved for 50-acre feet of water storage per facility (FTP, ITDF) however to reduce the amount needed for surety, the Operator will maintain no more than a combined total of 50 acre-feet in all tail's facilities. This will be accomplished through the careful management of mill water balance and the use of evaporators to remove excess water.

In September 2018, a construction permit was obtained for the West ITDF Expansion to 5820' and to the 5840' elevation. The permit is expected to expire and will need to be renewed prior to beginning construction on the West ITDF.

The ITDF facilities are designed to be Zero Discharge facilities. The HDPE liner prevents a direct path to ground water. With the construction of all currently planned phases the service life of the ITDF is expected to be 3-5 years. The Operator maintains a monitoring well at the toe of the East ITDF embankment, a second monitoring well will be installed at the toe of the West ITDF embankment. Should either monitoring well report above the established thresholds the Operator will do the following;

- Immediately report to DWQ and DOGM that a monitoring well sampled above establish thresholds outlined in the Operators GWDP.
- Should it be determined that the ITDF facility is leaking into ground water the monitoring wells will be converted to pump back wells.
- Additional monitoring wells will be drill down gradient of the existing wells.

- Additional pump back wells will be drilled if it determined to be necessary.

The ITDF perimeter road has been designed to act as a diversion structure to divert all upland runoff from any anticipated precipitation return events that may potentially occur within the MCO. The upland side of the perimeter road has large detention basins where intercepted water will be stored until the water either evaporates or infiltrates. The ITDF perimeter road will include a diversion swale and stormwater chute to direct receiving water away from entering the facility. The purpose of the perimeter road and detention basins is to prevent runoff from the surrounding drainage basin reporting to the impoundment.

The East ITDF was approved for use under a Ground Water Discharge Permit (GWDP) with DWQ (**Appendix**). The GWDP also includes the Construction Permit and Dam Safety Permit for the ITDF, PLS, and raffinate ponds.

More detailed information on the ITDF and tails chemistry can be found in **Section 106.9** below.

Detailed design drawings for the East ITDF, and its subsequent phases can be found in the **Appendix**.

106.2.10 Water Supply, Water Balance Management, Dust Control

Site Water Supply

Water is supplied to onsite facilities and process through the following means:

- Water for mill operations will be supplied foremost by recycling water from the Operators Tails Facilities.
- Fresh water supplied to the mill is pumped from three wells onsite (**Figure 1, 2 & 5**).
    - WW #3 (North Well)
    - WW#6 (South Well)
    - Truck Shop Well

- Fresh water is used for onsite domestic uses, to supplement the tails return water, and for dust control.
- An onsite reverse osmosis system supplies small amounts of water to systems that are sensitive to water quality.

The Truck Shop Well is located at the Operator's truck shop, with a 4.5-mile buried pipeline connecting the well to the Mill. This pipeline is located within a 20-foot-wide easement previously

approved by BLM. The other water lines have been or will be constructed and located within existing road rights-of-way from the well to the existing water line.

Recycled water from the ITDF is supplied to the process facilities by a return water pipeline that runs parallel to the discharge line in the HDPE-lined trench as shown in **Figure 2.** Any necessary freshwater is supplied to the process facilities by a buried (four feet deep) six- to eight-inch HDPE pipeline system running from the above-described water wells to a 100,000 gallon freshwater tank near the process facilities as shown on **Figure 2 & Photo 2**.

It is not planned to remove the pipeline post-mining. The portion from the well to the haul road would remain in place without any reclamation. The portion within the haul road would be reclaimed as part of the reclamation in this plan when the roads are returned to their pre-mining widths.

The freshwater tank supplies make-up water to the 300,000gal recycle tank directly connected to the mill.

The cost of plugging WW #3 (North Well) and the Truck Shops wells has been included in the surety calculations.

A septic system, which was approved by Beaver County, and the Southwest Health Department, is being used to dispose of wastewater generated by the showers, sinks, and lavatories in the mill office building.

Water Balance Management

In order to prevent a situation where the tails ponds have a combined total exceeding 50-acre feet the Operator carefully manages the mills water balance. The mill has two primary means of altering water balance to reduce water in its tailing's facilities:

- Decreasing freshwater introduced into the system and increasing water being pumped from the tails pond will reduce the amount of water in the tails pond. Tails trap ~40% of the water pumped to the tails pond. ~60% is available for recirculation.
- Employing the use of enhanced evaporation will dispose of ~70gpm and help to offset periods where more freshwater is required then what can be disposed of.

Water balance is monitored through the following key variables:

- The amount of tails being discharged into a tail's facility,
- The amount of water that decants off the tails (Assumed to be ~60%)
- Natural evaporation rates based on pan study
- Forced Evaporation Utilization

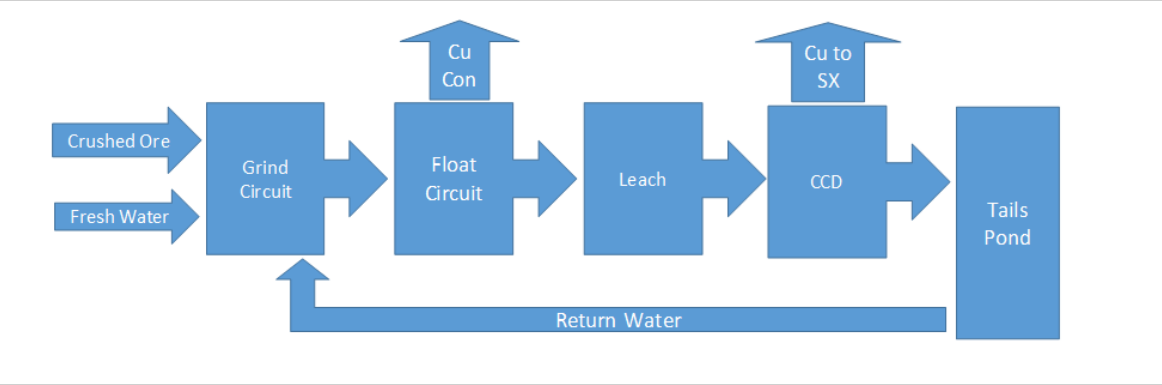

Figure 1: Mill Water Balance Block Diagram

Visual monitoring and measurements occur in the following ways

- Weekly aerial flights will be conducted by use of the Operators Drone, to measure the surface area of the pond, fill volume, and fill rates. This will be a new process but it has proven to be an invaluable tool.
- Daily visual inspections of all tail's facilities

The mill requires a pond size of 5-10 million gallons in order to control the buildup of deleterious minerals in the water. The operator has committed to maintaining no more than a combined (FTP and ITDF) total of 50-acre feet or ~16 million gallons of water in its tail's ponds. This includes the present ITDF and FTP, as well as the planned expansions of the ITDF.

Dust Control

Dust control is an important safety and environmental concern. Dust will be controlled on the site as follows:

- Freshwater pumped from one or more the site's water wells. This water will be sprayed on the roads during the day or night and the water trucks operator will keep a log of loads used per day to maintain water usage information.
- Process or tails water may be applied to the roads or used for dust suppression as long as the following criteria are met;
    - pH is between 5.5-8.0
    - The TDS is below 10,000mg/L (Measured via electrical conductivity as TDS is equivalent to 65%*1,000 of EC value)
- Magnesium Chloride or other similar dust suppressants may be applied to the roads.
- Speeds of both light and large vehicles will be governed to reduce dust generated.
- Adherence to any other requirements outlined in the Operators Air Quality Permit.

106.2.11 Boneyard for Obsolete or Unused Equipment

The boneyard is located in the northeast portion of the process facilities area (**Figure 2 & Photo 2**). The boneyard is used for storage of obsolete or unused equipment. The Operator periodically recycles or sells obsolete and unused equipment during the course of normal operations.

106.2.12 Guard Shack and Truck Shop

The Operator controls access to the mine site via a guard shack. This area consists of a temporary building and a storage Conex. (**Figure 1 & 5, Photo 5**)

The Truck shop sits to the west of PNT 1, and is used for the maintenance of light vehicle and mine equipment. (**Figure 1 & 5, Photo 5**) The truck shop includes a substation, well, and 6,000-gallon diesel fuel tank. Both the substation and fuel tanks are contained within concrete containments.

106.3 Estimated Acreage of Disturbance

This section will provide the Division with the estimated acreage of disturbance for current and near-future activities. This section will also discuss proposed ongoing reclamation activities such as pit backfilling, stockpile removal and re-contouring, and revegetation of disturbance areas.

The following table (**Table 6**) shows existing and proposed disturbance acreage according to land status within the MCO. Newly proposed disturbance as of the submittal of this NOI is highlighted in blue within the Table.

The Operator is committed to performing concurrent reclamation activities where applicable.

Table 6: Estimated Acreage of Disturbance

Area	BLM (acres)			Private (acres)			SITLA (acres)			TOTAL ACRES		Reclamation						TOTAL RECLAMATION	
												BLM		Private		SITLA			
	Existing	Final	Net New	Existing	Final	Net New	Existing	Final	Net New	Total	Net New	Rip & Re-See	Topsoil (C.Y.)	Rip & Re-See	Topsoil (C.Y.)	Rip & Re-See	Topsoil (C.Y.)	Rip & Re-See	Topsoil (C.Y.)
Rocky Range																			
MCO Haulage Road (existing 40' road widended to 86')	44.7	44.7	0.0	1.9	1.9	0.0	5.4	5.4	0.0	52.0	0.0	23.9	0.0	1.0	0.0	2.9	0.0	27.8	0.0
Hidden Treasure Pit	19.4	24.0	4.6	3.3	7.3	4.0	0.0	0.0	0.0	28.0	8.6	8.7	0.0	0.4	0.0	0.0	0.0	9.0	0.0
Hidden Treasure Waste Dump	80.8	89.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	89.0	8.2	89.0	71793.0	0.0	0.0	0.0	0.0	89.0	71793.0
Hidden Treasure Access Roads and Staging Areas	9.2	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.2	0.0	9.2	7421.3	0.0	0.0	0.0	0.0	9.2	7421.3
Hidden Treasure Topsoil Stockpile	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0
Hidden Treasure Pre-Act Areas (volunteer reclamation)	16.3	16.3	0.0	10.0	10.0	0.0	0.0	0.0	0.0	26.2	0.0	16.3	13148.7	10.0	8066.7	0.0	0.0	26.3	21215.3
Maria Pit	28.0	28.8	0.8	1.4	2.6	1.2	0.0	0.0	0.0	31.4	2.0	8.5	0.0	0.0	0.0	0.0	0.0	8.5	0.0
Maria Access Roads and Staging Areas	16.8	16.8	0.0	2.1	2.1	0.0	0.0	0.0	0.0	18.9	0.0	16.8	13552.0	2.1	1694.0	0.0	0.0	18.9	15246.0
Maria Topsoil Stockpile	0.4	0.4	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.9	0.0	0.4	0.0	0.5	0.0	0.0	0.0	0.9	0.0
Maria Waste Dump	2.6	2.6	0.0	14.5	14.5	0.0	0.0	0.0	0.0	17.1	0.0	2.6	2097.3	14.5	11696.7	0.0	0.0	17.1	13794.0
Bawana Pit	0.3	0.3	0.0	17.7	17.7	0.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	3.8	0.0
Bawana Waste Dump	27.5	30.7	3.2	9.9	17.4	7.5	0.0	0.0	0.0	48.1	10.7	38.7	24765.0	17.4	14036.0	0.0	0.0	48.1	38801.0
Bawana Access Roads and Staging Areas	4.7	4.7	0.0	28.5	28.5	0.0	0.0	0.0	0.0	33.2	0.0	4.7	3791.3	28.5	22990.0	0.0	0.0	33.2	26781.3
Bawana Low-Grade Ore Stockpile	0.0	0.0	0.0	7.8	7.8	0.0	0.0	0.0	0.0	7.8	0.0	7.9	6372.7	0.0	0.0	0.0	0.0	7.9	6372.7
Sunrise Pit	4.3	4.3	0.0	8.0	8.0	0.0	0.0	0.0	0.0	12.3	0.0	1.2	0.0	1.8	0.0	0.0	0.0	3.1	0.0
Sunrise Waste Dump	24.3	24.3	0.0	4.7	4.7	0.0	0.0	0.0	0.0	28.9	0.0	24.3	13721.4	4.7	2653.9	0.0	0.0	28.9	16375.3
Sunrise Access Roads and Staging Areas	3.4	3.4	0.0	7.6	7.6	0.0	0.0	0.0	0.0	10.9	0.0	3.4	2742.7	7.6	6130.7	0.0	0.0	11.0	8873.3
Sunrise Topsoil Stockpile 1	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0
Sunrise Topsoil Stockpile 2	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.1	0.0
Sunrise Topsoil Stockpile 3	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Candy B Pit	0.0	18.1	18.1	0.0	24.5	24.5	0.0	0.0	0.0	0.0	42.6	2.5	2017.0	9.5	7663.0	0.0	0.0	2.7	2178.0
Candy B Topsoil Stockpile	0.0	5.1	5.1	0.0	0.0	0.0	0.0	0.0	0.0	5.1	5.1	5.1	0.0	0.0	0.0	0.0	0.0	5.1	0.0
Candy B Waste Dump	** See Bawana Waste Dump																		
Niagara Pit	0.0	0.0	0.0	0.0	15.5	15.5	0.0	0.0	0.0	0.0	15.5	0.0	0.0	2.7	2178.0	0.0	0.0	2.7	2178.0
Niagara Access Roads and Staging Areas	0.0	0.0	0.0	0.0	2.7	2.7	0.0	0.0	0.0	2.7	2.7	0.0	0.0	2.7	2178.0	2178.0	0.0	2.7	2178.0
Niagara Waste Dump	**See Bawana Waste Dump																		
Copper Ranch Complex																			
SITL Ore Stockpile	0.0	0.0	0.0	0.0	0.0	0.0	6.1	6.1	0.0	6.1	0.0	0.0	0.0	0.0	0.0	6.1	4920.7	6.1	4920.7
SITLA Topsoil Stockpile	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6	0.0
CuR Mini Waste Dump	5.9	5.9	0.0	3.2	3.2	0.0	0.0	0.0	0.0	9.1	0.0	5.9	4759.3	3.2	2581.3	0.0	0.0	9.1	7340.7
CuR_Int Pit	4.3	4.3	0.0	14.1	14.1	0.0	0.0	0.0	0.0	18.3	0.0	2.4	0.0	7.9	0.0	0.0	0.0	10.3	0.0
CuR Waste Dump	36.9	36.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.9	0.0	36.9	8929.8	0.0	0.0	0.0	0.0	36.9	8929.8
CuR Access Roads and Staging Areas	1.9	1.9	0.0	1.8	1.8	0.0	0.0	0.0	0.0	3.7	0.0	1.9	1516.5	1.8	1476.2	0.0	0.0	3.7	2992.7
CuR Temporary Ore Stockpile	6.1	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	6.1	4904.50	0.0	0.0	0.0	0.0	6.1	4904.5
CuR Topsoil Stockpile	3.9	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	3.9	0.0	0.0	0.0	0.0	0.0	3.9	0.0
Beaver Lake																			
Greater Mill Area	0.0	0.0	0.0	109.3	121.6	12.3	0.0	0.0	0.0	121.6	12.3	0.0	0.0	121.6	98066.5	0.0	0.0	121.6	98066.5
OK Stockpile	0.0	0.0	0.0	9.0	9.0	0.0	0.0	0.0	0.0	9.0	0.0	0.0	0.0	9.0	0.0	0.0	0.0	9.0	0.0
ITDF	0.0	0.0	0.0	100.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	65.5	105673.3	0.0	0.0	65.5	105673.3
ITDF Topsoil Stockpile	0.0	0.0	0.0	5.8	5.8	0.0	0.0	0.0	0.0	5.8	0.0	0.0	0.0	5.8	0.0	0.0	0.0	5.8	0.0
Temporary Float Tails Stockpile	0.0	0.0	0.0	0.0	4.1	4.1	0.0	0.0	0.0	4.1	4.1	0.0	0.0	4.1	3968.8	0.0	0.0	4.1	3968.8
Mill Boneyard	0.0	0.0	0.0	2.9	2.9	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	2.9	0.0	0.0	0.0	2.9	0.0
Total	**343.9**	**360.7**	**16.8**	**365.3**	**394.4**	**29.1**	**12.1**	**12.1**	**0.0**	**763.5**	**45.9**	**314.9**	**179515.5**	**315.4**	**279034.1**	**9.6**	**4920.7**	**631.8**	**463470.2**

106.4 Nature of Materials, Including Waste Rock/Overburden and Estimated Volumes

The material to be mined is primarily copper ore with lesser amounts of gold and silver which occur in skarn type deposits. Information regarding the geology of the deposits within the MCO is in **Section 106.8.3** of this NOI.

Characterization of waste rock and ore is performed both prior and during mining operations. Testing includes characterization of waste rock and ore. This testing consists of the following:

- Elemental analyses for the 8 Resource Conservation and Recovery Act (RCRA) Metals
- Acid generation potential (AGP) reported in units of MPA. (Except Bawana which is report in AGP)
- Acid neutralization potential (ANP)

Table 7 summarizes the AGP and ANP for ore bodies within the MCO that are expected to be or are currently being mined by The Operator.

Table 8 summarizes the elemental results for the eight Resource Conservation and Recovery Act (RCRA) metals that are regulated by the United States Environmental Protection Agency (EPA).

The results presented in **Tables 7 & 8** demonstrate the following:

- Waste rock and ore zones are nonacid and non-deleterious generating
- Waste rock and ore zones are expected to have some neutralization potential
- Acid Rock drainage is not anticipated at either the waste dumps or pits.
- Mill Tailings alone are not acid generating but must be neutralized (5.5-8.0pH) prior to disposal.

Mill Tails discharge characteristics are dependent on the ore characteristics and methods used for processing. As per the operators GWDP (**Appendix**) Mill Tailings will be sampled daily for the following:

- pH
- Temperature
- Electrical conductivity (EC)

To ensure that ore and waste are non-deleterious and non-acid producing samples will be taken in the following manner:

- Ore and waste rock samples will be gathered from blast hole drilling within an active pit in a manner that will be representative of the bench or a geologic formation.
- Samples will be split/blended and prepared in house
- Samples will be sent to a third-party for analysis

Should testing demonstrate elevated levels of the 8 RCRA and/or found to have acid forming potential the following will occur:

- Further analyses will be conducted to verify results and to determine the amount of material which is deleterious and/or acid forming
- The afflicted waste rock will be placed in the following manner with the goal of total encapsulation;
    - Bedding of 25ft of benign waste rock
    - Placement of afflicted waste rock will not exceed 25ft.
    - Benign waste rock will be placed 20 feet on either side of the afflicted rock.
    - The afflicted rock will be capped with 25ft of benign waste rock

Table 7: AGP and ANP for Ore Bodies Within MCO

Deposit/Type	Rec vd Wt.	MPA[1]	NP[1]	pH	Ratio (NP:MPA)
Hidden Treasure - Ore[2]	See Bawana				
Hidden Treasure - Waste[2]	See Bawana				
Bawana - Ore[1]	0.23	-0.12	4.97		
Bawana - Waste[1]	0.2	0.005	3.95		
Sunrise - Ore[3]		13.53	552.13	8.69	74.3
Sunrise - Waste[3]		2.34	458.14	7.83	224.56
Maria - Ore[4]	0.2	9.4	124	8.5	13.23
Maria - Waste[4]	0.11	0.3	64	8.5	204.8
Niagara - Ore[4]	0.23	18.8	26	9.1	1.39
Niagara - Waste[4]	0.26	0.3	10	9.1	32
Copper Hill - Ore[5]					
Copper Hill - Waste[5]					
Copper Ranch - Ore (mini pit)[6]	0.18	1.1	147.5	8.1	134.68
Copper Ranch - Ore (large pit south)[6]	0.165	5.15	182.5	7.9	159.15
Copper Ranch - Ore (large pit north)[6]	0.165	1.4	180.5	8.2	149.95
Copper Ranch - Waste[6]	0.17	0.86	233.36	8.53	319.7
OK - Ore[7]					
OK - Waste[7]					
Crossroads - Ore[8]					
Crossroads - Waste[8]					
Candy B - Ore[9]					
Candy B - Waste[9]					

[1]Bawana results are presented in AGP and ANP. See Appendix E for complete results.

[2]Based on the proximity of the Bawana pit to the Hidden Treasure pit, and observations and experience by The Operator with the geology and mineralization in each pit, the AGP/ANP data for the Bawana pit is reasonably representative of that for

[3 thru 9] Complete lab reports have been submitted in previous NOI. New information will be submitted as it becomes available.

Table 8: RCRA Elemental Results

Deposit/Type	Arsenic (ppm)	Barium (ppm)	Cadmium (ppm)	Chromium (ppm)	Lead (ppm)	Mercury (ppm)	Selenium (ppm)	Silver (ppm)
Hidden Treasure - Ore[2]								
Hidden Treasure - Waste[2]								
Bawana - Ore[1]								
Bawana - Waste[1]								
Sunrise - Ore[3]								
Sunrise - Waste[3]								
Maria - Ore[4]	27.5	70.3	1.1	40	21	0.012	8.3	11.4
Maria - Waste[4]	16.9	217	0.6	30	8	<0.005	0.9	<0.5
Niagara - Ore[4]	47.2	665	1.2	30	42	0.005	2.6	34.9
Niagara - Waste[4]	4.7	1085	<0.5	40	18	0.007	0.3	<0.5
Copper Hill - Ore[5]								
Copper Hill - Waste[5]								
Copper Ranch - Ore (mini pit)[6]	118	341.75	1.7	75	42	0.044	0.9	6.65
Copper Ranch - Ore (large pit south)[6]	119.75	115.85	1.8	20	5	0.109	2.25	16.6
Copper Ranch - Ore (large pit north)[6]	81.2	110.9	5.7	35	32	0.0465	2.35	17.8
Copper Ranch - Waste[6]	21.4	641.1	<0.7	73.6	14.8	0.0108	0.41	<2
OK - Ore[7]								
OK - Waste[7]								
Crossroads - Ore[8]								
Crossroads - Waste[8]								
Candy B - Ore[9]								
Candy B - Waste[9]								

[2]Based on the proximity of the Bawana pit to the Hidden Treasure pit, and observations and experience by The Operator with the geology and mineralization in each pit, the AGP/ANP data for the Bawana pit is reasonably representative of that for Hidden Treasure.

[3 thru 9] Complete lab reports have been submitted in previous NOI. New information will be submitted as it becomes available.

106.4.1 Nitrates

The greatest risk for nitrate contamination to surface and ground waters are the nitrates introduced to waste rock by blasting activities. Management of the nitrate levels is discussed below.

Ammonium nitrate/fuel oil (ANFO) and emulsion are the blasting agents used by The Operator. While nitrates do not form as a direct result of blasting, nitrates may be formed in the following ways:

- Direct contact with water, whether meteoric or encountered as perched water in a blast hole
- Ammonium Nitrate redox reactions result in the formation of Nitrogen Dioxide, Nitric Oxide and Ammonia (Brochu, 2010)

The Operator employs best practice in the storage and handling of ammonium nitrate to prevent potential contact with water. The ANFO management includes the following:

- Proper Handling and Storage as outlined by ISEE standards
- Prevention of spillage, and proper clean up if a spill does occur at the silo as well as blasthole
- Appropriate blast hole spacing, blast hole loading, stemming, and delay timing all contribute

to the reduction of nitrate formation due to incomplete detonation.

- If blast holes show signs of water the following may be employed to reduce nitrate formation:
    - Attempt to dry the holes using compressed air or by placing booster charge
    - Plastic sleeves or hole liners
    - Use of emulsion or Packaged Emulsion which is waterproof

Any nitrates that form due to water contact with the Ammonium Nitrate Prills is expected to be very localized and confined due to the following reasons:

- Low annual rain fall contributes to low infiltration rates through waste dumps and underlying alluvium
- No surface water bodies, or established drainages are present in the vicinity.
- A Water Table aquifer has not been identified within the Rocky Range portion of the MCO, therefore conditions are ideal for the prevention of nitrate contamination in water. Water will not flow from the pits to the adjacent land surface.
- Due to the geology infiltration rates of water through bedrock is expected to be relatively slow
- Active waste dumps to be constructed with a top surface inclined to promote runoff and minimize infiltration of meteoric water into the dump
- Revegetation of the waste dumps will further reduce infiltration rates

Nitrates that may be present in ore are collected as follows:

- Tailings ponds are lined, nitrates will be retained with the other tailing's components.
- Concentrates are removed promptly following their production and any nitrates present in them provide no risk to the environment since they will not remain on site for more than a matter of days.

Nitrate concentration in a sample of Flotation Tailings Pond water was 1.7 mg/l, well below the ground water quality of 10 mg/l.

There are no established environmental standards for nitrate concentrations in solid wastes. Nitrates from blasting would have to "produce chemical or physical conditions in the soils or water that are detrimental to the biota or hydrologic systems" and thus become "deleterious materials".

"Nitrates are beneficial to terrestrial plant life. To be detrimental to hydrologic systems, concentrations would have to reach levels in excess of ground water quality standards in ground water or exceed water quality standards in surface water." (R647-1-106).

106.4.2 Flotation Tailings Characteristics

Excavated Flotation Tails

Excavated Flotation tails are tails which were processed through mill and flotation circuits prior to the construction and commissioning of the SX/EW plant. These tails were contained within the footprint of the current flotation pond. They have been excavated and stacked in separate piles, one directly to the north of the FTP, and one directly to the east. (**Figure 2 & Photo 2**).

These tails contain significant amounts of Oxide Copper and will be processed as outlined in Section 106.2.8. The tails from this process will be deposited either in the existing FTP, or in future tailings facilities designed to hold neutralized acid leach tails.

Since the construction of the SX/EW and Agitated Leach Plant, tails from the flotation circuit have passed through the leach plant before being neutralized and discharged as tails (**106.4.4**).

Future Flotation Tails

It is likely that future ore bodies may contain ore which will only pass through the flotation circuit prior to being discharged to tails. *In this instance,* a new tails characterization will need to be made and submitted as an amendment to this NOI.

106.4.3 Magnetite Characteristics

The magnetite concentrate, when produced, is roughly 58 percent iron, and contains up to 0.5 percent copper. This concentrate may be sold as is, or maybe passed through the agitated leach plant in order to capture the copper contained.

Other constituents in the magnetite concentrate include silicate (SiO_2), aluminum oxide (Al_2O_3), and magnesium oxide (MgO).

106.4.4 Acid Leach and SX/EW Tailings Characteristics

Characterization of the tailings produced from the acid leach circuit was completed in 2016. Over the course of one week, samples were taken twice per day from the tail stream. At the end of one week of sampling, the tails were separated into liquid and solids. The solid tails were sent as three independent splits of the bulk solid tails to a third-party laboratory for TCLP testing, while the liquid tails were sent to a third-party laboratory for water quality analyses.

Due to the ever-changing ore types, similar tests will be performed over the life of the operation, at a frequency beginning at once per month and increasing up to no less than once per quarter. The results are available on request.

Mineralogical analyses were also performed for the tails. The mineralogical data shown on **Table 8** was obtained from a small grab sample collected from the tailings produced during bench testing and analyzed using quantitative electron microscopy (QEM).

Pyrite content is reported at 0.50 percent. Because the ore in the Bawana and Hidden Treasure mines is known to have relatively little pyrite and because flotation would remove some of the pyrite along with other sulfides, the pyrite content measured by QEM is probably not representative of the tailings. In addition to carbonate, chlorite is an acid neutralizer and it was measured by QEM at 4.3 percent.

Tailings water samples will be collected daily from the tailings water return line at the plant terminus of that line. The daily samples will be analyzed for pH and electrical conductivity.

Table 9: Summary of Mineralogical Characteristics (See Appendix for Complete Report)

<table>
<tr><td>Data Type</td><td>Lab</td><td colspan="4">Data</td></tr>
<tr><td rowspan="2">ICP/MS</td><td rowspan="2">ALS Minerals</td><td rowspan="2">pH</td><td rowspan="2">Acid Generating Potential (AGP) – Tons $CaCO_3$</td><td rowspan="2">Acid Neutralizing Potential (ANP) – Tons $CaCO_3$</td><td>NNP–</td></tr>
<tr><td>Tons $CaCO_3$</td></tr>
<tr><td colspan="2">Mineralogy (XRD)</td><td>ALS Metallurgy</td><td><0.3</td><td>48.5</td><td>48.5</td></tr>
<tr><td colspan="2">Sulfides</td><td colspan="4">Notable Results (mg/L)</td></tr>
<tr><td colspan="2">0.6</td><td>pH = 7.37</td><td>TDS = 2400</td><td rowspan="2">Sb = 0.019 (exceeds UT GWQ std. of 0.006)</td><td rowspan="2">Other Trace Metals Non-detectable</td></tr>
<tr><td colspan="2">Carbonates</td><td>Ca = 550</td><td>SO_4 = 1,500</td></tr>
<tr><td colspan="6">* Includes chlorite (4.3%), which, along with carbonate minerals is known to be an acid neutralizer.</td></tr>
</table>

106.4.5 Estimated Volumes

Annual tonnages of ore and waste materials to be mined are not-to-exceed:

Annual Ore Tonnages: 1,100,000

Annual Waste Tonnages: 11,000,000

Annual Ore Tonnages are based on 3,000 Tons Per Day (TPD) which is the plant capacity. The TPD includes the feeding of Flotation Tails.

Annual waste tonnages are based upon an average strip ratio of 10:1; ten tons of waste moved for every one ton of ore extracted.

106.5 Existing Soil Types, Location of Plant Growth Material

The Natural Resource Conservation Service (NRCS) describes the soil in and around the project area as ranging from fine sandy loam to gravelly to very gravelly loam. **Table 10** describes the characteristics of soils found in and around the Project Area, based upon the NRCS.

Topsoil testing in 2002 for the Hidden Treasure area showed the following:

- Soil is classified as sandy loam, with a range of about 13 to 20 percent coarse rock fragments.
- The soils were characterized as being 'normal soils' (pH about 8.5 or less),
- Soluble salt level of 4.0 or less, and a SAR of 13 or less.
- Soils are considered suitable for vegetation establishment
- Soils sampled at Hidden Treasure are anticipated to be applicable to the other Rocky Range soils.

As part of an ongoing characterization of the environmental features within the MCO (including biological, geological, hydrologic, etc.), The Operator has initiated the following soil sampling procedures on areas of proposed disturbance:

- Soil sampling includes collecting samples using an auger-type sample collector to a depth of either bedrock or alluvium.
- Samples are collected in a grid pattern within and along the periphery of areas of proposed disturbance.
    - Grid size is dependent upon terrain and other features such as vegetative communities, previous disturbance, etc. within the sample area.
- Samples that are collected are sent to the Utah State University Analytical Laboratories (USUAL) for soil characterization.

The purpose of this endeavor is as follows:

- To characterize the soil types within the MCO
- Identify the boundary between topsoil and alluvium, in which a layer of highly alkaline material occurs. High alkalinity soils may have adverse effects on growth potential of the soil.
- To develop greater understanding of soil types, the identification of, and occurrence by The Operator.

Table 10: Characteristics of Soils Within MCO (NRCS, 2019) (Figure 6)

Soil Map Unit	Description	Ecological site	Soil Depth	Parent Material	Drainage Class	Frequency of Flooding/ Ponding
106	Dixie-Garbo complex, 3 to 8 percent slopes	Semidesert Loam and Gravelly Loam (Wyoming Big Sagebrush) South	0 to 60 inches: Gravelly to very gravelly clay loam and loamy coarse sand	Alluvium derived from igneous and sedimentary rocks	Well Drained	None / None
116	Hiko Peak-Crestline complex, 3 to 8 percent slopes	Semidesert Gravelly Loam (Wyoming Big Sagebrush) South	0 to 60 inches: Gravelly to very gravelly sandy loam and loamy sand	Alluvium derived from igneous and sedimentary rocks	Well Drained	None / None
149	Riverwash-Medburn association	Semidesert Sandy Loam (Wyoming Big Sagebrush)	0 to 60 inches: Fine sandy loam	Alluvium derived from igneous and sedimentary rocks	Well Drained	None / None
150	Pits, mine-Dumps complex, 0 to 30 percent slopes	-	-	-	-	-
167	Crestline sandy loam, 3 to 8 percent slopes	Semidesert Loam (Wyoming Big Sagebrush)	0 to 60 inches: Sandy loam to gravelly to very gravelly loamy sand	Alluvium derived from igneous and sedimentary rocks	Well Drained	None / None

Results of previous and ongoing soil characterization activities are summarized in **Table 11**.

Table 11: Soil Characteristics based on Grid Sampling Within MCO (Appendix D)

Grid Location	Description of Terrain	Ecological site	Soil Depth	Soil Type
Hidden Treasure	Flat valley	Moss, sagebrush, grass	Average depth: 36 – 72in. Minimum depth: 12 in.	Sandy Loam to Sandy Clay Loam. Average pH = 7.9;
Sunrise	Flat valley	Flowering plants, moss, grass	Average depth: 12 – 24in. Minimum depth: 12in. Maximum depth: 48in.	Sandy Loam to Sandy Clay Loam. Average pH = 7.8 Average Salinity = 0.59 dS/m
Copper Ranch	Flat valley and hillside.	Sagebrush, grass, moss	Average depth: 12 – 36 in. Minimum depth: 0 in. Maximum depth: 96 in.	Sandy Loam to Sandy Clay Loam to Sand. Average pH = 8.0; Average Salinity = 0.64 dS/m
Crossroads	Flat valley and hill slope	Sagebrush, grass, ephedra	Average depth: 12 – 36in. Minimum depth: 12in. Maximum depth:72in.	Sandy Clay Loam to Sandy Loam. Average pH = 7.8; Average Salinity = 0.42 dS/m
Candy B	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled
Bawana	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled
Niagara/Copper Hill	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled
Maria	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled
Plant Area	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled
OK	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled	Not Yet Sampled

Based upon the results of the soil grid sampling the Operator has determined the following:

- Soil salvaging can be adequately completed to a significant depth depending upon location of soil salvage with little to no risk of contamination from unsuitable soils.
- Alluvium harvested during pre-stripping of open pits may also be a useful substitute for growth media despite the low organic content. Especially if used as an initial cover while the actual salvaged soil be used as the final cap during reclamation.

106.5.1 Location of Plant Growth Material

To promote plant growth during reclamation all recoverable topsoil will be collected to a depth of 12 inches unless otherwise specified by the soil sample results. Reasons for salvaging topsoil at depths less than 12 inches include:

- Re-disturbing pre-disturbed areas where little to no topsoil remains
- Disturbing areas on hillsides or near rocky outcrops where little to no topsoil is found
- Encountering the alkaline layer between the alluvium and topsoil at depths shallower than 12 inches. Until more information is known on the adverse effects of the alkaline layer on the growth potential of topsoil, salvaging below this layer will not occur.

The following **Table 12** lists topsoil quantities and locations within the MCO.

Table 12: Topsoil Quantities and Locations

GREATER PLANT AREA AND ITDF			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
20,660	South of the SW Corner of the flotation tailings pond	Topsoil was collected from the footprint of the floatation tailings pond that included two smaller topsoil piles from prior operations. The topsoil is located west of the lab facility.	11
4,660	North of the NE Corner of the flotation tailings pond.	The top soil was collected and stockpiled either from the area previously permitted as a dry stack tailing area or the mill area and stockpiled north of the flotation tailings pond.	11
262,525	ITDF*	This topsoil will be collected from the proposed location of the Intermediate Tailings Disposal Facility and the surrounding access road, tailings line corridor, and diversion channel. The topsoil will be collected during each Phase's construction and placed in the existing topsoil stockpile located near the ITDF.	11
18,430	Acid plant, SX/EW, related facilities and ponds footprint	Estimated amount of topsoil to be collected from the footprint of the facilities to be built in the greater plant area and stockpiled to the north of those facility locations plus the tailings/decant line corridor from the plant site to the west edge ITDF, which will be wind-rowed adjacent to the corridor.	11
2,010	Laydown Area & Remainder of Greater Plant Area	Available topsoil will be collected and stockpiled at a location to be determined within the disturbance area.	11
308,285	**Total Greater Plant Area and ITDF**		
*Volume of current ITDF Stockpile is based on an aerial survey conducted on 11-12-2018. Volume was measured using Pix4D software.			

HIDDEN TREASURE MINE AND SITLA ORE TRANSFER AREA			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
105,000	Hidden Treasure Pit and initial disturbance (Hidden Treasure topsoil stockpile)*	The topsoil was collected from the Hidden Treasure pit extension and the footprint of the Hidden Treasure dump area and stored between the Hidden Treasure pit and dump area.	5
17 ,334	SITLA topsoil stockpile	The topsoil was collected and placed on the easterly boundary of the 6.06 acre parcel identified as an Ore Transfer Station on State Trust Lands. Additional amounts totaling 11,712 cu. yds were collected from the Hidden Treasure dump expansion and added to the existing 5,622 cu. yds. previously collected from the SITLA parcel.	5
57,870	Hidden Treasure Dump Expansion (2015) (SITLA topsoil stockpile)	This represents the calculated amount of topsoil to be salvaged by expanding the currently permitted 72.2 acre Hidden Treasure waste dump an additional 35.87 acres. It is assumed that topsoil salvage depth will be approximately one foot.	5
162,870	**Total from the Hidden Treasure and SITLA area.**		
*volume revised based on 2014 survey results Additional growth media in the form of a large alluvium stockpile can also be used during reclamation of the disturbed areas around the Hidden Treasure Mine and SITLA ore transfer area.			

BAWANA MINE & BAWANA ORE STOCKPILE AREA			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
0	Ore Stockpile Area	Part of an existing area that was previously partially disturbed by prior operations is now being used as a stockpilie site for low grade ore from the Bawana pit. The entire area will be covered with 1 foot of topsoil from nearby stockpiles then topsoiled area will ripped to a depth of two (2) feet, and reseeded.	5
2,400	Bawana Pit Extension* (stored in the Hidden Treasure topsoil stockpile)	Less topsoil than was originally estimated to be present was recovered and placed in the stockpile. This was due to more rocky terrain than anticipated, and more areas of previous disturbance.	5
13,600	Bawana Dump Extension* (stored in section of haul road)	Less topsoil than estimated was recovered. This was due to more rocky terrain than anticipated, and more areas of previous disturbance.	5
16,000	**Total Estimated Cubic Yards for the Bawana areas.**		

* volume revised based on 2014 survey results

Topsoil located in the road segment will be salvaged and used during reclamation activities within the Bawana disturbance area. If additional topsoil is needed during reclamation activities, growth media in the form of alluvium stockpile can be trucked from the Hidden Treasure area.

NIAGARA/COPPER HILL MINE, DUMP, AND HAUL ROAD			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
~25,600	Niagara Pit	Based on latest mine plan. Represents topsoil removed for the development of said pit.	5
0	Niagara Waste Dump	No new waste dump for the Niagara pit, the waste will either backfill the Bawana pit or be added to the Bawana waste dump.	5
TBD	Niagara Haul Roads	Total disturbance related to the haul roads to and from the Niagara open pit are to be determined. No haulage established at this time.	5
~25,600	**Total estimated Cubic Yards for the Niagara/Copper Hill areas.**		

MARIA MINE & RELATED HAULAGE ROADS			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
~1,600	Maria Pit Extension	The Maria Pit is currently designed to be extended. Any topsoil that had been salvaged historically will be used to reclaim the existing disturbance where applicable.	5
0	Maria Waste Dump	There are no current plans to increase the disturbed area of the Maria waste dump at this time.	5
~1,600	**Total estimated Cubic Yards for the Maria Mine areas.**		

SUNRISE MINE, WASTE DUMP, & RELTATED HAULAGE ROADS			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
26,000	Sunrise Pit (Sunrise pit topsoil stockpile)	The Sunrise Pit is planned to encompass 12.46 acres, some of which has been disturbed by historic mining in this area. A total of 26,000 CY of topsoil has been recovered from the entire pit footprint, and stored in a stockpile near the pit.	5
25,900	Sunrise Waste Dump* (Sunrise Dump topsoil stockpile and berm)	The Sunrise Waste Dump encompasses 23.3 acres southwest of the proposed Sunrise Pit. A total of 25,900 CY of topsoil was recovered; 18,100 CY is stored in a stockpile adjacent to the toe of the dump and 7,800 CY are stored as a berm around the perimeter of the current Sunrise dump toe.	5
1,600	ds (Sunrise Haul Road	Total disturbance related to the haul roads was approximately 8.63 acres. Topsoil salvaged from the haul road is stored in the pit stockpile.	5
53,500	**Total Estimated Cubic Yards for the Sunrise areas.**		

* Simple volume estimation based on area indicate that 37,500cy should have been scavenged, it is unknown as to why the previous operator (CS Mining) was unable to scavenge 37,500cy.

Although the volume of topsoil salvaged may have been lower than estimated using simple volumetric calculations, additional growth media is available in the form of alluvial cover, which can be harvested from the borrow pit located south of the existing pit, and southwest of the existing waste dump.

COPPER RANCH MINE WASTE DUMP AND COMPLEX			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
43,485	Copper Ranch Complex	Represents the amount of topsoil salvaged and stockpiled by the previous operator (TMC). Actual topsoil volumes were lower than estimated by TMC. Survey taken in 2024 using propeller dron software.	3
43,485	**Total estimated Cubic Yards for the Copper Ranch Complex areas.**		

CANDY B MINE & RELATED HAULAGE ROADS			
Total Cubic Yards	***Location***	***Notes***	**Map Figure**
~35,000	Candy B Pit	Based on latest mine plan. Represents topsoil removed from disturbance and mine development.	5
0	Candy B Waste Dump	Waste from the Candy B pit will be deposited on the existing Maria waste dump. No new disturbance planned for this deposition.	5
TBD	Candy B Haul Roads	No haulage has been designed for the Candy B pit at this time. Any changes to the haulage and mine plan will be updated accordingly to this NOI as an amendment to this section.	5
~35,000	**Total estimated Cubic Yards for the Candy B Mine areas.**		

106.6 Plan for Protecting and Re-depositing Existing Soils

This section will provide the Division with a description of the plan for protecting and re-depositing existing soils.

Topsoil will be recovered and preserved in the following way:

- The first 12 inches of an area to be disturbed will be salvaged.
- Topsoil will be deposited in designated topsoil stockpiles. (**Figures 2, 3, 4 & 5 and Table 12**)
- These stockpiles will be surrounded by a berm to prevent run off.
- Topsoil stockpiles will be ripped to a depth of 2feet and contoured to a 2H:1V prior to seeding.
- The stockpile will be seeded with an interim seed mix outlined below.

All topsoil stockpiles will be monitored via monthly inspections for weed growth. Should weeds take root the Operator will take the following actions:

- The topsoil stockpiles will be treated by the Operator or a Certified Contractor with commercial herbicide.
- The Operator will work with the BLM on establishing best practice for weed treatment prior to treating the topsoil stockpiles.
- Alternatively, the Operator will submit the Contractors certification to the BLM prior to topsoil treatment.
- Herbicide will be applied regularly until the stockpiles are either used for reclamation or the weed is no longer present. Care will be taken to ensure the application of the herbicide will not interfere with subsequent beneficial seeding.

One topsoil stockpile is located in a segment of haul road at the toe of the Bawana dump (**Figure 5**). The topsoil, due to being in the haul road, will not be treated with an interim seed mixture. The slope of the haul road, where topsoil is exposed, will be monitored for weed growth, as described previously.

On reclamation the previously disturbed soil will be replaced in the following way:

- The disturbed area will be contoured and ripped prior to topsoil placement
- Previously stockpiled soils will be hauled to a disturbance area.
- A minimum depth of 6 inches of topsoil will be spread over the disturbance.
- Detailed reclamation practices are outlined in **Section 110e**

Table 13:Interim Seed Mix

Interim Seed Mix	
Species	Seed lbs/acre
hycrest crested wheatgrass	1
Russian wild rye	4
Thickspike wheatgrass	3
Forage kochia	1
Yellow Sweet Clover	0.5

106.7 Existing Vegetative Communities to Establish Benchmarks for Revegetation Success

This section will provide the Division with a description of the existing vegetative communities and cover levels, sufficient to establish revegetation success standards in accordance with Rule R647-4-111.

The BLM (2002), in an EA for the original project at Hidden Treasure, classified the range site near the Hidden Treasure area in parts of Sections 20, 21, and 22 as follows:

- Semi desert Loam (#451)
- Semi desert Gravelly Loam (#453).
- Natural vegetation in this area was predominantly
    - Wyoming Big Sagebrush,
    - Indian Rice grass
    - Galleta (Curly grass)

Line-transect surveys completed for the 1996 LMO for the OK Mine by Centurion Mines Corporation showed the following:

- Vegetation cover of 21%,
- Litter 15%
- Rock/rock fragments 12%
- Bare ground 52%.
- The predominant perennial species of vegetation were listed as follows:
    - Big Sagebrush
    - Rabbit Brush
    - Squirrel Tail grass
    - Indian Rice Grass.

Under R647-4-106 (7), the operations plan must provide a description of existing vegetative communities and cover levels, sufficient to establish revegetation success standards at 70% of pre-mining vegetative cover.

The areas that have been or are to be disturbed can be described as follows:

- The area to be disturbed has been previously disturbed or occurs on steep rocky slopes.
- There are significant areas that are devoid of vegetation or dominated by invader species.
- Some older waste dump and alluvium storage areas have revegetated over the years, with a sparse (but not unlike surrounding cover patterns) cover of rabbitbrush, grass, and forbs.
- The Rock Range mining area has natural slopes of upwards 50 degrees and is dominated by large outcrops of volcanic rock.
- Soil characteristics are similar to Semi desert Gravelly Loam (#453), although no soil characterization has been performed.
- The area supports sparse amounts of sagebrush, rabbitbrush, and grass,
- Soil depths encountered during road building activities related to exploration within the Rocky Range have ranged from 0-3 inches.

The Operator's predecessor has completed a biological survey for the entire MCO. The survey has been approved by the Bureau of Land Management's Cedar City office (see **Appendix**). Follow-up biological surveys are also performed on an as-needed basis.

106.8 Depth to Ground Water, Depth of Overburden Material, and Geologic Setting

This section will provide the Division with a description of the depth to ground water, extent of overburden material, and geologic setting within the MCO.

106.8.1 Depth to Ground Water

Ground water in the general vicinity of the MCO has not been described in the published literature, but has been characterized by onsite geologists as follows:

- Aquifers occur in fractured granodiorite according to the limited on-site drilling data described in **Table 14**.
- Exploration drilling within the Rocky Range portion of the MCO encountered water from as shallow as 5037ft AMSL to as deep as 4709 ft AMSL.
- Water returns for the shallow water that was encountered yielded quantities from two to ten gallons per minute (GPM) (**Table 14**).
- Water returns greater than 10gpm are not encountered within the MCO until depths exceeding 5,037ft ASML.
- The types of rock in which water was encountered within the Rocky Range portion of the MCO consist of intrusive ranging from granite to a quartzite to quartz monzonite with skarn zones.
- No water is encountered in the overlying alluvial fill throughout the MCO.
- Drill-hole water intercepts and flows produced, along with past open pit mining experience,

indicates that any water that may be encountered during mining in the Rocky Range portion of the MCO is likely perched or compartmentalized.

Should water be encountered during pit development within the Rocky Range portion of the MCO, it is not expected to affect pit wall stability or interrupt mining. The occurrence of these isolated ground water occurrences at variable depths and elevations suggests that infiltration to a deeper aquifer is not taking place.

Sunrise Pit

The Sunrise pit contains a pond that has persisted since mining ceased in 2015. After reviewing site historic drill logs, The Operator is able to present the following:

- Exploration drilling encountered water sporadically in this area, with holes exceeding 1000 feet into dry strata neighbored by holes that encountered water as soon as 325 feet
    - Three historic vertical drill holes that plot directly in the present pond encountered water at an average depth of 4986 feet AMSL,
    - This is consistent with the Utah Division of Water Right's estimate that the pond lies at an elevation of 4,980 feet AMSL (60 feet above the water level of the 4920 feet AMSL Martin-Marietta Well.)
    - Sunrise pond is 2.1 miles from the Martin-Marietta Well. Given a water elevation difference of 60 feet, a gradient of roughly -0.5% Is achieved.

- Roughly 9% of drill holes located in the Sunrise – Old Hickory area encounter water in geology which may be characterize as follows;
    - 60% of wet holes were found in permeable and fractured altered and unaltered carbonate rocks
    - The Remaining wet holes encountered water within rock that was logged as quartzite, various intrusives, and altered intrusives.
    - Local compartmentalization may be demonstrated by the intermingling of wet and dry holes as they commonly exist in close proximity to one another.

- Maintaining a relatively static water level, it has been assumed that the pond is being recharged at a rate that equals or exceeds the rates of evaporation and/or drainage.

- The nature of groundwater in the Sunrise area is thought to be very localized, given the extensive faulting, fracturing, folding, and hydrothermal alteration that the area has experienced.

- Holes drilled into significant overburden include two holes in the Sunrise dump and seven holes roughly 1/3 of a mile southeast of the pit.
    - Holes within the dump encountered overburden ranging from from 30 to 188 feet in depth, while the other six holes were in alluvium for an average of 214 feet.
    - All nine holes encountered water at an average depth of 4,835ft AMSL with an original

topography of 5,192.
    - Lithologic logging for these holes indicates that each save for one encountered water within monzonite, the other in overburden.

Copper Ranch Complex

Exploration drilling encountered water within the Copper Ranch Complex and is summarized as follows:

- Water was encountered as shallow as 5,168ft AMSL to as deep as 4,139ft AMSL.
- Water results for the shallow water that was encountered yielded quantities of 5 gpm (**Table 14**).
- The types of rock in which water was encountered within the Copper Ranch Complex consist of volcanics along with granite and associated skarn zones.
- Water at quantities greater than 5 gpm are not encountered until depths of 4855 ft AMSL.
- No water has been encountered in the Copper Ranch Mini or Intermediate pits.

Beaver Lake

Exploration drilling within the Beaver Lake portion of the MCO did encounter large quantities of shallow water (Crossroads drilling).

Any mining in this area will require further ground water characterization in order to optimize pit design and mine production.

Milford Copper Operation (MCO)

The Operator will perform baseline hydrologic studies prior to pit development. This study will include:

- Sampling any standing ground water within open pits for water quality analyses;
- Creating a comprehensive map of all exploration drill holes in which ground water was encountered;
- Creating ground water contours for the areas where heavy drilling has been performed and ground water was encountered.

Results of these studies will be presented to the Division and included in **Appendix** of this NOI.

See **Section 109** below for detailed information on ground water quality and water rights information for the MCO.

Table 14:Summery of Drill Holes that Intercepted Water in MCO.

Location		Hole Attributes		Water Level		Geology	Flow Rate
Mine Area	Mine Name	Exploration Hole ID	Hole Depth	Top of Water	Elevation	Lithology	GPM
Copper Ranch Complex	Copper Ranch	CRR-23	900	500	5010	Volcanics/Skarn/Granite	5
		CUR14-1	565	320	5138	Volcanics	5
		CUR14-10	965	480	5051	Volcanics/Skarn/Granite	5
		CUR14-11	585	500	4994	Skarn/Granite	5
		CUR14-13	845	440	5016	Volcanics/Skarn/Granite	5
Rocky Range	**Bawana**	BW-8A	525	485	5029	Granite	1
	Maria	MAR_48	570	500	4819	Granite	5
		MAR_49	600	500	4819	Granite	10
		MAR_58	635	610	4709	Granite	28
		MAR_59	600	600	4717	Granite	10
		MAR_67	545	385	4926	Skarn/Granite	4
	Old Hickory	SOH-24WA	540	360	4953	Quartz	5
		SOH-32WA	540	355	4961	Quartz/Monozonite	5
		SOH-8.24WA	480	330	4953	Quartz/Monozonite	5
	Sunrise	SR-117	500	380	4913	Quartz	10
		SR-121WA	390	350	4898	Quartz/Monozonite	5
		SR15-19	600	500	4786	Quartz/Monozonite	25-30
		SR15-20	480	480	4807	Quartz/Monozonite	40-45
		SR-15WA	370	250	5026	Quartz/Monozonite	5
Beaver Lake	**Crossroads**	XRD-9	500	140	5557	Granite	100
		XRD-35	440	340	5357	Granite	158

106.8.2 Depth of Overburden

Overburden thickness varies depending on location within the MCO but can generally be categorized in the following ways:

- In the Rocky Range portion of the MCO, overburden thickness varies between 0 to 300 feet, and is composed of alluvium and/or bedrock.
- In the Copper Ranch Complex, overburden thickness varies between 25 to 200 feet, and is composed of alluvium and/or bedrock.
- In the Beaver Lake portion of the MCO, overburden thickness varies between 0 to 300 feet, and is composed of alluvium and/or bedrock.

106.8.3 Geologic Setting

The Rocky Range

- A small isolated range three miles west, four miles north of Milford, with a peak elevation of 6,003 feet.
- The southern portion of the range is comprised primarily of sedimentary units which include:

    - The Permian Talisman Quartzite
    - Toroweap,
    - The Kaibab-Plympton Undifferentiated
    - In the Triassic, the Moenkopi Formation.
- All are intruded by quartz monzonite stocks and sills, along with aplite and hornblende-latite dikes.
    - Dips are generally 70 degrees + and some beds on the east flank of the range are overturned.
    - The Old Hickory and Sunrise mines are in this structure.
- All sedimentary units have been metamorphosed with alteration ranging from mild to extreme.
    - Quartzites are generally strongly silicified.
    - Limestones, the primary host of mineralization in the range, have been marbleized or metamorphosed into skarns containing diopside, garnet, wollastonite and magnetite in differing abundances.
    - Siltstones have been altered to skarns or hornfels.
- Alteration makes stratigraphic identification of all sedimentary units difficult.
- Intrusive rocks in the range include:
    - Granite in the northwest
    - Quartz monzonites are scattered and exposed in the Southern portion
    - Granodiorite, lies primarily in the East-Northeast Portion.
- Volcanics including ignimbrites and andesites occur in the northeast portion on the western flank of the range.
- Proceeding north through the range, the trend of the structure changes to a northwest orientation and becomes an asymmetric,
    - North plunging anticline containing the Bawana ore body in the Toroweap.
    - The Montreal in the Kaibab-Plympton on the north flank of the anticline.
    - The Maria ore body is in different beds of the Toroweap formation on the southern flank of the anticline.
- Both portions of the Rocky Range structure contain faults parallel to the axes, along with east-west trending faults that appear to play a crucial role in localizing separate ore bodies

Beaver Lake Mountains

- Oligocene age volcanics accumulated both in the Beaver Lakes and the Rocky Range upon eroded thrust sheets of underlying Paleozoic and Mesozoic rock. Flows consisted of plagioclase, hornblende, and biotite andesitic flows.
- These volcanics and their underlying rocks are intruded by granodiorite/quartz monzonite which imparted alteration on both volcanics and carbonates.
- Primary alteration types in the volcanics are epidote-chlorite and quartz-sericite.
- The pre-volcanic structure in the Beaver Lakes Mountains is dominated by the Frisco thrust. The thrust caused Precambrian metaquartzites and Cambrian quartzites and carbonates to override the Devonian Simonson Dolomites in the Beaver Lake mountains.

- Lime mountain block at the north end has several minor overthrusts as well as bedding plane thrusts that thin stratigraphic units. This imbrication is below the Frisco thrust. The westernmost thrust brought Mississippian limestone over a complex anticline of Ordovician to Devonian rocks. The easternmost thrust brought Devonian dolomite and Quartzite over Mississippian limestone.
- After Mesozoic thrusting, and considerable erosion and deposition of fanglomerates, the Milford area was the site of Oligocene andesitic volcanism.
- Normal Faulting, horst and graben structures, postdate andesite flows. This faulting either predates or is contemporaneous with the emplacement of stocks, sills, and dikes.

106.9 Location and Size of Ore and Waste Material Stockpiles, Tailings Facilities and Treatment Ponds, and Discharge Locations

This section will provide the Division with a description of the proposed location and size of ore and waste stockpiles, tailings facilities, and water storage/treatment ponds located within the MCO.

106.9.1 Ore and Waste Material Stockpiles

As discussed in previous sections of this NOI, there will be several pits within the MCO, each with a designated waste dump. **Table 15** below describes the waste dumps within the MCO. Descriptions include: approximate size (in terms of acreage) of each dump, maximum height, maximum capacity, and source of waste rock material.

Table 15: Active and Inactive Waste Dumps in MCO

Waste Dump Name	Size (acre)	Maximum Height (ft amsl)	Maximum Capacity (tons)	Source of Waste Material
Hidden Treasure	100.58	Toe: 4920 Crest: 5600	16,000,000	Hidden Treasure, Maria, Copper Ranch Mini
Bawana*	37.41	Toe: 5350 Crest: 5500	2,300,000 above historic waste dump amounts	Bawana, Niagara/Copper Hill
Sunrise	41.23	Toe: 5300 Crest: 5420	6,000,000	Sunrise
Copper Ranch Intermediate	36.9	Toe: 5450 Crest: 5635	7,500,000	Copper Ranch
Copper Ranch Mini	8.56	Toe: 4570 Crest: 5690	1,200,000	Copper Ranch
Niagara - Copper Hill	N/A	N/A	N/A	Niagara/Copper Hill
OK	?	?	?	
Crossroads	?	?	?	
Candy B	?	?	?	

*This footprint may be used by the Niagara/Copper Hill waste mined upon approval of bond.

Ore material extracted from the various open pits within the MCO is stockpiled on the Run of Mill (ROM) pad, or in previously disturbed and bonded areas. The ROM pad stockpile area at the process facilities is located north of the flotation mill and has a maximum capacity of approximately 800,000 tons of material.

106.9.2 Tailings Facilities and Treatment Ponds

The Following is a summarize timeline of the Operators tails facilities.

- In February 2015 a Permit to Use the Intermediate Tails Disposal Facility East (EITDF) was issued by the DWQ to the previous Operator (CSM).
- Tails were deposited in the ITDFE until May 2018 when the facility reached capacity by TMC.
- Between April 2018 and May 2018, the old Float Tail Pond was excavated and relined as an Emergency Tails Facility. A Permit to Use was issued in May 2018.
- In September 2018, construction began on a 10ft raise was built around the Float Tails Pond (FTP) and was completed in November 2018.
- In September 2018, a Construction Permit was issued for the construction of the West ITDF

(WITDF) to 5820' and 5840'. Construction on this new facility did not take place and the permit has since expired MMCU expects to explore creating a new set of WITDF plans and specs in the coming years.

- Future tails facility expansions and plans are detailed in 106.2.9 (**Table 5**)
- The FTP was previously Operated under the original Permit-by-Rule. DWQ has asked that it be included on the most recent renewal of the Operators GWDP.
- After The Operator acquired the property and operation in 2023, the EITDF 5,840' lift was designed and approved. At this time The Operator is working on constructing said lift.

Tails Discharges into the Tails Facility are characterized in the following ways;

- Daily discharge into the sites tails facility is expected to be between 2,000 and 3,000 Dry Tons Per Day (TPD) or ~2,800 to ~4,200cy per day of wet tails.
- Tails comprises ~40% water and ~60% solids.
- Tailings are neutralized with Lime Kiln Dust (LKD) prior to disposal. Tails pH is between 5.5-8.0.

Detailed design drawings for both the FTP and the ITDF (Both East and West) may be found in the Appendix but as a summery, the following applies:

- The area of disturbance for the ITDF (East and West) is 65.5 Acres.
- The inner slopes of the ITDF do not exceed 2.5:1, the southern embankment does not exceed a 2.2:1 slope.
- The area of disturbance for the FTP is 32 Acres.
- The inner slopes of the FTP are constructed a 2.5:1 the outer slopes are constructed at 2:1

Subsequent dam construction and raises will specify either the same not-to-exceed slopes, or shallower slopes depending upon the recommendation of the certified engineer and Utah Dam Safety Engineer.

106.9.3 Process Water Discharge and Storm Water Management

Process Water Discharge

Operators facilities are designed to be Zero Discharge facilities. As Detailed in **Section 106.2.2** the Operator obtained a onetime permission to discharge up to 40 Million Gallons of solution. This permission has expired and The Operator manages current water balance in a manner to ensure that no further discharges are required. Process water may be used for dust control if the criteria in **Section 106.2.10** are met.

Storm Water Management Plan

A storm water management plan (SWPPP) has been prepared in accordance with approval to operate under the Multi-Sector General Permit for Storm Water Associated with Industrial Activities, which has been obtained from the DWQ.

Surface water flow in the project area occurs as sheet flow and rare storm-induced runoff in two ephemeral drainages which are described as follows:

- The ephemeral drainages associated with the process facilities area are the unnamed drainages to be impounded by the ITDF, and a small unnamed drainage that is blocked by the ITDF north diversion berm.
- An ephemeral drainage within the Rock Range portion of the MCO, the Hickory Wash, will also be impounded due to ongoing mining activities.

Erosion from the out slope faces of the ITDF dams is expected to be minimal for the following reasons;

- The dams, stormwater chutes, diversion swales, and compacted berms will block the entire watershed upstream.
- The small area of the dam out slopes is insufficient to generate ongoing flows that will cause transport of any sediment that may be deposited below the toes of the dams as a result of erosion.

Any sediment that interferes with operations or accumulates in significant quantities will be collected and placed in a stockpile adjacent to the toes of the dams. These stockpiles will be seeded with temporary seed mix for late use during reclamation.

R647-4-108 Hole Plugging Requirements

- All exploration holes drilled by The Operator will be plugged according to the requirements of R647-2-108.
- Drill holes would not be left unplugged for more than 30 days unless approved by DOGM.
    - Two water production wells, WW-3 (North Well), and the Truck Shop well will be plugged and abandoned unless a non-mining use for them is identified and confirmed by a written agreement.
        - In that event, release from surety of the cost of plugging and abandoning the well or wells will be sought from the Division.
    - WW-6 (South Well) will remain, along with the freshwater tank, for use by ranchers.
- There are currently four properly completed and secured former monitoring wells on the property.

- These wells will remain available for use throughout the life of the proposed and subsequent operations.
- The four monitor wells will be plugged according to the requirements of the Utah State Engineer as part of facility closure.
- The cost for plugging and abandoning these wells has been included in the surety estimate.

R647-4-109 Impact Assessment

109.1 Impacts to Surface and Ground Water Systems

109.1.1 Surface Water Systems

The MCO is located in the Beaver River drainage basin. The Beaver River drains to the Sevier River, which flows to the terminal Sevier Lake.

The following is data collected by the Western Regional Climate Center (WRCC) in the Milford Area over a 30-year period (1981 – 2010):

- The average rainfall in this area is 9-11 inches annually.
- Evaporation rate in this area was measured to be 78 inches annually.
- The arid climate in which the project is located lends itself to low amounts of precipitation and high evaporation rates.
- This climate accounts for the lack of perennial streams at or near the project area.
- Storm events do occur, which produce runoff, and in some instances of intense rainfall flow in, ephemeral stream channels.
    - These storm events generally occur as late summer/early fall thunderstorms, or winter frontal storms.
    - The highest recorded precipitation rate measured between 1906 and 2005 for a single storm event occurring in the Milford area produced 4.83 inches of rain over a five-day period in October, 2004 (WRCC).

A Hydrology Map, **Figure 23**, shows the watershed boundaries in the project vicinity in addition show the following:

- No perennial or intermittent streams occur in the project area and no springs have been mapped or identified in the vicinity of the project area.
- **Figure 23** shows relevant hydrologic features appropriate given the local climate and terrain.

Runoff patterns in the MCO and the process facilities are depicted on **Figure 23b (Previously Submitted)**, respectively and are discussed below:

- The unnamed canyon to the north discharges via an ephemeral channel to the west of the existing process facilities.
- A diversion berm was constructed upgradient of the process facilities.
    - The diversion berm was designed by GEM Engineering, and constructed in such a way as to divert any intercepting precipitation and runoff from the upgradient drainage

basin to the west of the process facilities, and discharge into existing ephemeral channels beyond the disturbance boundary.

- Monthly monitoring of the berm indicates the berm is successfully diverting any runoff not directly intercepted within the process facilities.
- The process facilities are surrounded by concrete foundation walls and/or lined berms designed for spill containment; these walls and/or berms will prevent any sheet flow that may occur in intense storms from affecting the facilities and will also serve to disrupt flow and interrupt erosion.
- The solution ponds have been built above grade on fill and bermed. The uphill berms of the ponds are approximately 6 feet above grade and will not intercept any runoff from surrounding areas.

Run off patterns for the ITDF are show in **Figures 23, and 23b (Previously Submitted)**, supplemental information is discussed below:

- The ITDF footprint intercepts a pair of drainages with a relatively small combined watershed (**Figure 23b, Previously Submitted**).
- 2 foot of freeboard is maintained around the ITDF.
    - This provides more than adequate capacity to store not only the direct precipitation from the design storm event (2.99 inches), but also the quantity of precipitation typically falling in the impounded watershed during an entire year (see above); therefore, the ITDF freeboard is appropriate and conservative.
    - The watersheds above the ITDF have a combined area of about ~84 acres.
    - All of the runoff generated from the upgradient area (~84 acres) will be intercepted by the perimeter road that surrounds the ITDF on all sides (excluding the dams).
    - The perimeter road created two large water collection areas to the north and northwest of the ITDF.
    - **Figure 23b (Previously Submitted)** shows the watershed boundaries and the basic ITDF features.
    - The intercepted water from the upgradient area will flow in two directions from the high point on the north side of the pond.
    - The perimeter road will intercept significantly all the runoff (from 73 of 84 acres) within the above-described water collection areas. Precipitation falling within the perimeter of the ITDF will be contained within the facility.

Open pits located within the Rocky Range portion of the MCO will have minimal impact to surface water due to the following:

- Currenting mining activities do not intercept any defined stream channels that have not been previously blocked by past mining-related waste rock piles.

- Upland watersheds that could be a source of significant run-on are virtually non-existent, resulting in improbably low potential for transport of eroded material from the new waste rock dumps.
- When surface water flows in response to intense rainfall events occur, flow is to the south toward the ephemeral and obstructed Hickory Wash, the original course of which drains around the south end of the Rocky Range to the Beaver River about 4 miles north of Milford.

The Beaver Lake portion of the MCO is located in a relatively broad drainage basin between steeper mountain slopes and will have minimal impact to surface water due to the following:

- There is no single main channel through this area, instead, runoff is apparently dispersed and distributed in small channels.
- Mining features do not intercept any of the smaller channels.
- The Process facilities are located on the southern flank of the range and do not intercept any defined stream channels.

The Float Tails Pond (FTP) is south of the process facilities and will have minimal impact due to the following;

- A diversion channel is cut up gradient of the Float Tails Pond intercepting and diverting any runoff away from the facility.
- A 2-foot freeboard is maintained and is sufficient to contain 100-year storm event.

The waste rock and gangue from the open pits within the MCO will not degrade surface water as it contains the following attributes:

- Waste rocks contain relatively little sulfide material and significant quantities of calcium carbonate contributed by the limestone that hosts the Rocky Range ore deposits.
- The presence of this mineral in waste rock will contribute to neutralization of any acid that might be generated in the waste rock from the various open pits.
- No acid or deleterious leachate and subsequent discharge is anticipated, as discussed in **Section 106.4**.

109.1.2 Ground Water Systems

The open pits within the MCO are internally draining, with no outflow and are discussed in the following;

- Groundwater from isolated perched occurrences may be intercepted during mining operations; however, the quantities are anticipated to be small if encountered at all (**see Section 106.8**).

- Any ground water encountered will typically evaporate or infiltrate.
- If water does accumulate in pit bottoms, water quality sampling will be performed.
    - The results of the water quality analyses will help The Operator determine whether or not the water might be put to beneficial use, such as dust suppression.

Sunrise pit has accumulated water that is believed to be perched or compartmentalized water and not connected to any deeper ground water system. The previous operator (TMC) sampled the water finding the following:

- The water quality analyses indicated the water is Class III drinking water, with TDS less than 3,000 mg/L and all metals below DWQ limits.
- Elevated nitrates and nitrites occurred within the water which is why the classification for the water quality is Class III and not Class II.
    - Sources of the elevated concentrations of nitrates/nitrites may be from the final blast within the bottom of the Sunrise pit, which did have one hole that misfired.
- The Operator will continue to monitor the ground water quality within the Sunrise pit for fluctuations in nitrate/nitrite concentrations.
- The Operator may use the perched water in Sunrise to suppress dust.

The potential for acid rock drainage is very low, as discussed in **Section 106.4**.

All reagents in use for the benefaction of ore are stored in the following manner to reduce the chance of impacting ground water:

- Reagents are kept within manufacture approved containers.
- Containers are stored in areas with proper secondary containment designed to contain any accidental release.
- Accidental spills are cleaned up in accordance with the Operators SPCC plan.

The Flotation Tailings Pond (FTP) was excavated and re-lined, this facility will not have a significant impact to groundwater due to the following measures.

- The emergency storage facility was constructed in accordance with the original construction parameters for the flotation tailings pond regarding inner sloping.
- The 60-mil HDPE liner was installed to meet the specifications of the facility's GWDP.
- The DWQ has asked that this facility be included in the Operators GWDP 2019 Application.
    - This pond operated under a previous Permit-by-Rule from May 2018 to June 2019
- Tailings and/or solution that would be stored in the emergency storage facility would be identical to what is being discharged in the ITDF. (**Refer to 106.4**)

The ITDF and FTP containment systems are designed to prevent degradation of ground water quality and prevent surface release of tailings liquids beyond the containment. The designs share many common features which are outlined below:

- 4-6in of silty sand compacted to 95% was placed as bedding prior to any liner. Permeability is estimated at $1.0x10^{-5}$ ft/s.
- 40mil HDPE was placed over the bedding in the ITDF and 60mil HDPE was placed in the FTP.
- HDPE Liner withstands low pH and will not degrade at pH's below 1.
    - Tails within the ITDF and the FTP are neutralized with LKD to a pH of at least 5.5 prior to placement.

There is a very low potential for a leak escaping the pond to reach any water table under the largely unsaturated flow conditions that will exist beneath the ITDF. This conclusion is based on the following:

- The professional experience of engineers, technical staff and consultants involved in the design and construction of the ITDF.
- The presence of a liner beneath the entire ITDF.
- Due to the natural consolidation of tails the moisture content of the tails near the bottom of the facility is expected to be between 20-30% as the tails naturally consolidate.

The ITDF is not anticipated to adversely impact ground water quality primarily due to the distance to ground water, and the limited amount of water that may leak from the impoundment.

Leak detection systems are not installed in the FTP or the ITDF. Leak detection is accomplished through monitoring wells installed at the base of the East ITDF impoundment and the FTP. These wells are sampled quarterly, and reports are submitted to DWQ in accordance with the Operators GWDP. Leak remediation for both facilities is discussed in **Section 106.2.9.**

Both the ITDF and the FTP have diversion berms that are outlined in **Section 109.1.1** discussing Surface water and serve to protect ground water by diverting water around the facilities.

The solution reduction plan discussed in **Section 106.2.2** allowed for the discharge of neutralized solution on the following dumps:

- Hidden Treasure
- Sunrise
- Copper Ranch

The solution reduction plan was not expected to make any measurable impact on ground water and permission was obtained from the DWQ.

- DWQ issued authorization for 40 million Gallons on November 14, 2017 based on the following;

- No significant aquifer exists beneath the mine site.
- This was a onetime discharge.
- Water is not permitted to seep out of the toe of the dumps.
- Column testing indicated storage capacity of the Hidden Treasure, Copper Ranch and Sunrise dumps to be 135 Million gallons.

TMC ceased solution dumping in October, 2018 and The Operator is no longer permitted to dump any solution except for the control of dust as outlined in **Section 106.9.2.**

The 2-acre PLS and raffinate ponds have been constructed with a synthetic liner and leak detection system. Several factors make these ponds unique compared with tailing ponds:

- They will be in use for a greater time period than a tails facility.
- They contain solution columns in direct contact with their upper liners.
- They contain acidic solutions as well as residual SX solvent and reagents.

Given these operating conditions, a leak detection system for these ponds is appropriate and represents BMPs. The solution ponds are not anticipated to have any effect on local ground water quality and because the leak detection system will be in place, no monitor wells are planned.

Though consumption of ground water may increase with increased production rates, water use will remain within the quantities authorized by The Operator's water rights.

109.1.3 Water Rights

The Operator has the only water rights in the vicinity of the proposed operations.

The Operator holds multiple water rights, most of which have multiple points of diversion, some of which are shared by multiple individual water rights and are detailed below;

- The locations of the various approved points of diversion and their associated points of diversion are shown on the Hydrology Map, **Figure 23**.
- All approved points of diversion are for groundwater production.
- Eight-inch production wells range from 200 to 600 feet in depth.
- Detailed information on the Water Rights held by the Operator is located in the **Appendix**.

The sites primary wells are described below:

- WW-3 (North Well) is associated with the following water rights 71-4396, 71-4773, 71-5052, 71-5327.
  - Located north of the mill, has a collar elevation of approximately 6341ft.
  - The elevation of the water level at the time the well was drilled was recorded at approximately 6,155 ft. in a granodiorite layer (a depth of 186 feet).

- WW-6 (South Well) is associated with the following water right 71-4783
    - Located southeast of the ITDF tailings pond, has a collar elevation of approximately 5,599 ft.
    - The elevation of the water level, recorded at the time of drilling was approximately 5,503 ft. in a granodiorite layer (a depth of 96 feet).
- The Truck Shop Well is associated with the following water rights 71-4396, 71-5111
    - Located next to the Sites Truck Shop and pumps water via buried pipeline to the mill.
- Lab Reports for Water Well #3 and #6 are summarized in **Table 16 & 17**
    - Both wells are considered Class II drinking water due to high TDS, and elevated sulfate concentrations
    - Both wells are sampled quarterly as part of the Operators GWDP.

In addition to the sites primary wells the site has several monitoring wells,

- Four monitor wells are installed immediately down gradient of the flotation tailings pond excavations, these are part of water right 71-4783.
    - These wells were part of the former Nevada Star proposed heap leach operation.
    - They have an average depth to ground water of approximately 167 feet.
- The ITDF Monitoring Well was installed south of the East ITDF Embankment in 2015 and is sampled Quarterly.
- The Ground Water Discharge Permit Application (GWDP) is included in the **Appendix.**

Table 16 & 17: Water Well 3 & 6 Test Summary

Southern Utah University Water Lab Data				
Parameter	Units	Well #3	Well #6	MRL*
pH	SU	6.72	7.36	4
Arsenic	µg/L	<5	<5	10
Barium	mg/L	0.014	0.029	0.005
Beryllium	mg/L	ND	ND	0.001
Cadmium	µg/L	<1	<1	1
Chromium	mg/L	ND	ND	0.005
Copper	µg/L	<50	<50	50
Lead	µg/L	5.66	<5	5
Mercury	mg/L	ND	ND	0.0002
Nickel	µg/L	<10	<10	5
Selenium	µg/L	<5	<5	5
Thallium	µg/L	ND	ND	2
Fluoride	mg/L	<0.4	0.435	0.4
Sodium	mg/L	65.8	81	5
Sulfate	mg/L	700	798	5
Nitrate	mg/L	0.313	<0.1	0.1
Nitrate+ Nitrite Total	mg/L	0.313	<0.1	0.1
Nitrite	mg/L	<0.1	<0.1	0.1

GE Water & Process Technology Data			
Parameter	Units	Well #3	Well #6
Specific Conductance	µmhos	2220	2560
Alkalinity - $CaCO_3$	ppm	297	84
Sulfur	ppm	528	697
Chloride	ppm	236	364
Hardness, Total - CaCO3	ppm	1090	1260
Calcium Hardness	ppm	810	893
Magnesium Hardness	µg/L	279	364
Copper	ppm	<0.05	<0.05
Iron	ppm	<0.05	<0.05
Sodium	ppm	68	89
Potassium	8.4	2	798
Phosphate, Total - PO_4	ppm	<0.4	<0.4
Phosphate, Ortho - PO4	ppm	0.2	0.2
Silica - SiO_2	ppm	19.6	25

109.2 Impacts to State or Federal Threatened and Endangered Species or their Habitats

The area within the MCO is a high priority year-long antelope habitat and receives some use by mule deer. According to the BLM (1998), antelope habitat would be lost due to continued mining activity.

The Operator's predecessors have conducted the following biological surveys for the entire MCO:

- baseline vegetative studies
- habitat surveys for bats
- surveys for sensitive plant species

Other wildlife species that occur in the area (BLM, 2011) include:

- Golden eagle,
- Ferruginous hawk,
- Kit Fox,
- Great Basin rattlesnake,
- Black Tail jackrabbit,
- Cottontail Rabbit
- Misc. small mammals and birds.

Federally listed species that may have the potential to occur in Beaver County include:

Table 17: Threatened or Endangered Species Near MCO

Species	Protection Status
California condor *(Gymnogyps californianus)*	Endangered/Experimental-Non-Essential
Greater sage-grouse (*Centrocercus urophasianus*)	Candidate
Utah prairie dog (*Cynomys parvidens*)	Threatened
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Candidate

The California condor is designated as an experimental, non-essential population in this part of Utah:

- In 1997 California Condors were released into the wild at the Vermilion Cliffs in northern Arizona near the Grand Canyon.
- Condors from this release site have subsequently been observed in various locations in southern Utah, including in and around Zion National Park.
    - These sightings are isolated incidents, and the birds eventually return to the Vermilion Cliffs.
    - These individuals are part of a non-essential, experimental population, and are not subject to the same level of protection as naturally occurring populations of Listed species.

- The California Condor is not known to nest or roost near the project area; mining activities would not impact this species.

The Greater sage-grouse are an obligate sagebrush species:

- Utah populations occur primarily in habitat dominated by sagebrush species.
- Sage grouse nest in sagebrush with heights ranging from 11.5 - 31.5 inches, with greatest nesting success in habitat with sagebrush 16 - 31.5 inches, canopy cover averaging 27%, and grass height > 7 inches (Connelly et al. 2000).

The Utah prairie dog is the westernmost member of the genus *Cynomys*:

- The species range is limited to the southwestern quarter of Utah.
- Utah prairie dogs have not been observed in the project area and would not be impacted by mining activities in the operations area.

The Western Yellow-Billed Cuckoo is a bird that occurs in cottonwood-willow forests in the west:

- Populations in Utah have been historically noted to be uncommon to rare along river bottoms.
- Due to the lack of vegetation or riverine habitats in the operations area, this bird would not be expected to occur and would not be impacted by copper mining activities in the operations area.

109.3 Impacts to Existing Soil and Vegetative Resources

Ongoing mining activities are performed in compliance with the Division's rules:

- Mining activities have and will result in the temporary displacement of topsoil. In order to preserve the soil resource, the Operator commits to the following:
    - Any new area, not previously disturbed, will preserve the top 12in of topsoil (except instances where this is not possible) in designated topsoil Piles.
    - Topsoil piles are documented, and seeded with an interim seed as outlined in **Section 106.6, Table 13**
- Reclamation of the area will be performed by the Operator. The appropriate topsoil pile will constitute the final layer prior to seeding.
- Areas not reclaimed, primarily open pits, will no longer be soil covered and will not support all of the vegetation types that grew there prior to mine development.

The arid climate and high-alkaline nature of the soil within the MCO promotes growth of weeds and invasive species such as Halogeton and Russian thistle over desirable species. Because of this, disturbed areas that are anticipated to be reclaimed may be overrun by invasive species during the reclamation process. This could reduce the success of desirable plant species within proposed reclaimed areas.

109.3.1 Concurrent Reclamation

- The Operator will conduct concurrent reclamation where practical.
    - Hydro mulching, and hydro seeding of tails facility out slopes will be considered so long as it does not impede the safe, and efficient operation of the facility.
    - The Operator does tentatively plan to backfill pits when the opportunity arises, provided that the area is proven sterile of additional resource, and no additional mining is deemed feasible by the Operator.
- Areas disturbed under this notice that are not routinely or currently used will be kept in a safe, environmentally stable condition.
- Noxious weeds on the State of Utah and Beaver County Noxious Weeds list will be monitored for, and aggressively treated if present, on these disturbed sites.
- Until reclamation is deemed to be successful by the Division, surety for post-operation reclamation will remain in place.

109.4 Impacts to Cultural Resources

The results of the cultural resource records search indicate both prehistoric and historical use of the land within the MCO. Based on the previously recorded sites within the MCO, expected cultural resources include prehistoric sites with artifacts commonly attributed to the Archaic through the Fremont cultural phases, while historical resources will be primarily mining related.

Class III cultural surveys will be completed before any surface disturbing activity is initiated. Historic properties found will either be avoided or mitigated in coordination with the Utah State Historic Preservation Office (SHPO).

109.5 Impacts to Public Health and Safety

This section will provide the Division with a description of the projected impacts of mining operations on slope stability, erosion control, air quality, and public health and safety.

109.5.1 Slope Stability – Open Pits

Pit slopes within the MCO have been exposed for many years. Most of these slopes are approximately 50-55 degrees, and have generally remained stable; however, small toppling failures have occurred as have minor wedge failures. The catch berms on the benches have prevented movement of rock too great a distance within the pits. The fallen rock is cleaned up and hauled to the waste dumps as part of routine pit operations. As pits are deepened, they will also be laid back to maintain the existing overall slope angles, and thus their current stability will continue.

The Operator and its predecessors have conducted detailed studies of the pits and dumps within the MCO. Pit slopes that exceed the 45 Degree requirements will be backfilled or blasted down to meet the 45 Degree requirement, unless a variance is granted by the Division.

Table 18: Pit and Dump Slopes within MCO

Pits	Minimum Degrees	Maximum Degrees	Average
Bawana	19	42	32
Copper Ranch Intermediate	34	41	37
Hidden Treasure	17	47	37
Maria	28	45	36
Sun Rise	26	49	38
Dumps	**Minimun Rise over 1**	**Maximum Rise over 1**	**Average**
Bawana	1.5	4.1	2.3
Copper Ranch	1.5	2.9	1.9
Copper Ranch Mini	2.2	5	3.3
Hidden Treasure	1.5	4.2	2
Maria	1.5	2	1.7
Sun Rise	2.2	4.5	3

*See Pit and Dump .pdf in the Appendix for detailed cross sections of all site pits and dumps

*See Dumps and Pits Reclamation Area .pdf for detailed areas requiring recontour or backfilling to meet the 45 Deg or 2.5:1 slope requirements

109.5.2 Slope Stability – Waste Dumps

Historic waste dumps with angle-of-repose slopes have stood within the MCO for over 50 years with no sign of sloughing or cracking. For active waste dumps, dump designs are chosen to minimize safety risks by stepping out 50 feet for every 70 feet of vertical lift. The tops of all dumps will be checked daily for cracks. If any cracks are noted, appropriate safety measures will be taken, including diverting traffic around the crack, and short-dumping. See Table 18 above for the current overall dump slopes.

Areas of the dump that are steeper than 2.5:1 will be regraded to a minimum of 2.5:1 during reclamation.

109.5.3 Slope Stability – Tailings Ponds

The following can be stated regarding slope stability and factors of safety for the sites tailing ponds:

- The State Engineer has issued dam safety permits for the Flotation Tails Pond, its subsequent lift, and East ITDF (**Appendix)**
- Factors of safety for the ITDF dams were calculated by (IGES, 2014).
- The Operator will be consistently monitoring two piezometers installed during the beginning stages of the EITDF 5,840' raise.
- Factors of Safety for the FTP, the FTP Raise and West ITDF were calculated by Picacho Associates July 2018.
- All long-term static minimum factors of safety are greater than 1.5 and those under design pseudo dynamic conditions are greater than 1.1
- DWQ and the State Engineer have approved the use of the PLS and Raffinate Ponds.

109.5.4 Erosion Control

The low precipitation rate and porous alluvial and soil cover minimize runoff except in exceptional precipitation events. The ephemeral stream channels in the project vicinity are discontinuous, as evidenced by the subtle terrain features and often vegetated ephemeral channels. Details of the impacts of the mining and beneficiation operations on ephemeral stream channels are provided in **Section 109.1**.

The following measures will be employed to control erosion within the MCO;

- Waste Dump Slopes:
    - Will be protected from erosion by berming off the crest of all dumps, per MSHA requirements.
    - The design of the waste dumps, with alternating angle-of-repose slopes and terraces, will help catch runoff from each consecutive lift.

    - A 3-4% grade on the top of the dump will direct storm water runoff away from the slopes.
- Topsoil stockpiles:
    - All topsoil stockpiles in the MCO are protected by circumference berms to both minimize runoff from up-gradient areas, and retain eroded soil materials within the pile vicinity.
- Open Pits:
    - The open pits within the MCO are impounding structures, both during and following completion of operations.
- Tailings Ponds:
    - Tailings Ponds are impounding structures during the life of the operation.
    - A 2' freeboard ensures that the capacity of the tailings is sufficient to contain a 100 years storm. The design precipitation event for making this determination is the 100-year, 24-hour storm, which would yield rainfall of 2.99 inches (IGES, 2014).
    - Refer to **Section 109.1** for further information on surface water impacts.
- Diversion berms and drainages divert water around tails ponds to prevent erosion.
- Process Facilities: A diversion berm is located upgradient of the process facilities. The diversion berm functions effectively for diverting any intercepted storm water around the areas of disturbance and into a natural drainage to the west of the process facilities.
- Post Mining:
    - As described in **Section 110.2**, revegetation efforts during reclamation will provide erosion control on dump surfaces, the mill facility area, the new plant facilities area, reclaimed tails facilities and reclaimed (narrowed) roads.

109.5.5 Air Quality

- The operations will result in low levels of air emissions, mostly fugitive dust. Dust control measures include:
    - Water from onsite water wells, perched water in pits, or compliant process water (**Section 106.2.10**) will be utilized to suppress dust on a as needed basis.
    - Chemical dust suppressants may be used to assist in suppressing dust, with approval from DWQ.
    - Vehicle speed will be regulated to limit dust generation.
    - Pre-wetting material prior to crushing.
- Tails facilities can be sources of fugitive dust therefore:
    - During facility operation tails will remain wet in order to prevent fugitive dust
    - On closure the tails facility will be reclaimed as outline in **Section 110.2.5**
- Evaporative emissions from the site's solution ponds have been approved by the DAQ and determined to be minimal.

Site emissions to the local airshed are detailed in the sites DAQ NOI and are compliant with DAQ's requirements for protection of human health and the environment.

109.5.6 Public Health and Safety

All operations would be conducted in compliance with applicable MSHA safety regulations. In addition, the following would be implemented:

- Access to the beneficiation facilities would be controlled by construction of berms, fences, and signed with *No Trespassing* and *Warning* signs. Signs as well as berms would be placed and maintained at all access points to the open pits and dumps.
- Trash, scrap metal, wood, buildings, and any extraneous debris attributed to the active mining would be removed and properly disposed of within one year of cessation of operations.
- Any drill holes not used for blasting purposes would be plugged and capped according to the requirements of the Division of Oil, Gas and Mining.
- Blasting practices would be conducted in accordance with state and federal rules, in a manner to prevent fly rock, and to assure compliance with the dust opacity limitations of the Division of Air Quality.
- During reclamation, any necessary repairs to the safety berm constructed around the pit margins will be made and WARNING signs would be placed along the berm to discourage access.
- Through the planned slope stability evaluation program (described above), the pits will be demonstrated to be stable prior to their abandonment at the end of mine life.

R647-4-110 Reclamation Plan

110.1 Current Land Use and Post-Mining Land Use

This section will provide the Division with a description of the current and post-mining land use for lands within the MCO.

110.1.1 Current Land Use

The MCO has been used historically for mining and exploration as well as livestock grazing. The area also provides habitat for wildlife such as, migratory birds, antelope, and other small mammals.

110.1.2 Post-Mining Land Use

The proposed post-mining land use would be as open space for recreation, grazing, and wildlife habitat.

110.2 Reclamation Treatments

This section will provide the Division with a description of the manner and extent to which roads, highwalls, slopes, impoundments, drainages, pits and ponds, piles, and shafts and adits, drill holes, and similar structures will be reclaimed.

110.2.1 Surface Facilities (Figure 2, 7 & 8, Photo 2, 2A, 4 &5)

At the conclusion of the operations the following will take place:

- All trash, equipment, debris will be removed from the site.
- All process facility buildings, tanks, and structures will be dismantled and disposed of offsite.
- Any remaining EW solution will be neutralized, then discharged to tails facility.
- All chemical waste or excess chemicals will be disposed of according to manufacturer's recommendations and in accordance with all federal, state and local laws and regulations.
- Any remaining concrete in the vicinity of the mill, SX, and EW facilities would be broken up, buried on site, and covered with 1-3 feet of fill prior to topsoil application.
- All infrastructure will be removed including:
    - Fabricated and structural components
    - Containment vessels
    - Electrical equipment
    - Piping
- PLS and Raffinate Ponds will have any remaining solution neutralized and pumped to a tail's facility
    - The upper synthetic liners will be removed from their anchors, cut and folded, and placed on the bottoms of the ponds.
    - Any concrete incidental to pond construction will be broken up and buried.
    - The reclaimed pond covered with 12in of topsoil, and the surrounding area ripped to a depth of 2 feet and revegetated.
- Any remaining dry stack tailings located west of the Float Tails Pond will be removed as part of reclamation and disposed of in a tailing facility or buried. The remaining footprint will be ripped and seeded.
- Water supply will be plugged and abandoned in accordance with the requirements of the

State Engineer.

  - If a non-mining post-reclamation agricultural and/or wildlife land use is identified for any of the production wells they will be turned over to a successor owner under a written agreement.
  - A request for release of surety would then be submitted, along with appropriate documentation, to the Division.

- The sites monitoring wells will be abandoned and plugged per State regulations.
- The septic systems located near the mill, PNT3, and the lab building will be closed (abandoned) in place in accordance with the requirements of the Utah Division of Environmental Quality and the local health department.
- Final grading will be performed to contour all reclaimed areas.
  - Areas of the process facilities that do not require grading will be ripped on the contour to reduce compaction.
- All areas of the process facilities will be covered with a minimum of six inches of topsoil prior to reseeding.

110.2.2 Roads, Storage Pads, and Parking Areas (Figures 1, 2, 3, 4, 5 & Photo 2, 2A, 3, 4, 5)

Roads:

- Roads will either be fully regraded and ripped, or if they are County roads, will be returned to their previous width (28- to 36-foot-wide road).
- All access roads to pits floors and dump tops will be ripped and regraded in prior to topsoil placement.

Storage Pads:

- Any remaining stockpiled material will be graded around the storage pad to blend with the surrounding contour.

Parking Areas:

- Parking areas will be regraded and ripped to a depth of 24 inches.
- Topsoil will then be placed to a depth of six inches unless otherwise specified, and seeded.

110.2.3 Highwalls, Pits, (Figures 1, 3, 4 & Photo 3, 4)

Where possible, open pits will be backfilled with waste rock mined within the MCO.

- Backfilled pits will have the surfaces regraded and ripped to a depth of 24 inches in preparation for topsoil placement.
    - Topsoil will be placed and seed as described in **Sections 110.5.1 thru 110.5.3**
- If pits are only partially backfilled, the backfilled portion will be graded to a safe slope, then regraded and ripped to a depth of 24in in preparation of topsoil placement.
    - Topsoil will be placed and seeded as described in **Sections 110.5.1 thru 110.5.3**

For those pits left un-backfilled,

- High walls will be left un-reclaimed because of limited access and safety issues.
- Access to the pits would be discouraged with placement of several large boulders across the reclaimed road spur.
- The safety berms around the open pits within the MCO would be repaired, if necessary, to ensure that side slopes are 2h:1v and the berms would be signed with DANGER/WARNING-type signs every 150 feet along the perimeter of the pits to further discourage access.
- It is expected that the berms would be colonized by shrubs, forbs, and grasses from the area naturally over several years.
- Pits with overall slopes greater than 45 degrees will be blasted to ensure an overall 45-degree slope upon final closure, unless a variance request is approved.
- Access ramps and accessible pit surfaces will be ripped to 24inches, topsoil place, and seeded as described in **Sections 110.5.1 thru 110.5.3**

110.2.4 Waste Dumps (Figures 1, 3, 4 & Photo 3, 4)

Dump Slopes:

- Waste dumps will be built as outlined in **Section 106.2.2**
- As part of reclamation dumps will be regraded to a minimum of 2.5H:V1 .
- Topsoil will be placed at a minimum depth of 6in prior to seeding.
- The Operator may work with the Division to test different reclamation methods on various dumps within the MCO to determine Best Practice for dump reclamation.

Dump Tops:

- Dump tops that have been treated with neutralized and clarified solution will have a minimum of two feet of untreated waste material and/or alluvium placed on the treated

surfaces.

  - This may take place with concurrent mining operations. The Operator plans to cover affected dumps with alluvium and waste rock from future mining operations.
  - Alluvium may be sourced from the Hidden Treasure Alluvium Stockpile.
  - An additional six inches of topsoil and/or adequate alluvium will be deposited prior to seeding.

- Untreated dump tops will be ripped to a depth of 24 inches in preparation for topsoil placement.
  - The minimum depth of topsoil to be placed will be six inches.
  - Depth of topsoil may change with the development of best practice methods approved by the Division.

110.2.5 Tailings Facilities (Figures 2 & Photo 2)

Tailings Surface:

- Prior to closure of a tail's facility:
    - Electrical Transmission infrastructure, disposal, and decantation pipelines will be removed from in and around the tail's facility.
    - Any remaining ponded solution will undergo enhanced evaporation until no longer practical.
    - Any remaining ponded water will be at a pH of 5.5 or higher.
    - Tails will be dewatered in the manner outlined in the construction plans for the facility.
        - In the case of the East ITDF, an engineered dewatering solution will be developed and installed.
    - If the exposed surface of dried tails is found to be acidic (Below a pH of 5.5), LKD or similar product will be mixed into the surface.
    - A period of 6-12 months will be allowed to pass prior to tails pond reclamation to allow tails to dry and consolidate. This will aid stabilizing the tails.
- On reclamation of a tailing facility:
    - Exposed liner will be cut and folded into the tails pond.
    - Depending on how stabile the tails are a suitable (one that allows root penetration) geotextile may be placed on the tails prior to any additional alluvium or rock.
    - A minimum of one foot of waste rock will be placed on tails in order to form a stable foundation for vehicle traffic.
    - Combination of alluvium and topsoil will be placed on the rock, graded, and then seeded as described in **Section 110.5**
    - Trenches that supported pipelines will be recontoured and seeded.
    - Areas in and around tails facility will be ripped to a depth of 2ft and seeded.

The two decantation ponds below the FTP will be reclaimed in a similar manner as a Tails Facility. With a few exceptions noted below:

- Ponds will be filled and contoured with the dike materials.
- Six inches of topsoil will be placed and seeded.

<u>Tailings Embankments</u>

- Tails Facility Embankments will be constructed to a minimum of 2H:V1 to facilitate reclamation
    - The Dams will remain in place following closure and reclamation

    - Outboard slopes and inaccessible slopes will be hydroseeded and hydro mulched if not previously done (**Section 109.3.1**)
- Access roads will be ripped to a minimum of 2ft and then seeded.

110.2.6 Natural Drainages

Any natural drainage impounded during mining activities (such as the Old Hickory Wash near the Hidden Treasure dump expansion) will be re-routed to allow water to flow around the disturbance areas. The re-route will follow input from the Division and BLM, dependent upon land status for those specific areas.

110.3 Surface Facilities to be Left

The water system will be left for agriculture or wildlife use. The area around the mill concentrator is frequently visited by wildlife to include antelope, deer, elk, wild horses and other small native animals. Area livestock operators (sheep and cattle) also use the area where water produced by the operation is purposely diverted into small holding ponds to water livestock. These operators intend to operate the wells as needed for livestock watering and arrangements may be made with BLM to provide water for wildlife and wild horses. The following equipment will remain:

- 100,000 gallon fresh water tank
- Underground water lines
- WW-6 and its associated underground water lines.

No other mining-related surface facilities will be left in the permit area as part of post-mining land use.

110.4 Treatment, Location and Disposition of Deleterious Materials

Remaining potentially deleterious materials include:

- Sulfuric Acid,
    - will be consumed during operations or recycled.
    - None would be disposed of or allowed to remain on site.
- Fuel (Diesel, Gasoline, hydrocarbons)
    - Will be consumed or disposed of offsite.
- Ore Benefaction, leaching, and solvent extraction reagents,
    - Will be disposed via a licensed third party who would dispose of the reagents in accordance with manufacturer's recommendations and in accordance with all

federal, state and local laws and regulations.

- In the event that potentially deleterious materials are encountered during mining or ore beneficiation, they will be characterized using appropriate and established laboratory test methods and then managed appropriately in accordance with their characteristics.

110.5 Revegetation Planting Program and Topsoil Redistribution

This section will provide the Division with a description of the proposed planting program as best calculated to revegetate the disturbed areas with desirable species.

110.5.1 Soil Material Replacement

Topsoil will be placed on all regraded and final reclamation surfaces including:

- Process Facilities,
- Waste rock dump tops and terraces,
- Access roads to pit floors,
- Tailings ponds,
- Portions of the haul roads widened for this project (the pre-mining road width would remain in use).
- Prior to topsoil placement, these surfaces will be ripped or scarified depending upon their condition after regrading to provide a roughened surface to receive the soil and to enable root penetration.
- Unless otherwise specified in sections above, topsoil will be replaced and spread to a depth of six inches.
- Topsoil placement will be performed with a tracked dozer or other suitable equipment.

110.5.2 Seed Bed Preparation

Unless otherwise specified:

- The topsoil surface will be ripped to a depth of 12 inches with a dozer or scarified with a grader, to provide a good seedbed.
- On flat surfaces and on slopes, roughening with tracked dozer will create small depressions to provide soil catchments, water retention sites, and habitat niches.

110.5.3 Seed Mixture

A single seed mix is proposed for all reclaimed surfaces. As shown in the following table (**Table 19**), it is comprised of various grasses, forbs, and shrubs suitable for the conditions that occur within the MCO. Should seed availability change prior to reclamation, some variation in the mix could occur, with agency approval.

Table 19: Reclamation Seed Mix

Species (Pure Live Seed)	Lbs/Acre
Intermediate Wheatgrass *(Elymus hispidus)*	2
Bottlebrush squirreltail *(Elymus elymoides)*	0.67
Great Basin Wildrye *(Elymus cinereus)*	1.34
Indian Ricegrass *(Achnatherum hymenoides)*	1.34
Yellow Sweet Clover *(Melilotus officinalis)*	0.67
Hycrest crested wheatgrass *(Agropyron cristatum* X *A. desertorum*)	2
Palmer Penstemon *(Penstemon palmeri)*	0.35
Forage Kochia *(Kochia prostrata)*	0.67
Wyoming Big Sagebrush *(Artemisia tridentata)*	0.13
Four-Wing Saltbush *(Atriplex canescens)*	1.34
Rubber Rabbitbrush *(Chrysothamnus nauseosus)*	0.35
Total all Species PLS	**10.86**

To prevent the spread of invasive and noxious weeds, the Operator will monitor the re-seeded areas and, where needed, will re-seed those areas at the lbs/acre rate identified in (**Table 19**). Re-seeding will occur in the fall of the year following the original seeding attempt.

No further disturbance of the reclaimed areas will be performed, as it has been noted to cause more spread of unwanted invasive and noxious weeds.

110.5.4 Seeding Method

Broadcast seeding will be done on all surfaces scheduled for revegetation. The seeding would be performed in conjunction with placing the topsoil via dozer or other track-mounted equipment.

Revegetation work, including both seedbed preparation and seed application will take place in the late fall season and seed would be spread immediately following seedbed preparation.

110.5.5 Other Revegetation Procedures

Revegetation of open pits will be carried out within practical limits. (**Section 110.2.3**)

The Operator will monitor for noxious weeds and would provide weed control measures according to County directives should noxious weeds pose a potential problem.

Further, the Operator will monitor revegetation success for three years.

110.6 Operator Statement Committing to Reclamation

The Operator commits to conduct reclamation as required by these rules, or as stipulated by the requested variances stated in Section 112 of this NOI.

110.7 Interim Management Plan

While operational, The Operator commits to abide by the rules and stipulations set forth in this NOI in an effort to manage and reduce the environmental impacts as much as practicable. BMPs will be utilized throughout the MCO to ensure this is the case.

R647-4-112 Variance

Rule R647-4-111.12 - "Topsoil Redistribution"

Rule R647-4-111.12: "After final grading, soil materials shall be redistributed on a stable surface, so as to minimize erosion, prevent undue compaction and promote revegetation."

Variance Request

A variance is requested for the redistribution of topsoil on waste dumps within the MCO. The variance is for topsoil placement only occurring on the dump terraces and dump tops.

As described in Section 110, all dump terraces, tops, and access ramps will be reclaimed. By requesting this variance, The Operator is also requesting a variance to leave the slopes barren of redistributed topsoil (111.12).

This Variance Request is contingent upon the completion of the Copper Ranch Mini waste dump tests. The default depth of topsoil placement on waste dump slopes for the MCO would be six inches. However, as discussed in more detail below, the Operator believes that better revegetation rates can be produced without the use of topsoil.

Justification for the Variance

The materials from which the waste dumps within the MCO are constructed consist of various sizes of waste rock, ranging from fine-grained to 4+ foot boulders. Moreover, because of the type of growth media present within the MCO, spreading of topsoil on slopes may run a high risk of creating areas for monoculture of halogeton or Russian thistle. After doing site visits of various reclaimed areas around Southern and Central Utah, the overriding impression was that slight re-grading of slopes to a 2.5H:1V with seed distribution on the coarse material (no topsoil placement) yielded the most desirable regrowth.

The reason for this is that soil placed on areas with coarse material would be more prone to erosion or infiltration into the void spaces between rocks. Therefore more topsoil than is present within the MCO would have to be required in order to provide any desirable soil depth. Also, it appears from areas within the MCO that have been reclaimed that the alkaline characteristics of the soils within the MCO may favor growth of invasive species such as halogeton, Russian thistle, and cheat grass over the growth of favorable species. This has been shown in the first attempt topsoil stockpile revegetation, the second attempt at revegetating the water line running from the Truck Shop to the Mill, and the third attempt at revegetating the exploration disturbance areas at Copper Ranch, performed by The Operator in 2014. All areas of first, second, and third attempt revegetation yielded predominant growth of halogeton and Russian thistle. However, over at the Mary I, where no soil was placed but the area was regraded, favorable species of grasses and even junipers are visible. It is worth noting that although first attempt seeding on the Sunrise and ITDF topsoil stockpiles resulted in abundant invasive species, later years of leaving the stockpiles undisturbed

showed a success rate of more desirable species. However, this is not the case for other areas of the MCO, especially the Bawana, Copper Ranch, and Hidden Treasure areas.

Historic waste dumps within the MCO show successful revegetation of dump slopes left at angle-of-repose with no topsoil placement. For example, the Montreal waste dump, located on the eastern-most portion of the MCO, has established sagebrush, rabbitbrush, and various grasses and forbs, with little to no presence of invasive species such as halogeton and Russian thistle. On slopes re-graded to 3H:1V, however, the presence of halogeton vastly outnumbers the desirable species. This is most prominently seen on the 3H:1V slope at the base of the Bawana waste dump, as well as the Copper Ranch exploration areas, which have had numerous revegetation attempts that have only been overrun by halogeton.

By re-grading the slopes to a 2.5H:1V and not placing topsoil on the regraded slopes, it is The Operator's belief that the waste slopes will provide an adequate slope for topsoil-less regrowth as seen in other areas around Central and Southern Utah, and will also prevent erosion such as those visible on the angle-of-repose slopes at the Montreal dump.

Due to the historical mining activities within the MCO, many areas of previous disturbance had little to no topsoil salvaged. Because of this, reclamation practices that include topsoil re-distribution must be chosen carefully in order to maximize the amount of topsoil available. Due to the overwhelming visual evidence of re-graded slopes being overrun by halogeton and other invasive species, topsoil placement on dump slopes should be considered a last option if excess topsoil is available upon completion of reclaiming other areas such as dump terraces and dump tops, haul roads and access roads, stockpile areas, and backfilled pits.

Alternate Methods Proposed

The proposed method of reclamation for dump slopes within the MCO is to regrade the slopes to a 2.5H:1V, with minimal to no topsoil placement on the slopes. Instead, place topsoil on the terraces and dump tops to a desirable thickness as discussed in previous sections. Seed will be broadcast on both the flat portions and also on the re-graded dump slopes. This is to ensure that although topsoil will not be placed, the areas where fines will naturally collect will provide adequate areas for regrowth, and will be seeded with desirable species.

Also, by re-grading to a 2.5H:1V, The Operator is ensuring that there is less chance for slope failure and significant erosion, which would improve public safety as well as protect the areas downstream of the waste dumps. The terraces and dump tops will be topsoiled and re-seeded adequately with Division-approved seed mix and rates, so would continue to provide post-mining habitat for grazing animals.

Rule R647-4-111.7 – "Highwalls"

"In surface mining and in open cuts for pads or roadways, highwalls shall be reclaimed and stabilized by backfilling against them or by cutting the wall back to achieve a slope angle of 45 degrees or less."

Variance Request

A variance is requested in order to leave highwalls in place in open pits that were constructed with overall pit slopes of greater than 45 degrees, and for which geotechnical reports have been completed.

Justification for the Variance

The economics are dramatically affected by increased stripping ratios that result from flatter pit slopes. Access to the highwalls is nonexistent or limited. The Hidden Treasure pit has existing highwalls with relative stability, as demonstrated by the 30+ years between the end of the first mining endeavor in 1973 and resumption of mining just a few years ago. Geologic information indicates that wall rock stability will not be decreased as the pits are expanded. Pit expansion would not contribute to unstable slope conditions, and would not be a safety hazard due to the post-mining limitations on public access. To evaluate this further, geotechnical reviews of the rock mechanics along the perimeter of active open pits and future deposits to be mined are underway. The Operator commits to alert the Division and any other appropriate agency within 10 days of any slope failure that may occur within the pits or waste dumps.

Furthermore, as the MCO gets developed, and pits expand, many of the open pits will be backfilled with waste rock from adjacent mining activities. So any risk to public safety would not be an issue due to the pits being backfilled.

Alternate Methods Proposed

Perform geotechnical evaluations of slope stability related to the open pits with high walls greater than 45 degrees. Based upon the findings of the geotechnical evaluations, the open pits will be left intact upon closure, or further work will be performed to reduce any safety concerns.

Rule R647-4-111.9 – "Impoundments"

"Water impounding structures shall be reclaimed so as to be self-draining and mechanically stable unless shown to have sound hydrologic design and to be beneficial to the postmining land use."

Variance Request

The final pit configurations will remain as a topographic low with no external drainage. Although there is minimal precipitation and excess evaporation in this arid environment, there could be water ponded in the pit bottoms for short periods of time.

The ITDF will remain an impounding structure after it is reclaimed. Further information on reclamation of the ITDF is provided in **Section 109.2**. Diversion berms and perimeter road designed to contain the flow from a 100-year, 24-hour storm event will remain in place. Should these berms and roads erode in the future and discharge return to the ITDF, the revegetated ITDF surface will adequately contain all precipitation for the design storm event that falls within the drainage boundary of the pond and evapotranspiration will contribute to minimizing infiltration. Removal of the tailings dams is not practicable or sound from either an engineering or environmental perspective. Therefore, a variance to allow the impoundment to remain is necessary and therefore requested.

R647-4-113 Surety

Surety calculation tables are under review at this time. After review and approval from The Division, this section will be updated to include all pertinent information relating to the surety and its calculations.

SIGNATURE REQUIREMENT

XI. **SIGNATURE REQUIREMENT**

I hereby certify that the foregoing is true and correct. **(Note: This form must be signed by the owner or officer of the company/corporation who is authorized to bind the company/corporation).**

Signature of Permittee / Operator/Applicant: _____

Name (typed or print): Brendan Moseley

Title/Position (if applicable): CEO

Date: 10/9/2024

APPENDIX A

Beaver County Agreements & Permits

CONDITIONAL USE PERMIT

No. 2005-06 Amended

APPLICANT: Milford Mining Company Utah, LLC

APPLICATION APPROVED BY: Beaver County Planning/Zoning Commission
Beaver County Commission

PERMIT ISSUED BY: Beaver County Zoning Administrator

LEGAL DESCRIPTION OF PROPERTY: See conditional use permit application.

PURPOSE OF CONDITIONAL USE: To develop and operate a copper mine and haul road in Beaver County

CONDITIONS:

1) The entire Application, including all maps, drawings, statements, and other documents received by the Planning Commission and Zoning Administrator is hereby incorporated into this permit.

2) This Conditional Use Permit is subject to compliance with all applicable Codes.

3) Milford Mining Company Utah, LLC will need to submit copies of all the permits they need from other agencies, i.e. Div. of Air Quality, Div. of Oil, Gas & Mining, Div. of Water Quality, etc., and have them changed into their name.

4) Milford Mining Company Utah, LLC shall inform Beaver County Emergency Services Director of the nature and location of the project.

5) Milford Mining Company Utah, LLC shall continue a Road Maintenance Agreement with Beaver County.

6) Milford Mining Company Utah, LLC will provide a yearly review to ensure they are complying with the conditions of this permit.

NOTICE: Action authorized by a Conditional Use Permit must commence within one (1) year of the time the permit is issued. If the permit holder fails to comply with the conditions imposed, if the intended use of the project changes or is significantly altered, or the project has not commenced action under the permit within this time, the permit shall expire. The Planning Commission may grant a single, one-year extension for good cause shown. In order to obtain an extension, the permit holder must apply in writing, describing the cause for the extension and submit to the Planning Commission Office, prior to the expiration of the original permit.

VIOLATION OF ANY OF THE ABOVE CONDITIONS COULD RESULT IN TERMINATION OF THIS PERMIT.

DATED this _____ day of _____, 2024

_____
Kyle Blackner
Zoning Administrator

_____
Print Name: BRENDAN MOSECK 9
Title: CEO
Company: Milford Mining Company Utah LLC

_____
Wade Hollingshead
Chairman, Beaver County Commission

BEAVER COUNTY COMMISSION

105 East Center
P.O. Box 789
Beaver, UT 84713
P: (435)438-6490
F: (435)438-6481

Michael F. Dalton
Chairman
Mark S. Whitney
Member
Tammy T. Pearson
Member

April 4, 2016

To Whom it May Concern,

CS Mining, LLC (CSM) is currently conducting mining activities approximately four miles west of Milford in Beaver County, Utah. Maintenance of all mine vehicles are currently being performed in the CSM Truck Shop Facilities Area (Attachment A), which is located on land privately owned by CSM in the South ½ of the NE Corner of Section 34, Township 27 South, Range 11 West, in Beaver County, Utah. The Truck Shop Facilities Area consists of the following structures, as identified on Attachment A:

- Truck Shop (120'x72' metal structure with roof and side-rolling doors)
- Power Substation (65'x50' fenced area with substation and transformers)
- Fuel Depot (40'x40' concrete containment with 3' high curb, containing two 11,000 gallon diesel tanks and two 7,500 gallon diesel tanks)
- Water Tank (12' high, 40' diameter concrete water tank with metal roof)
- Pump House (14'x14' roofed structure made from mixed materials)

Upon completion of mining activities, it is the intention of CSM and Beaver County to assign use of the Truck Shop Facilities Area to Beaver County. The details of this exchange have not yet been finalized, however discussions are ongoing and Beaver County is in agreement with CSM for providing a post-mining use for the Truck Shop Facilities Area.

Any remaining ancillary structures and debris within the Truck Shop Facilities Area will be removed by CSM prior to closure of the mining operations.

Best Regards,

Mike Dalton
Chairman

NOTICE OF ADOPTION OF ORDINANCE

On the date of September 6, 2005, during the regularly scheduled meeting of the Beaver County Commission, the Commission adopted BEAVER COUNTY ORDINANCE NO. 2005-16, an ORDINANCE VACATING CERTAIN CLASS-D COUNTY ROADS *More Commonly Known as the "OK Mine Road," the "Upper Bowana Bench Road," and the "Bowana Pass Road."*

SHORT SUMMARY OF ORDINANCE: Three unimproved class-d county roads located in the Milford Flat area of Beaver County were vacated after a public hearing on the subject. A complete copy of the ordinance, and a full description of the vacated roads, is available at the Beaver County Clerk's office, 105 E. Center, in Beaver.

MEMBERS VOTING FOR AND AGAINST ORDINANCE:

For: Commissioner Mark Whitney, Commissioner Chad Johnson and Commissioner Billie Dalton

Against: _____.



ATTACHMENT A

Truck Shop Facilities with structures dedicated for post-mining use

CS MINING

(Ancillary structures and debris not identified on this Attachment will be the responsibility of CS Mining, LLC to remove prior to completion of mining activities)

NOTICE OF ADOPTION OF ORDINANCE

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MEMBERS VOTING FOR AND AGAINST ORDINANCE:

For: Commissioner Mark Whitney, Commissioner Chad Johnson and Commissioner Billie Dalton

Against: _____.

BEAVER COUNTY ORDINANCE NO. 2005-16

ORDINANCE VACATING CERTAIN CLASS-D COUNTY ROADS

More Commonly Known as the "OK Mine Road," the "Upper Bowana Bench Road," and the "Bowana Pass Road."

WHEREAS a public hearing was held before the Beaver County Commission on the date of September 6, 2005 regarding the vacation of the following described class-d county roads, more commonly known as the "OK Mine Road," the "Upper Bowana Bench Road," and the "Bowana Pass Road," located in Beaver County, State of Utah, and described as follows, to-wit:

38.4468 -113.069 NAD27; 1; 1,361 W 3,427 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44733 -113.065 NAD27; 2; 204 W 3,234 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44017 -113.074 NAD27; 3; 2,628 W 577 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.44218 -113.074 NAD27; 4; 2,587 W 5,116 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44387 -113.073 NAD27; 5; 2,379 W 4,500 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44527 -113.071 NAD27; 6; 1,938 W 3,987 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44656 -113.07 NAD27; 7; 1,460 W 3,515 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44758 -113.067 NAD27; 8; 744 W 3,142 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44838 -113.065 NAD27; 9; 144 W 2,848 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.4491 -113.063 NAD27; 10; 4,833 W 2,589 S from NE Sec 23 T 27S R 11W PM Salt Lake 1855; 38.44972 -113.06 NAD27; 11; 4,014 W 2,368 S from NE Sec 23 T 27S R 11W PM Salt Lake 1855; 38.44677 -113.074 NAD27; 12; 2,755 W 3,443 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44704 -113.075 NAD27; 13; 3,128 W 3,348 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44557 -113.075 NAD27; 14; 3,050 W 3,881 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44381 -113.074 NAD27; 15; 2,792 W 4,520 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44189 -113.074 NAD27; 16; 2,752 W 5,222 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.45003 -113.08 NAD27; 17; 4,398 W 2,261 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.45385 -113.08 NAD27; 18; 4,579 W 871 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.45528 -113.085 NAD27; 19; 558 W 357 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.45672 -113.089 NAD27; 20; 1,855 W 5,111 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855; 38.45806 -113.094 NAD27; 21; 3,113 W 4,629 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855; 38.45938 -113.098 NAD27; 22; 4,288 W 4,158 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855; 38.4603 -113.101 NAD27; 23; 5,139 W 3,829 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855 38.46071 -113.102 NAD27; 24; 206 W 3,681 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46163 -113.107 NAD27; 25; 1,607 W 3,350 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46359 -113.111 NAD27; 26; 2,912 W 2,643 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46427 -113.113 NAD27; 27; 3,402 W 2,396 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46736 -113.116 NAD27; 28; 4,148 W 1,271 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.47049 -113.118 NAD27; 29; 4,903 W 136 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.47369 -113.121 NAD27; 30; 351 W 4,236 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.47677 -113.124 NAD27; 31; 1,092 W 3,108 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.47942 -113.126 NAD27; 32; 1,747 W 2,139 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.48 -113.127 NAD27; 33; 1,873 W 1,925 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.48133 -113.127 NAD27; 34; 2,150 W 1,439 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.48368 -113.129 NAD27; 35; 2,531 W 578 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.41237 -113.166 NAD27; 36; 2,602 W 401 S from NE Sec 2 T 28S R 12W PM Salt Lake 1855; 38.4177 -113.074 NAD27; 37; 2,867 W 3,522 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855; 38.42132 -113.074 NAD27; 38; 2,716 W 2,202 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855;

38.42507 -113.073 NAD27; 39; 2,559 W 837 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855; 38.42538 -113.073 NAD27; 40; 2,564 W 726 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855 38.42911 -113.072 NAD27; 41; 2,318 W 4,601 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43281 -113.072 NAD27; 42; 2,101 W 3,254 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43641 -113.073 NAD27; 43; 2,346 W 1,944 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.44004 -113.074 NAD27; 44; 2,624 W 622 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.42836 -113.076 NAD27; 45; 3,355 W 4,876 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43105 -113.079 NAD27; 46; 4,310 W 3,900 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43367 -113.083 NAD27; 47; 5,236 W 2,948 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43634 -113.086 NAD27; 48; 854 W 1,975 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855; 38.43919 -113.089 NAD27; 49; 1,806 W 936 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855; 38.44171 -113.092 NAD27; 50; 2,629 W 19 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855; 38.44445 -113.095 NAD27; 51; 3,519 W 4,318 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.44718 -113.098 NAD27; 52; 4,302 W 3,330 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.45021 -113.101 NAD27; 53; 5,091 W 2,230 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.45245 -113.103 NAD27; 54; 611 W 1,418 S from NE Sec 20 T 27S R 11W PM Salt Lake 1855; 38.4563 -113.106 NAD27; 55; 1,444 W 20 S from NE Sec 20 T 27S R 11W PM Salt Lake 1855; 38.45952 -113.109 NAD27; 56; 2,259 W 4,122 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.4629 - 113.112 NAD27; 57; 3,092 W 2,894 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46417 - 113.113 NAD27; 58; 3,395 W 2,432 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855.

and,

WHEREAS due and proper notice of said public hearing having been given; and

WHEREAS public comment was taken at said hearing regarding said vacation; and

WHEREAS after the closure of said public hearing and upon further deliberation;

NOW THEREFORE, the Board of County Commissioners of the County of Beaver, State of Utah, hereby **ORDAIN AS FOLLOWS**:

The above described class-d county road, located within Beaver County, State of Utah, is vacated, said ordinance to take effect on the date of September 22, 2005.

PASSED AND APPROVED this 6th day of September, 2004.

BEAVER COUNTY

By Actng Chairman of the Board

ATTEST

Paul B. Barton
Beaver County Clerk

Votes of the Commissioner of adoption of the foregoing ordinance

For: Commissioner Mark Whitney, Billie Dalton, Chad Johnson

Against: none

BEAVER COUNTY COMMISSION

105 East Center
Post Office Box 789
Beaver UT 84713
435-438-6466 Fax: 435-438-6481

Mark S. Whitney
Chairman
William L. Dalton
Commissioner
Chad W. Johnson
Commissioner
Bryan L. Harris
Commission Assistant

January 19, 2007

Western Utah Copper Company
Charles W. McGinley III, Mine Engineer
1208 South 200 West
Milford, UT 84751

Dear Mr. McGinley:

At the request of Western Utah Copper, the Beaver County Commission initiated the process of vacating its rights to certain roads affecting your mining operation. After the required advertising and notice requirements, the Beaver County Commission voted on September 6, 2005 unanimously to vacate these roads. This vacation gives up any legal right the county has to these roads.

Enclosed is a copy of the Commission Minutes from that meeting as well as a legal description and map of the roads.

Regards,

Bryan L. Harris
Commission Assistant

TD071682

Beaver County
Beaver, UT 84713
September 6, 2005

The Board of County Commissioners met on September 6, 2005 at 10:00 a.m. for its regularly scheduled meeting. Those present were Mark S. Whitney, Chairman; William L. Dalton, Member; Chad W. Johnson, Member; Bryan L. Harris, Commission Assistant; Von J. Christiansen, Attorney; and Paul B. Barton, Clerk/Auditor.

Minutes of the August 1, 15 & 29, 2005 meetings were read. It was moved by Comm. Johnson, seconded by Comm. Dalton and unanimously passed to approve the minutes.

Kay Kimball and Rick Roberts, from Kimball & Roberts, met with the Board to present the 2005 audit report for Beaver County. The report was reviewed and stated that the County is in good financial condition and the statements fairly represent the financial position of the County. It was moved by Comm. Johnson and seconded by Comm. Dalton to accept the report. All voted in favor of the motion.

It was moved by Comm. Johnson and seconded by Comm. Dalton to go into closed session to discuss the character, professional competence, or physical or mental health of an individual. All voted in favor of the motion. The meeting was closed at 11:00 a.m. Those present were members of the Board, Mr. Harris, Mr. Christiansen, Mr. Barton, Mr. Kimball and Mr. Roberts. It wasmoved by Comm. Johnson and seconded by Comm. Dalton to return to open session. All voted in favor of the motion. The Board returned to open session at 11:40 a.m.

Ken Olsen met with the Board to discuss road and bridge concerns re: Navajo Trail Road. Mr. Olsen was requesting that the road be deeded to the County. He reported that most of the property owners are willing to deed the property for the right-of-way. The Board agreed to take over maintenance of the road if Mr. Olsen can obtain the rights-of-way. Mr. Harris will obtain an estimate to survey the road. The County requires a 56' right-of-way.

Pearl Philipps and Mark Nelson, from the Extension Service, met with the Board to present a report on their activities. Ms. Philipps also reported that she has taken a new job with the State Board of Education. The Board thanked Ms. Philipps for her service to the county.

It was moved by Comm. Johnson, seconded by Comm. Dalton and unanimously passed to approve an architectural agreement with PJHM Architects on the proposed Milford Senior Center.

The Board reviewed a list of proposed surplus by the IT Director. Commissioner Dalton made a motion to declare the list surplus. Commissioner Johnson seconded, and it passed unanimously.

The charge rates and public use of the Fairgrounds was discussed. Mr Christiansen will prepare a proposed ordinance addressing some of the issues; prohibiting the sale or consumption of alcohol, no smoking in the building, setting rental rates and deposits, etc.

Kelly Beeson, from the Council on Aging, met with the Board to review the termination of Peggy Bird as a cook at the Minersville Senior Center. After review of the documents, it was moved by Commissioner Johnson, seconded by Commissioner Dalton and unanimously approved to uphold the termination as recommended by the County Council on Aging.

Commissioner Dalton made a motion, seconded by Commissioner Johnson to approve Beaver County participating in a Utah Geological Survey with Beaver City. The county's cost will be $5,000.00. The motion passed unanimously.

Wade Bradshaw met with the Board to discuss problems with the Administrative Building air conditioning unit. After an explanation of the problems, it was the consensus of the Board to have a mechanical engineer check the building for a cost to replace the air conditioning system.

A Public Hearing was opened at 1:30 p.m. on changing Agricultural Zone Conditional Uses as a part of Ordinance 2005-14. The hearing was closed at 1:37 p.m. It was moved by Commissioner Dalton, seconded by Commissioner Johnson and unanimously passed to approve to adopt Ordinance 2005-14.

Mr Craig Davis presented a plat map of a land division filed by Karl Snedeger, which was reviewed. It was moved by Commissioner Johnson, seconded by Commissioner Dalton and unanimously approved to sign the plat map.

Mr Paul Barton introduced the applications for the 2005 Tax Abatements. After review of the applications, it was moved by Commissioner Johnson, seconded by Commissioner Dalton and unanimously passed to approve the following property tax abatements and Service District fees attached to the property tax as recommended by the County Auditor. (See attached list)

Commissioner Whitney was excused from the meeting at the time. Commissioner Johnson was appointed as the acting chairman.

A Public Hearing was opened at 2:00 p.m. on the Adoption of Ordinance No. 2005-16; Vacating Certain Class-D County Roads. Charles W. McGinley III spoke in favor of the road closures. The public hearing closed at 2:05 p.m. It was moved by Commissioner Dalton to adopt Ordinance 2005-16. The chair was passed to Commissioner Dalton and Commissioner Johnson seconded the motion. The chair was then passed back to Commissioner Johnson. All voted in favor of the motion.

Bills on file were approved for payment.

There being no further business, the meeting was adjourned.

APPROVED _____ _____

Chairman Clerk/Auditor

...orated Beaver County)
...e such livestock on land
...surrounded by a lawful
...lowever, the amended
...e adds the new provi-
...it in areas of Beaver
...defined as "open.
...t is the responsibility of
...ty owner who desires to
...livestock from entering
...perty to construct and
... adequate fencing
...e border of the open

...ordinance also
...the definition of a law-
... to include metal post
... of no less than 1.33
...foot of post and class-1
...wire or class-1, field

...mplete copy of the ordi-
...available at the Beaver
...Clerk's office, 105 E.
...n Beaver.
...RS VOTING FOR AND
...T ORDINANCE
...ommissioners, Chad
..., Billie Dalton, Mark

...none.

...B. Barton
...County Clerk

...d in The Beaver Press
..., 2005.

...E OF TRUSTEE'S SALE

...following described
... will be sold at public
...to the highest bidder,
...in lawful money of the
...States, at the main
...e of the Beaver County
...use, 2160 South 600
...leaver Utah, on August
...5 at 12:00 p.m. (noon) of
...ly, for the purpose of
...ing a trust deed original-
...ited on May 28,2002, by
...Lagoon Inc., as trustors
...r of Utah Independent
...covering the following
...perties purported to be
...in Beaver County at 882
... Main, Beaver Utah
... and more particularly
...ed as:

...: 03-0045-0047

...ginning at a point on the
...ne of Old U.S. Highway
...ich is 89°42'57" East
...ne Section line 1118.84

NOTICE OF INTENT TO VACATE COUNTY ROAD

PUBLIC NOTICE IS HEREBY GIVEN of the intention of the Board of County Commissioners of Beaver County, Utah, to vacate county roads hereafter described. The Board of County Commissioners will hold a Public Hearing on such intentions, Tuesday, September 6, 2005 at 2:00 p.m. in the Commission Chambers in the County Administrative Offices, 105 East Center, Beaver, Utah, 84713.

The roads are located approximately 5 miles northwest of Milford City in the vicinity of the old copper mill. The legal description of the roads is as follows:

38.4468	-113.069	NAD27;	1;	1,361 W 3,427 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44733	-113.065	NAD27;	2;	204 W 3,234 S from NE Sec 22 T 27S R 11W PM Sal Lake 1855;
38.44017	-113.074	NAD27;	3;	2,628 W 577 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.44218	-113.074	NAD27;	4;	2,587 W 5,116 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44387	-113.073	NAD27;	5;	2,379 W 4,500 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44527	-113.071	NAD27;	6;	1,938 W 3,987 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44656	-113.07	NAD27;	7;	1,460 W 3,515 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44758	-113.067	NAD27;	8;	744 W 3,142 S from NE Sec 22 T 27S R 11W PM Sal Lake 1855;
38.44838	-113.066	NAD27;	9;	144 W 2,848 S from NE Sec 22 T 27S R 11W PM Sal Lake 1855;
38.4491	-113.063	NAD27;	10;	4,833 W 2,589 S from NE Sec 23 T 27S R 11W PM Salt Lake 1855;
38.44972	-113.06	NAD27;	11;	4,014 W 2,368 S from NE Sec 23 T 27S R 11W PM Salt Lake 1855;
38.44677	-113.074	NAD27;	12;	2,755 W 3,443 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44704	-113.075	NAD27;	13;	3,128 W 3,348 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44557	-113.075	NAD27;	14;	3,050 W 3,861 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44381	-113.074	NAD27;	15;	2,792 W 4,520 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.44189	-113.074	NAD27;	16;	2,752 W 5,222 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.45003	-113.08	NAD27;	17;	4,398 W 2,261 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.45385	-113.08	NAD27;	18;	4,579 W 871 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855;
38.45528	-113.085	NAD27;	19;	558 W 357 S from NE Sec 21 T 27S R 11W PM Sal Lake 1855;
38.45672	-113.089	NAD27;	20;	1,855 W 5,111 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855;
38.45806	-113.094	NAD27;	21;	3,113 W 4,629 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855;
38.45938	-113.098	NAD27;	22;	4,288 W 4,158 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855;
38.4603	-113.101	NAD27;	23;	5,139 W 3,829 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855;
38.46071	-113.102	NAD27;	24;	206 W 3,681 S from NE Sec 17 T 27S R 11W PM Sal Lake 1855;
38.46163	-113.107	NAD27;	25;	1,607 W 3,350 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;
38.46359	-113.111	NAD27;	26;	2,912 W 2,643 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;
38.46427	-113.113	NAD27;	27;	3,402 W 2,396 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;
38.46736	-113.116	NAD27;	28;	4,148 W 1,271 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;
38.47049	-113.118	NAD27;	29;	4,903 W 136 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;
38.47369	-113.121	NAD27;	30;	351 W 4,236 S from NE Sec 7 T 27S R 11W PM Sal Lake 1855;
38.47677	-113.124	NAD27;	31;	1,092 W 3,108 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855;
38.47942	-113.126	NAD27;	32;	1,747 W 2,139 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855;
38.48	-113.127	NAD27;	33;	1,873 W 1,925 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855;
38.48133	-113.127	NAD27;	34;	2,150 W 1,439 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855;
38.48366	-113.129	NAD27;	35;	2,531 W 578 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855;
38.41237	-113.166	NAD27;	36;	2,602 W 401 S from NE Sec 2 T 28S R 12W PM Salt Lake 1855;
38.4177	-113.074	NAD27;	37;	2,867 W 3,522 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855;
38.42132	-113.074	NAD27;	38;	2,716 W 2,202 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855;
38.42507	-113.073	NAD27;	39;	2,559 W 837 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855;
38.42638	-113.073	NAD27;	40;	2,564 W 726 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855;
38.42911	-113.072	NAD27;	41;	2,318 W 4,601 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.43281	-113.072	NAD27;	42;	2,101 W 3,254 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.43641	-113.073	NAD27;	43;	2,346 W 1,944 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.44004	-113.074	NAD27;	44;	2,624 W 622 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.42836	-113.076	NAD27;	45;	3,355 W 4,876 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.43105	-113.079	NAD27;	46;	4,310 W 3,900 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.43367	-113.083	NAD27;	47;	5,236 W 2,948 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855;
38.43634	-113.086	NAD27;	48;	854 W 1,975 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855;
38.43919	-113.089	NAD27;	49;	1,806 W 936 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855;
38.44171	-113.092	NAD27;	50;	2,629 W 19 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855;
38.44445	-113.095	NAD27;	51;	3,519 W 4,318 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855;
38.44718	-113.098	NAD27;	52;	4,302 W 3,330 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855;
38.45021	-113.101	NAD27;	53;	5,091 W 2,230 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855;
38.45245	-113.103	NAD27;	54;	611 W 1,418 S from NE Sec 20 T 27S R 11W PM Salt Lake 1855;
38.4563	-113.106	NAD27;	55;	1,444 W 20 S from NE Sec 20 T 27S R 11W PM Salt Lake 1855;
38.45952	-113.109	NAD27;	56;	2,259 W 4,122 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;
38.4629	-113.112	NAD27;	57;	3,092 W 2,894 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;
38.46417	-113.113	NAD27;	58;	3,395 W 2,432 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855;

BY ORDER OF THE BOARD OF COUNTY COMMISSIONERS FOR BEAVER COUNTY.

TD071686

7 July 7, 2005

Bryan L. Harris
Commission Assistant
Beaver County Commission
105 East Center St.
P.O. Box 789
Beaver, Utah 84713

Dear Mr. Harris,

The following data supplied to you, and the Beaver County Commissioners as per our conversation in your office on 5 July, 2005.

1) The Western Utah Copper Company requests that the Beaver County Commissioners abandon the below described roads.
2) The maintaince of the below described roads will become the responsibility of Western Utah Copper Company. The Beaver County Road Department will not Again need to maintain these roads until the reclamation work has been completed, following cessation of active mining.
3) The conditions of the Beaver County issued conditional use permit No. 2005-06 will be adhered to by Western Utah Copper Company.

4) Description of Beaver County roads referenced in item 1 (one) above:

Salt Lake Meridian
T. 27 S., R. 11 W.,
Road travels So. through Sec.6, enters Sec 7, NE¼, exits SEC 7 SE ¼, Into NW¼ of SEC 18 exits NE ¼ SEC 18 into NW ¼ SEC 17, travels Across SEC 17, exits SEC 17, SE1/4 into SEC16 SW1/4 traverses/ Exits SEC 16 SE ¼ into SEC 21 NE ¼ exits SEC 21 NE ¼ into SEC 22 NW ¼, traverses through SEC 22 into SE ¼, where a Bifurcation begins, trends SW and exits SEC 22 (end of our interest in this Bifurcation), main axis of Co. road (and start of this bifurcation) trends East and exits SEC 22 SE ¼ into SEC 23 NW ¼, proceeds approximately 500 ft. to the E. where another prominent bifurcation starts. The start of this bifurcation is the terminus of our interest.

TD071687

The above description, along with the highlighted map should provide the needed data for the Beaver County Commissioners, and the Beaver County Road officials to see where the area of our focus, and intrest precipitating this request is. Any questions that may occur, I will gladly answer. My business card is also enclosed for your convenience in this regard. Please don't hesitate to call. Thank you for your help with these issues.

Sincerely,

Charles Walter McGinley III
Mining Engineer

NOTICE OF ADOPTION OF ORDINANCE

On the date of September 6, 2005, during the regularly scheduled meeting of the Beaver County Commission, the Commission adopted BEAVER COUNTY ORDINANCE NO. 2005-16, an ORDINANCE VACATING CERTAIN CLASS-D COUNTY ROADS *More Commonly Known as the "OK Mine Road," the "Upper Bowana Bench Road," and the "Bowana Pass Road."*

SHORT SUMMARY OF ORDINANCE: Three unimproved class-d county roads located in the Milford Flat area of Beaver County were vacated after a public hearing on the subject. A complete copy of the ordinance, and a full description of the vacated roads, is available at the Beaver County Clerk's office, 105 E. Center, in Beaver.

MEMBERS VOTING FOR AND AGAINST ORDINANCE:

For: Commissioner Mark Whitney, Commissioner Chad Johnson and Commissioner Billie Dalton

Against: _____.

BEAVER COUNTY ORDINANCE NO. 2005-16

ORDINANCE VACATING CERTAIN CLASS-D COUNTY ROADS

More Commonly Known as the "OK Mine Road," the "Upper Bowana Bench Road," and the "Bowana Pass Road."

WHEREAS a public hearing was held before the Beaver County Commission on the date of September 6, 2005 regarding the vacation of the following described class-d county roads, more commonly known as the "OK Mine Road," the "Upper Bowana Bench Road," and the "Bowana Pass Road," located in Beaver County, State of Utah, and described as follows, to-wit:

38.4468 -113.069 NAD27; 1; 1,361 W 3,427 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44733 -113.065 NAD27; 2; 204 W 3,234 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44017 -113.074 NAD27; 3; 2,628 W 577 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.44218 -113.074 NAD27; 4; 2,587 W 5,116 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44387 -113.073 NAD27; 5; 2,379 W 4,500 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44527 -113.071 NAD27; 6; 1,938 W 3,987 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44656 -113.07 NAD27; 7; 1,460 W 3,515 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44758 -113.067 NAD27; 8; 744 W 3,142 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44838 -113.065 NAD27; 9; 144 W 2,848 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.4491 -113.063 NAD27; 10; 4,833 W 2,589 S from NE Sec 23 T 27S R 11W PM Salt Lake 1855; 38.44972 - 113.06 NAD27; 11; 4,014 W 2,368 S from NE Sec 23 T 27S R 11W PM Salt Lake 1855; 38.44677 - 113.074 NAD27; 12; 2,755 W 3,443 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44704 - 113.075 NAD27; 13; 3,128 W 3,348 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44557 - 113.075 NAD27; 14; 3,050 W 3,881 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44381 - 113.074 NAD27; 15; 2,792 W 4,520 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.44189 - 113.074 NAD27; 16; 2,752 W 5,222 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.45003 - 113.08 NAD27; 17; 4,398 W 2,261 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.45385 - 113.08 NAD27; 18; 4,579 W 871 S from NE Sec 22 T 27S R 11W PM Salt Lake 1855; 38.45528 -113.085 NAD27; 19; 558 W 357 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.45672 -113.089 NAD27; 20; 1,855 W 5,111 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855; 38.45806 -113.094 NAD27; 21; 3,113 W 4,629 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855; 38.45938 -113.098 NAD27; 22; 4,288 W 4,158 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855; 38.4603 -113.101 NAD27; 23; 5,139 W 3,829 S from NE Sec 16 T 27S R 11W PM Salt Lake 1855 38.46071 -113.102 NAD27; 24; 206 W 3,681 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46163 -113.107 NAD27; 25; 1,607 W 3,350 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46359 -113.111 NAD27; 26; 2,912 W 2,643 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46427 -113.113 NAD27; 27; 3,402 W 2,396 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46736 -113.116 NAD27; 28; 4,148 W 1,271 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.47049 -113.118 NAD27; 29; 4,903 W 136 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.47369 -113.121 NAD27; 30; 351 W 4,236 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.47677 -113.124 NAD27; 31; 1,092 W 3,108 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.47942 -113.126 NAD27; 32; 1,747 W 2,139 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.48 -113.127 NAD27; 33; 1,873 W 1,925 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.48133 -113.127 NAD27; 34; 2,150 W 1,439 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.48368 -113.129 NAD27; 35; 2,531 W 578 S from NE Sec 7 T 27S R 11W PM Salt Lake 1855; 38.41237 -113.166 NAD27; 36; 2,602 W 401 S from NE Sec 2 T 28S R 12W PM Salt Lake 1855; 38.4177 -113.074 NAD27; 37; 2,867 W 3,522 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855; 38.42132 -113.074 NAD27; 38; 2,716 W 2,202 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855;

38.42507 -113.073 NAD27; 39; 2,559 W 837 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855; 38.42538 -113.073 NAD27; 40; 2,564 W 726 S from NE Sec 34 T 27S R 11W PM Salt Lake 1855 38.42911 -113.072 NAD27; 41; 2,318 W 4,601 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43281 -113.072 NAD27; 42; 2,101 W 3,254 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43641 -113.073 NAD27; 43; 2,346 W 1,944 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.44004 -113.074 NAD27; 44; 2,624 W 622 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.42836 -113.076 NAD27; 45; 3,355 W 4,876 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43105 -113.079 NAD27; 46; 4,310 W 3,900 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43367 -113.083 NAD27; 47; 5,236 W 2,948 S from NE Sec 27 T 27S R 11W PM Salt Lake 1855; 38.43634 -113.086 NAD27; 48; 854 W 1,975 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855; 38.43919 -113.089 NAD27; 49; 1,806 W 936 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855; 38.44171 -113.092 NAD27; 50; 2,629 W 19 S from NE Sec 28 T 27S R 11W PM Salt Lake 1855; 38.44445 -113.095 NAD27; 51; 3,519 W 4,318 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.44718 -113.098 NAD27; 52; 4,302 W 3,330 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.45021 -113.101 NAD27; 53; 5,091 W 2,230 S from NE Sec 21 T 27S R 11W PM Salt Lake 1855; 38.45245 -113.103 NAD27; 54; 611 W 1,418 S from NE Sec 20 T 27S R 11W PM Salt Lake 1855; 38.4563 -113.106 NAD27; 55; 1,444 W 20 S from NE Sec 20 T 27S R 11W PM Salt Lake 1855; 38.45952 -113.109 NAD27; 56; 2,259 W 4,122 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.4629 - 113.112 NAD27; 57; 3,092 W 2,894 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855; 38.46417 - 113.113 NAD27; 58; 3,395 W 2,432 S from NE Sec 17 T 27S R 11W PM Salt Lake 1855.

and,

WHEREAS due and proper notice of said public hearing having been given; and

WHEREAS public comment was taken at said hearing regarding said vacation; and

WHEREAS after the closure of said public hearing and upon further deliberation;

NOW THEREFORE, the Board of County Commissioners of the County of Beaver, State of Utah, hereby **ORDAIN AS FOLLOWS**:

The above described class-d county road, located within Beaver County, State of Utah, is vacated, said ordinance to take effect on the date of September 22, 2005.

PASSED AND APPROVED this 6th day of September, 2004.

BEAVER COUNTY

By Actng Chairman of the Board

ATTEST

Paul B. Barton
Beaver County Clerk

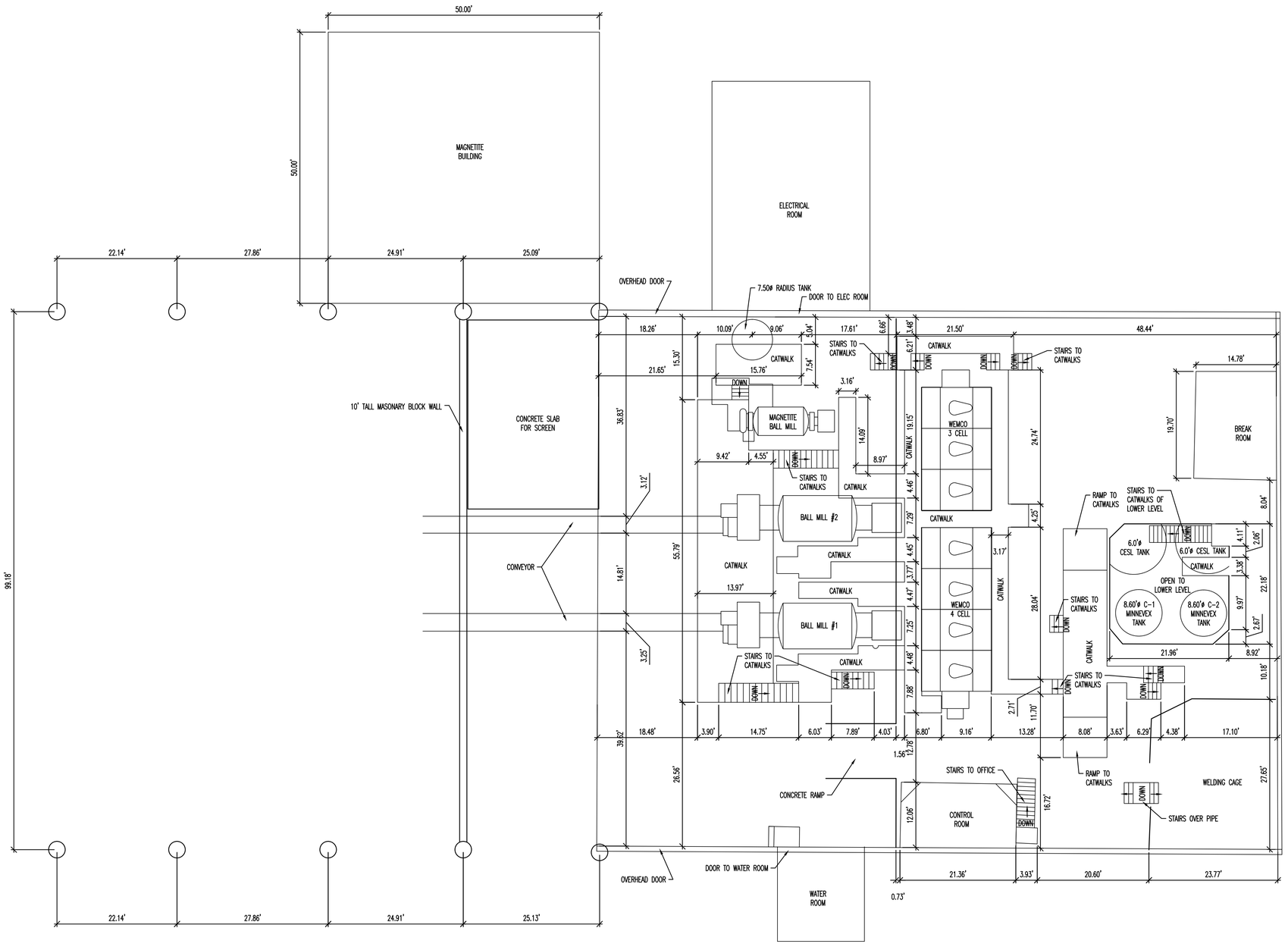
Votes of the Commissioner of adoption of the foregoing ordinance

For: Commissioner Mark Whitney, Billie Dalton, Chad Johnson

Against: none

APPENDIX B

Facilities Construction Drawings



NORTH

SCALE: 1" = 10'

0 5 10 15 20 30 40 50

UPPER LEVEL

AVOID CUTTING UNDERGROUND UTILITIES. IT'S COSTLY.
Call BEFORE YOU Dig
1-800-662-4111

NOTICE!

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION, PROTECTION, AND RESTORATION OF ALL BURIED OR ABOVE GROUND UTILITIES, SHOWN OR NOT SHOWN ON THE PLANS.

McNEIL ENGINEERING
ST. GEORGE - L.C.
1664 SOUTH DIXIE DRIVE, D-104 ST. GEORGE, UTAH 84770
TEL (435) 673-5127 FAX (435) 673-6090

BALL MILL BUILDING
CS MINING
MILFORD, UTAH
SECTION INFORMATION

REVISIONS

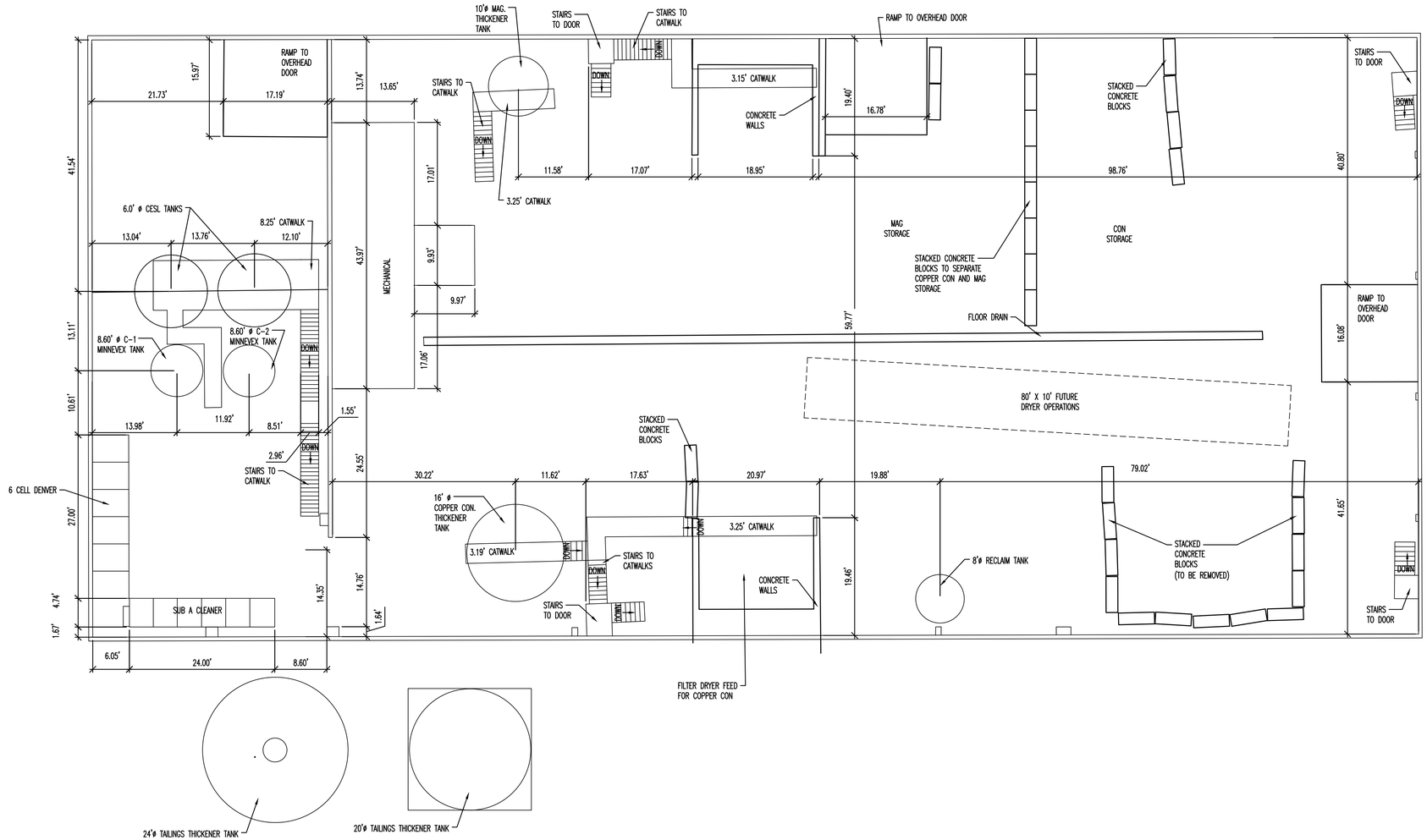
REV.	DATE	DESCRIPTION

PROJECT NO:	2012003.1
CAD DWG. FILE:	2012003-2D
DRAWN BY:	RDH
DESIGNED BY:	N/A
FIELD CREW:	FCT
CHECKED BY:	FCT
DATE:	6-22-12

SHEET TITLE:
UPPER LEVEL FLOOR PLAN

C1.01
SHEET: 1 OF 2

C:\Users\Rudin Owner-PC\Corporate\Local\Temp\AcPublish_10088\2012003-2D Building Plan.dwg, Jun 26, 2012 - 10:01am



LOWER LEVEL

NORTH

SCALE: 1" = 10'

0 5 10 15 20 30 40 50

AVOID CUTTING UNDERGROUND UTILITIES. IT'S COSTLY.
Call BEFORE YOU Dig
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BALL MILL BUILDING
CS MINING
MILFORD, UTAH
SECTION INFORMATION

REVISIONS

REV.	DATE	DESCRIPTION

PROJECT NO:	2012003.1
CAD DWG. FILE:	2012003-2D
DRAWN BY:	RDH
DESIGNED BY:	N/A
FIELD CREW:	FCT
CHECKED BY:	FCT
DATE:	6-22-12

SHEET TITLE:
LOWER LEVEL FLOOR PLAN

C1.02
SHEET: 2 OF 2

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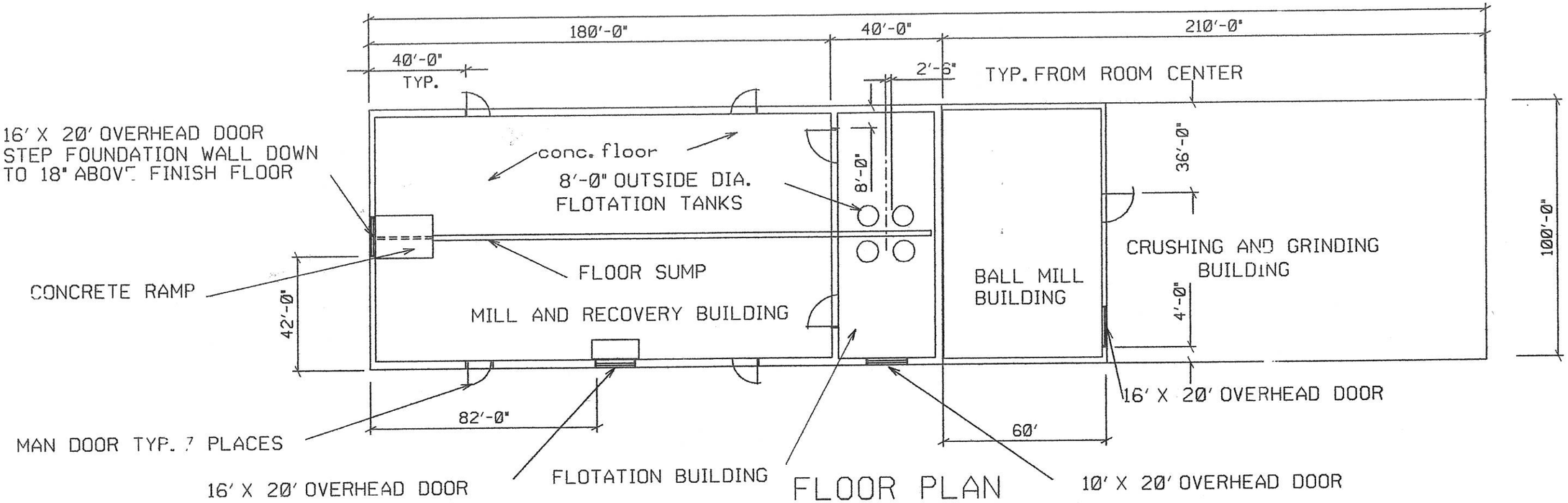
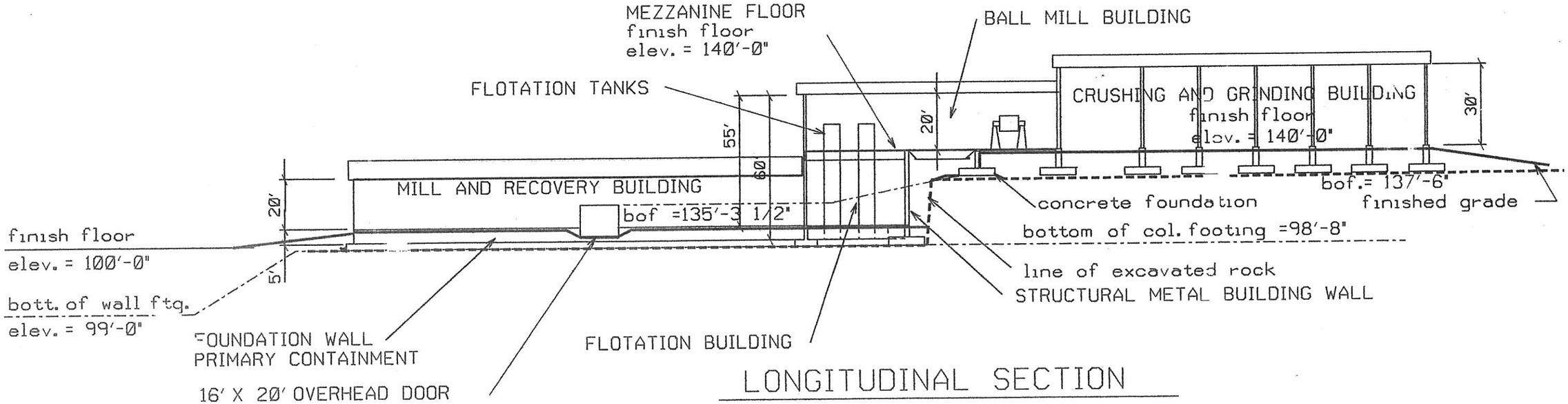


FLOOR PLAN



LONGITUDINAL SECTION

9-7-07 AH

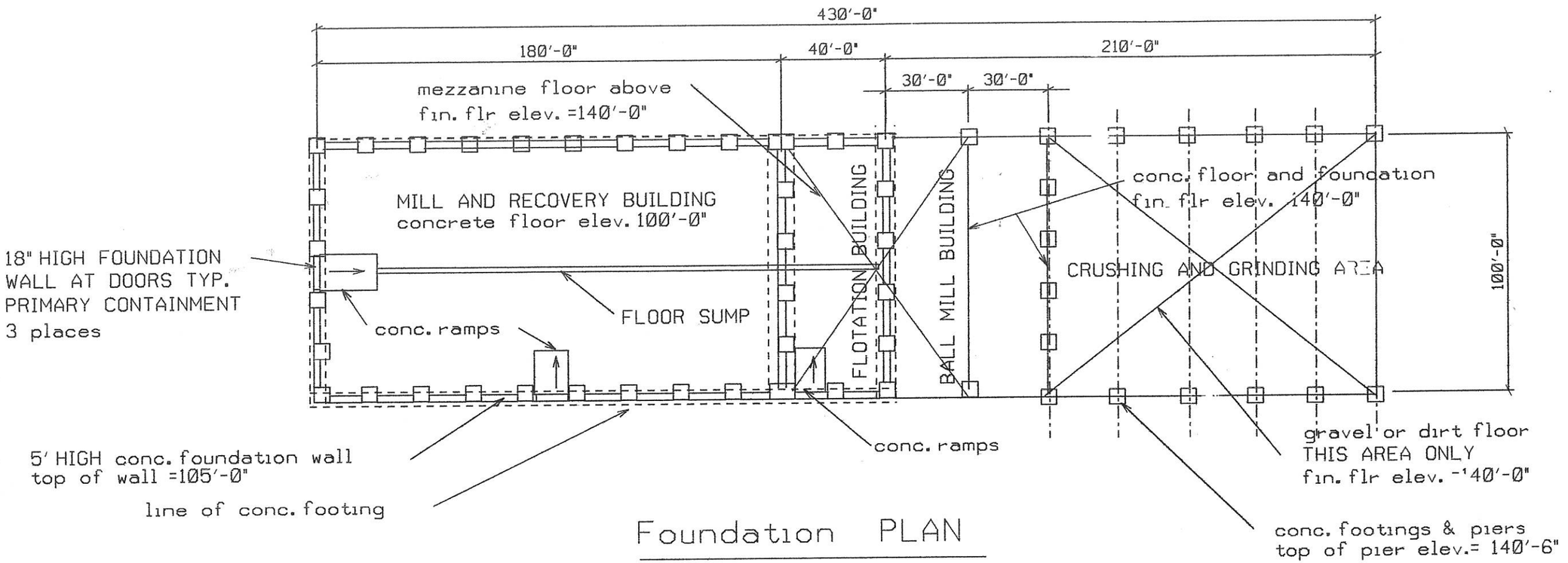
rev 4

design by: april mckeon, p.e.
date: 2/28/05

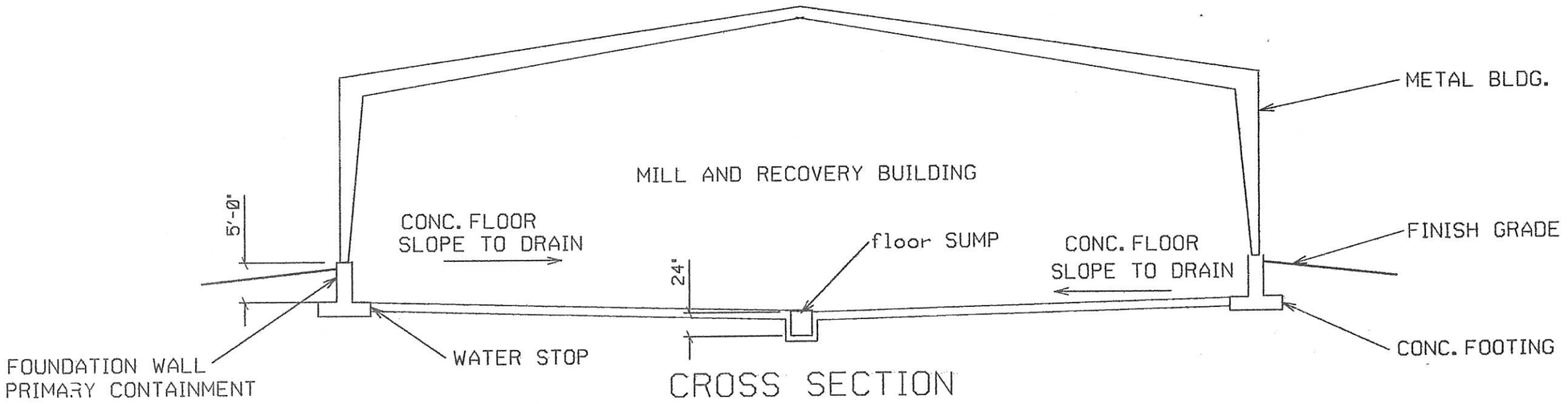
FLOOR PLAN
CONCENTRATOR BLDG.

western utah COPPER CO
MILFORD, UTAH

sht. A1



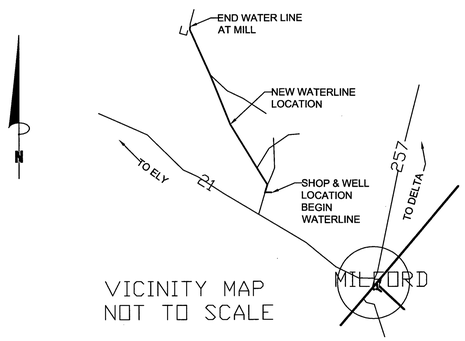
Foundation PLAN



CROSS SECTION

9-7-07

rev	3
design by:	april mckeon, p.e.
date:	10/12/04
FOUNDATION PLAN	CONCENTRATOR BLDG.
western utah COPPER CO	MILFORD, UTAH
sht.	A2



VICINITY MAP
NOT TO SCALE

IMPROVEMENT PLANS

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

WITHIN SECTIONS 7, 8, 17, 20, 21, 27, 28, & 34
T. 27 S. R. 11 W., S.L.B & M.

MARCH, 2013

INDEX

I 1	INDEX SHEET		
PP 1	-1+00 - 14+00 10"ø	PP 12	153+00 - 168+00
PP 1(A)	13+00 - 28+00	PP 13	167+00 - 182+00
PP 2	13+00 - 28+00	PP 14	181+00 - 196+00
PP 3	27+00 - 42+00	PP 15	195+00 - 210+00
PP 4	41+00 - 56+00	PP 16	209+00 - 224+00
PP 5	55+00 - 70+00	PP 17	223+00 - 238+00
PP 6	69+00 - 84+00	PP 18	237+00 - 252+00 10"ø
PP 7	83+00 - 98+00	PP 19	-1+00 - 14+00 8"ø
PP 8	97+00 - 112+00	PP 20	13+00 - 28+00 8"ø
PP 9	111+00 - 126+00	PP 21	27+00 - 42+00 8"ø
PP 10	125+00 - 140+00	D 1	PUMP HOUSE 1 DETAILS
PP 11	139+00 - 154+00	D 2	PUMP HOUSE 2 DETAILS
		D 3	PUMP HOUSE DETAILS
		D 4	DETAIL SHEET

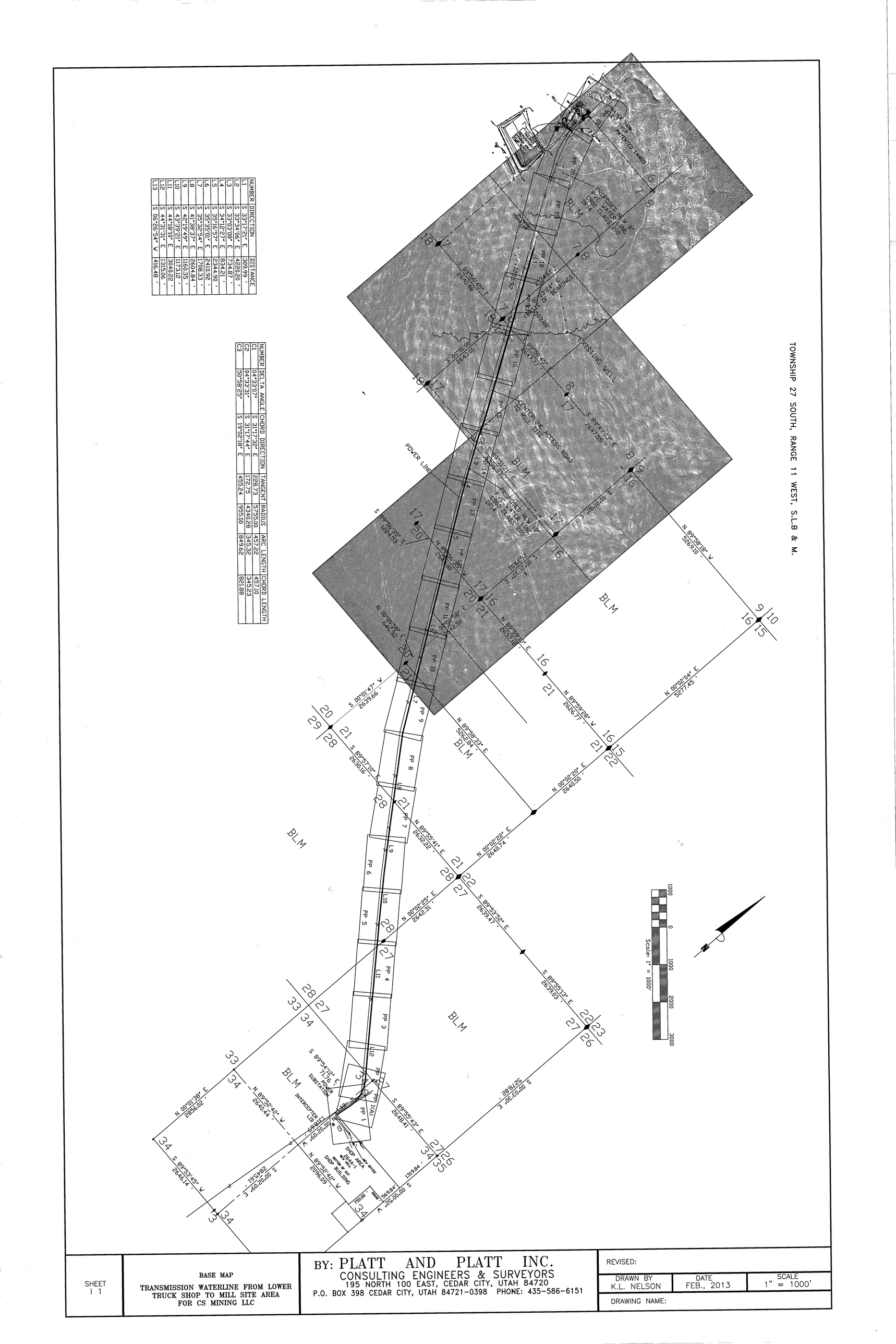
BLUE STAKES 1-800-662-4111

ROBERT B. PLATT 164659 STATE OF UTAH
3-8-2013

BY: PLATT AND PLATT, INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

DRAWN BY K.L. NELSON

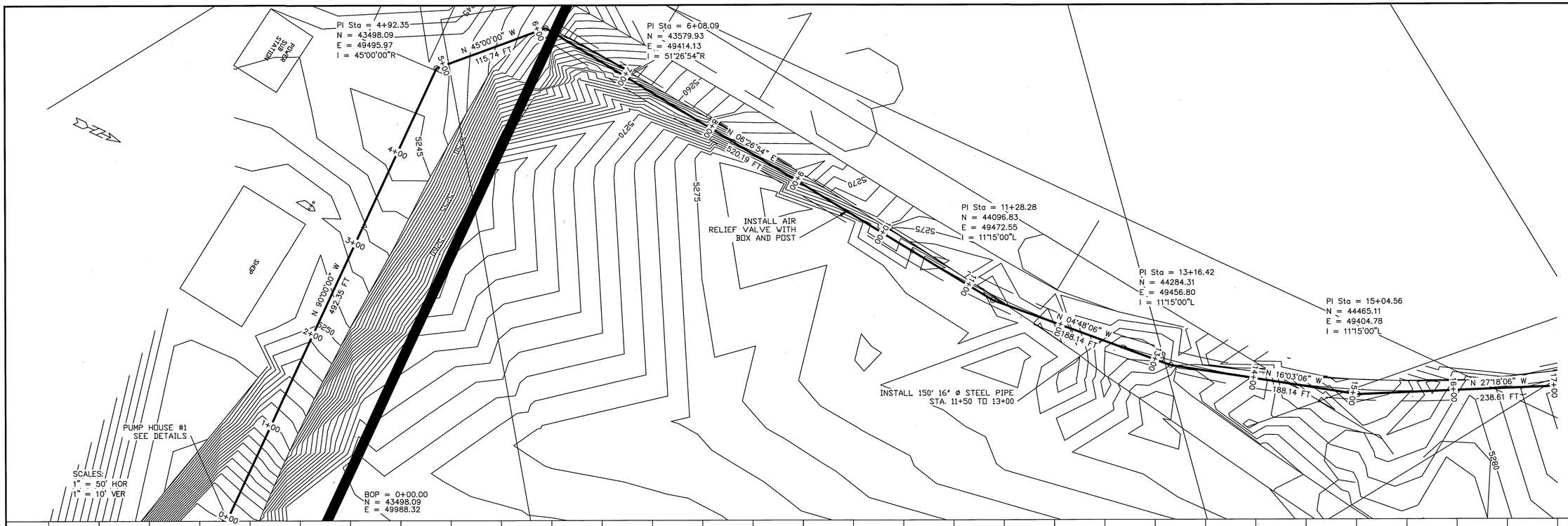
DRAWING NAME:

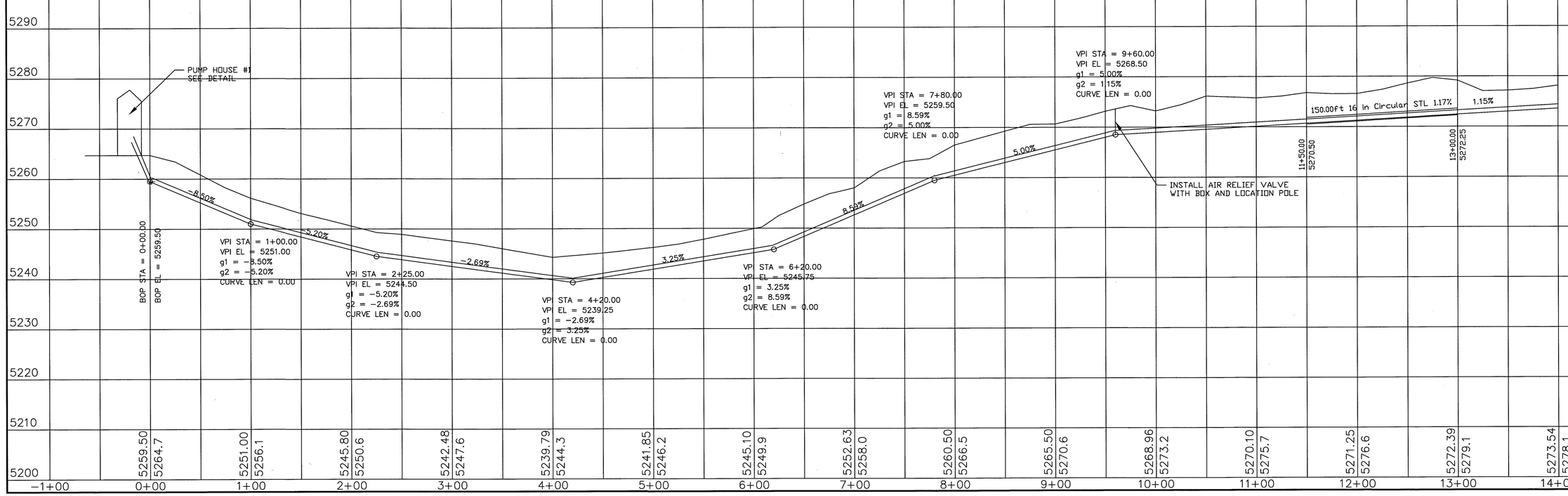


NUMBER	DIRECTION	DISTANCE
L1	S 33°17'21" E	309.99 '
L2	S 33°34'06" E	4220.20 '
L3	S 33°03'08" E	734.87 '
L4	S 34°12'27" E	834.21 '
L5	S 35°16'57" E	2344.90 '
L6	S 35°35'01" E	2410.92 '
L7	S 41°38'37" E	2604.84 '
L8	S 42°19'49" E	1160.35 '
L10	S 43°39'21" E	1173.12 '
L11	S 44°18'10" E	3040.22 '
L12	S 44°31'31" E	1315.06 '
L13	S 06°26'54" W	416.48 '

NUMBER	DELTA ANGLE	CHORD DIRECTION	TANGENT	RADIUS	ARC LENGTH	CHORD LENGTH
C1	04°33'07"	S 31°17'32" E	228.73	5735.00	457.32	457.21
C2	04°33'31"	S 31°17'44" E	172.75	4560.28	345.93	345.84
C3	50°58'25"	S 19°02'18" E	435.24	955.00	849.62	821.88

SHEET	BASE MAP	BY: PLATT AND PLATT INC.	REVISED:		
1 1	TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC	CONSULTING ENGINEERS & SURVEYORS 195 NORTH 100 EAST, CEDAR CITY, UTAH 84720 P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151	DRAWN BY K.L. NELSON	DATE FEB., 2013	SCALE 1" = 1000'
			DRAWING NAME:		





REVISED:

DRAWN BY K.L. NELSON | DATE MARCH, 2013 | SCALE 1" = 50'

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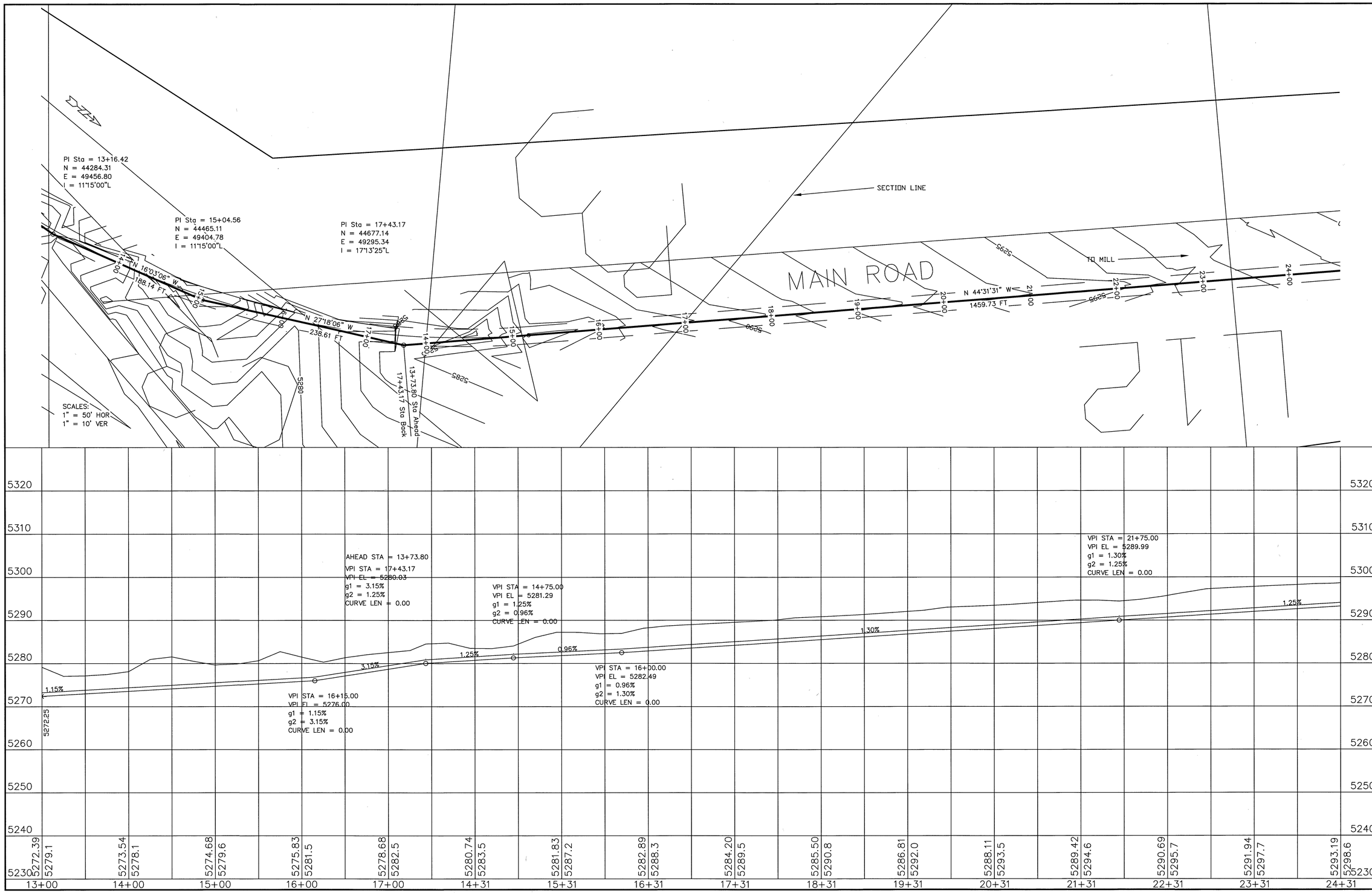
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

PLAN AND PROFILE

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET PP1



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DATE FEB., 2013

SCALE 1" = 50'

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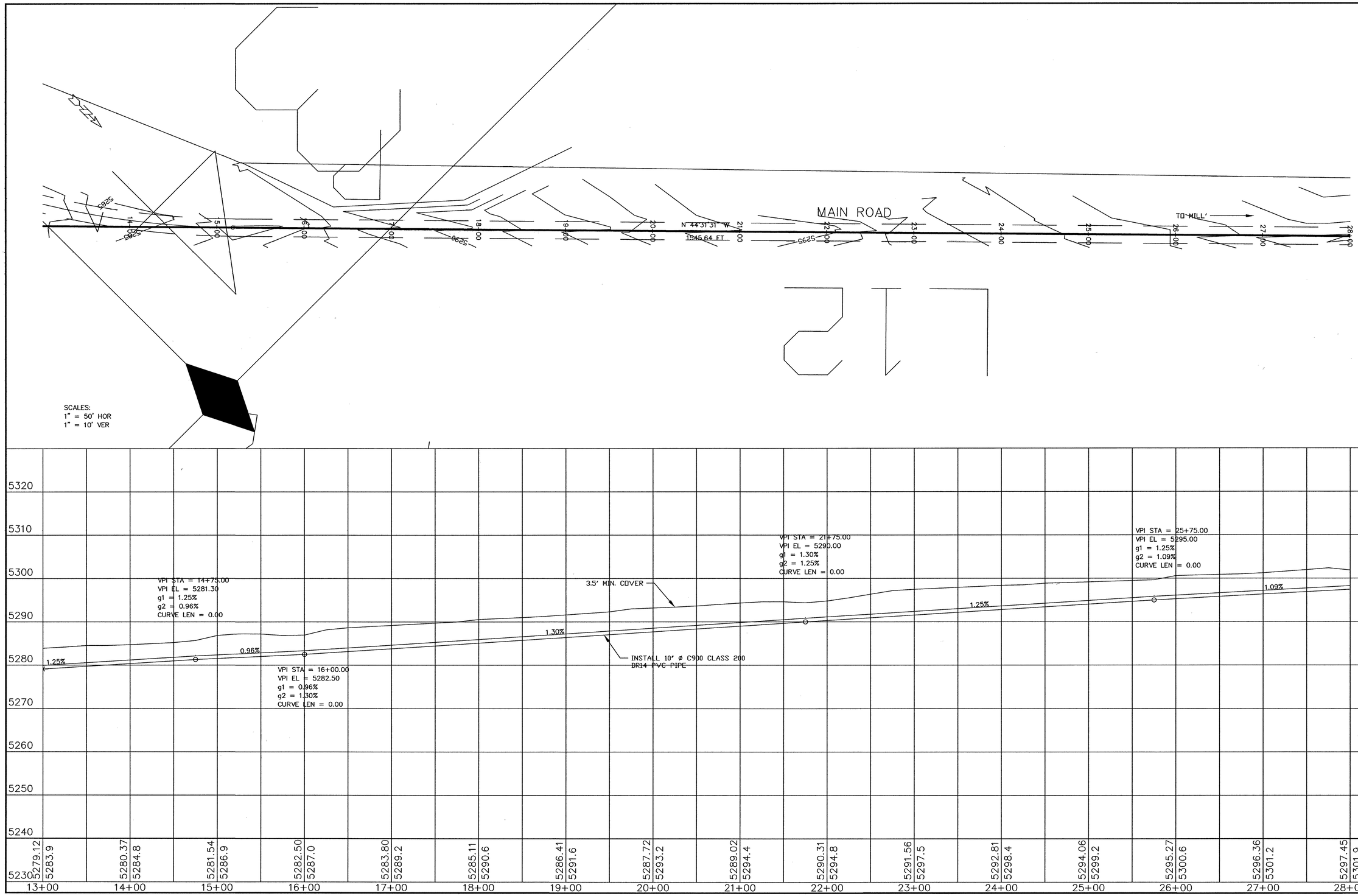
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

PLAN AND PROFILE

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET PP 1(A)


SCALES:
1" = 50' HOR
1" = 10' VER
MAIN ROAD
N 44°31'31" W
1545.64 FT
TO MILL
S29°S
S29°
S29°S
S29°
S29°S
S29°

SCALES:
1" = 50' HOR
1" = 10' VER

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
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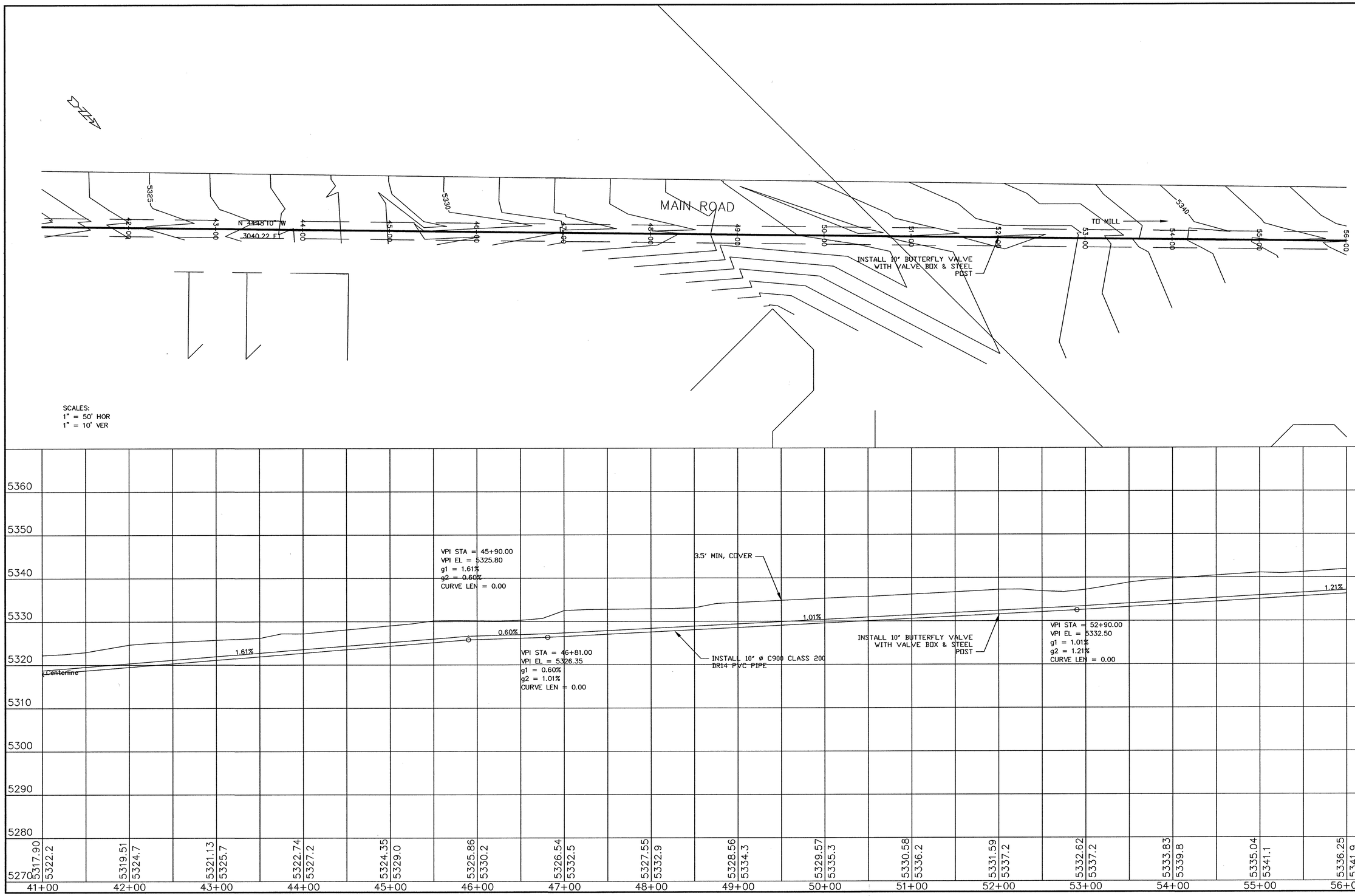
REVISED:

DRAWN BY	DATE	SCALE
K.L. NELSON	FEB., 2013	1" = 50'

DRAWING NAME:

PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 3



BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
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P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

REVISED:

DRAWN BY: K.L. NELSON | DATE: FEB., 2013 | SCALE: 1" = 50'

DRAWING NAME:

PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET PP 4

PI Sta = 58+73.23
N = 47893.61
E = 46148.29
I = 00°38'39"R

TO SHOP & OFFICE

MAIN ROAD

N 43°39'31" W
1170.62 FT

SCALES:
1" = 50' HOR
1" = 10' VER

VPI STA = 59+10.00
VPI EL = 5340.00
g1 = 1.21%
g2 = 1.86%
CURVE LEN = 0.00

VPI STA = 61+25.00
VPI EL = 5344.00
g1 = 1.86%
g2 = 1.03%
CURVE LEN = 0.00

VPI STA = 62+41.00
VPI EL = 5345.20
g1 = 1.03%
g2 = 1.36%
CURVE LEN = 0.00

VPI STA = 64+10.00
VPI EL = 5347.50
g1 = 1.36%
g2 = 1.02%
CURVE LEN = 0.00

3.5' MIN COVER

INSTALL 10" ø C900 CLASS 200
DR14 PVC PIPE

VPI STA = 68+60.00
VPI EL = 5352.10
g1 = 1.02%
g2 = 0.68%
CURVE LEN = 0.00

1.21%
1.86%
1.03%
1.36%
1.02%
0.68%

55+00	56+00	57+00	58+00	59+00	60+00	61+00	62+00	63+00	64+00	65+00	66+00	67+00	68+00	69+00	70+00
5335.04	5336.25	5337.46	5338.67	5339.88	5341.67	5343.53	5344.78	5346.00	5347.36	5348.42	5349.44	5350.46	5351.49	5352.37	5353.06
5341.1	5341.9	5343.3	5344.0	5344.3	5346.7	5347.8	5349.0	5351.1	5352.0	5352.8	5354.4	5355.4	5356.3	5356.0	5356.8

5380 5370 5360 5350 5340 5330 5320 5310 5300 5290

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

REVISED:

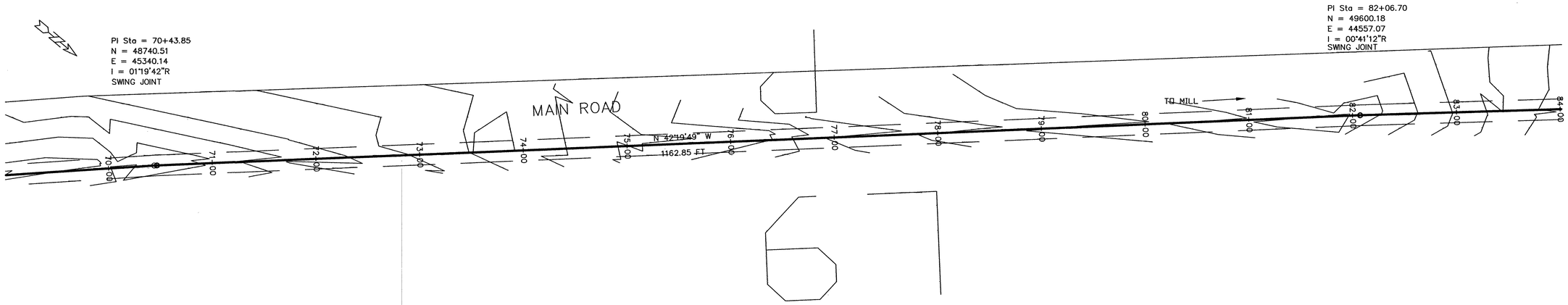
DRAWN BY K.L. NELSON | DATE FEB., 2013 | SCALE 1" = 50'

DRAWING NAME:

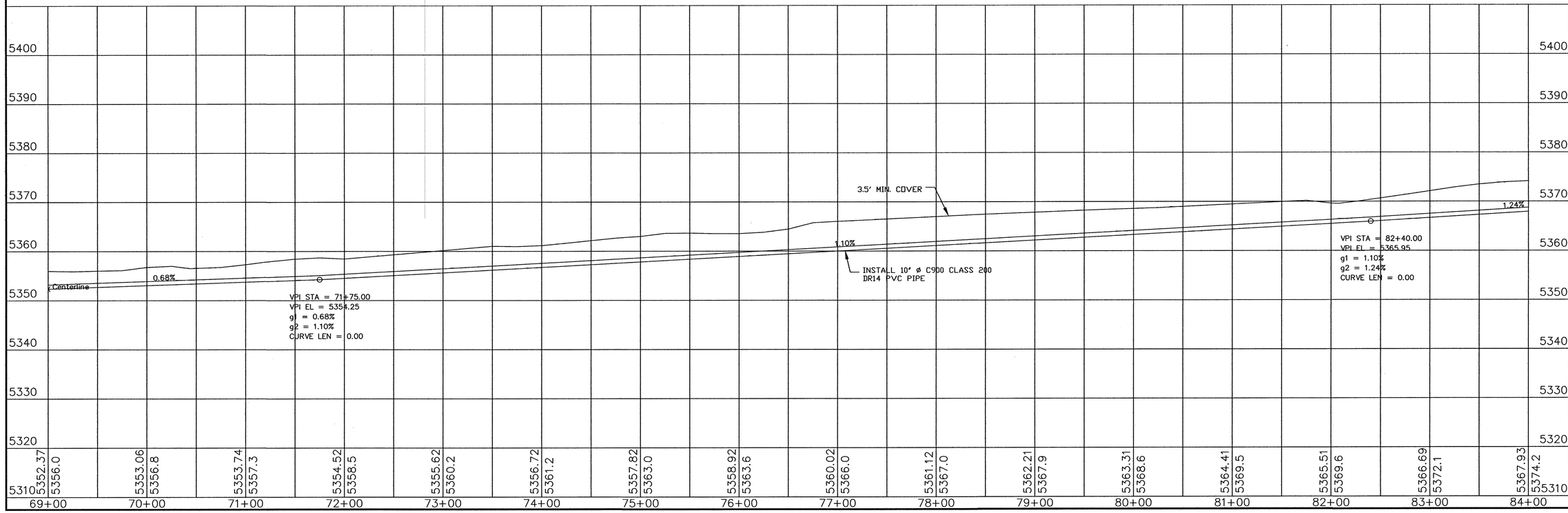
PLAN AND PROFILE

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET PP 5



SCALES:
1" = 50' HOR
1" = 10' VER



REVISED:

DRAWN BY
K.L. NELSON

DATE
FEB., 2013

SCALE
1" = 50'

DRAWING NAME:

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
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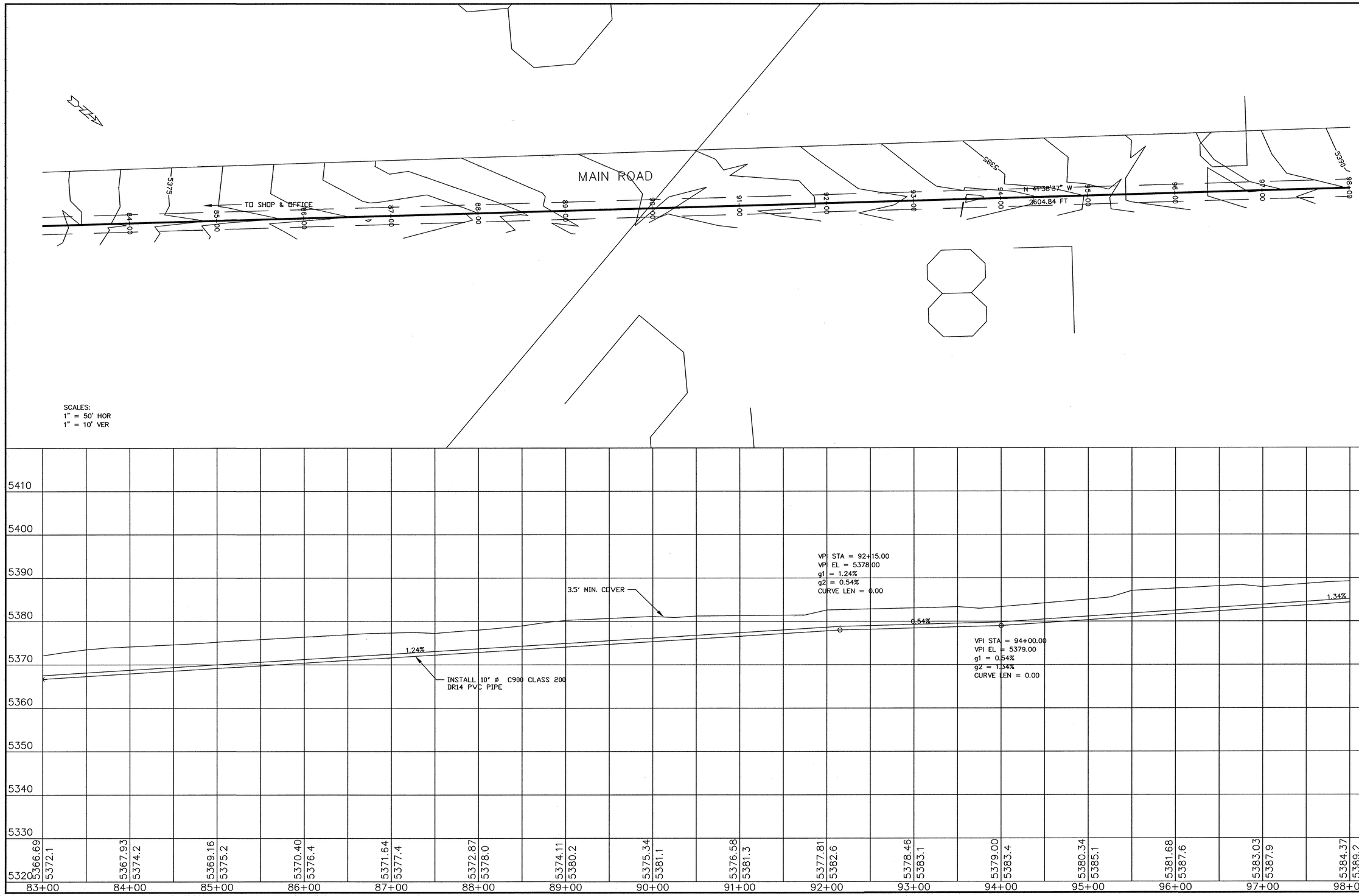
PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 6



BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
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P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

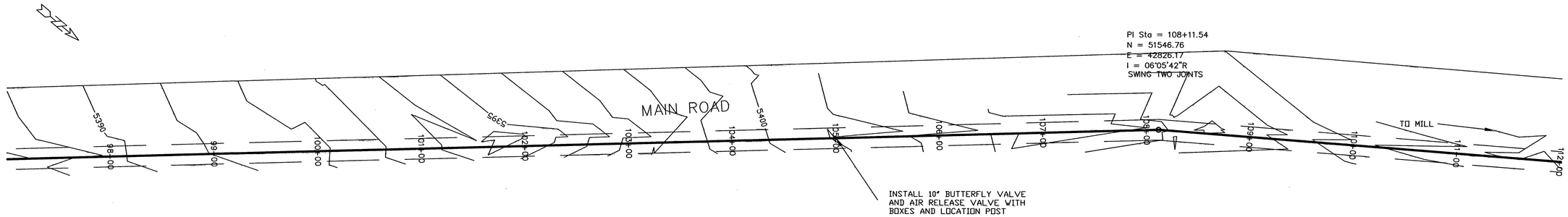
REVISED:

DRAWN BY	DATE	SCALE
K.L. NELSON	FEB., 2013	1" = 50'

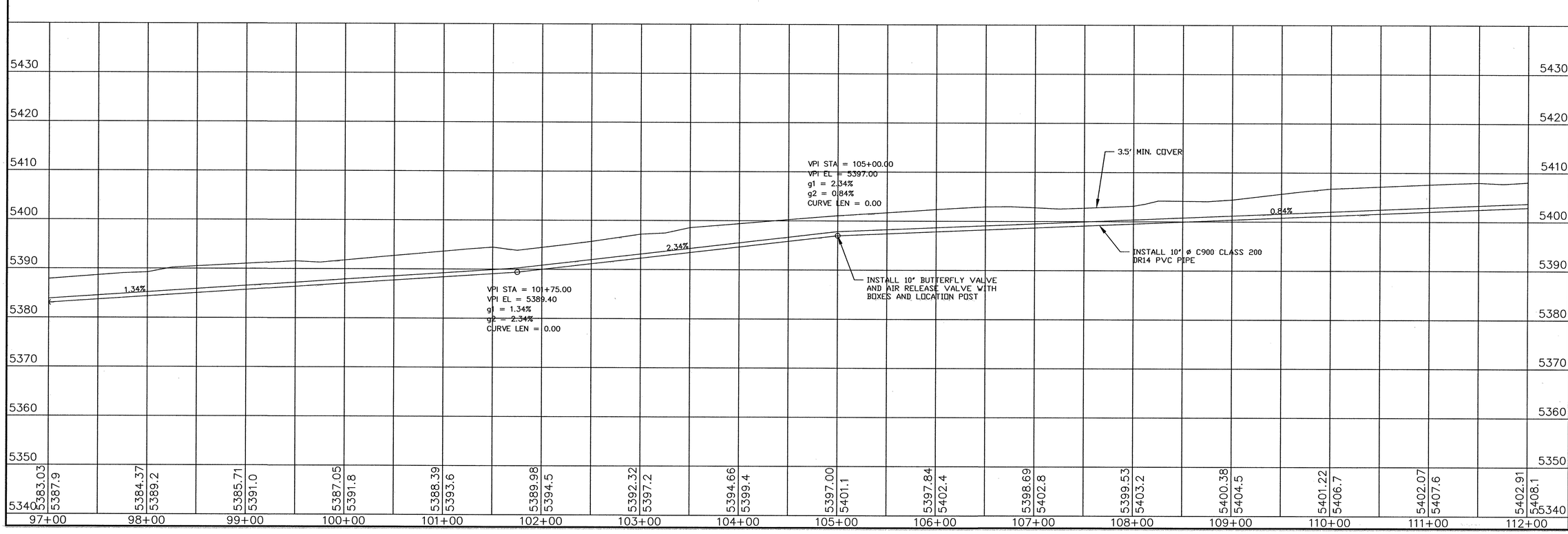
DRAWING NAME:

PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET
PP 7



SCALES:
1" = 50' HOR
1" = 10' VER



REVISED:

DRAWN BY K.L. NELSON | DATE FEB., 2013 | SCALE 1" = 50'

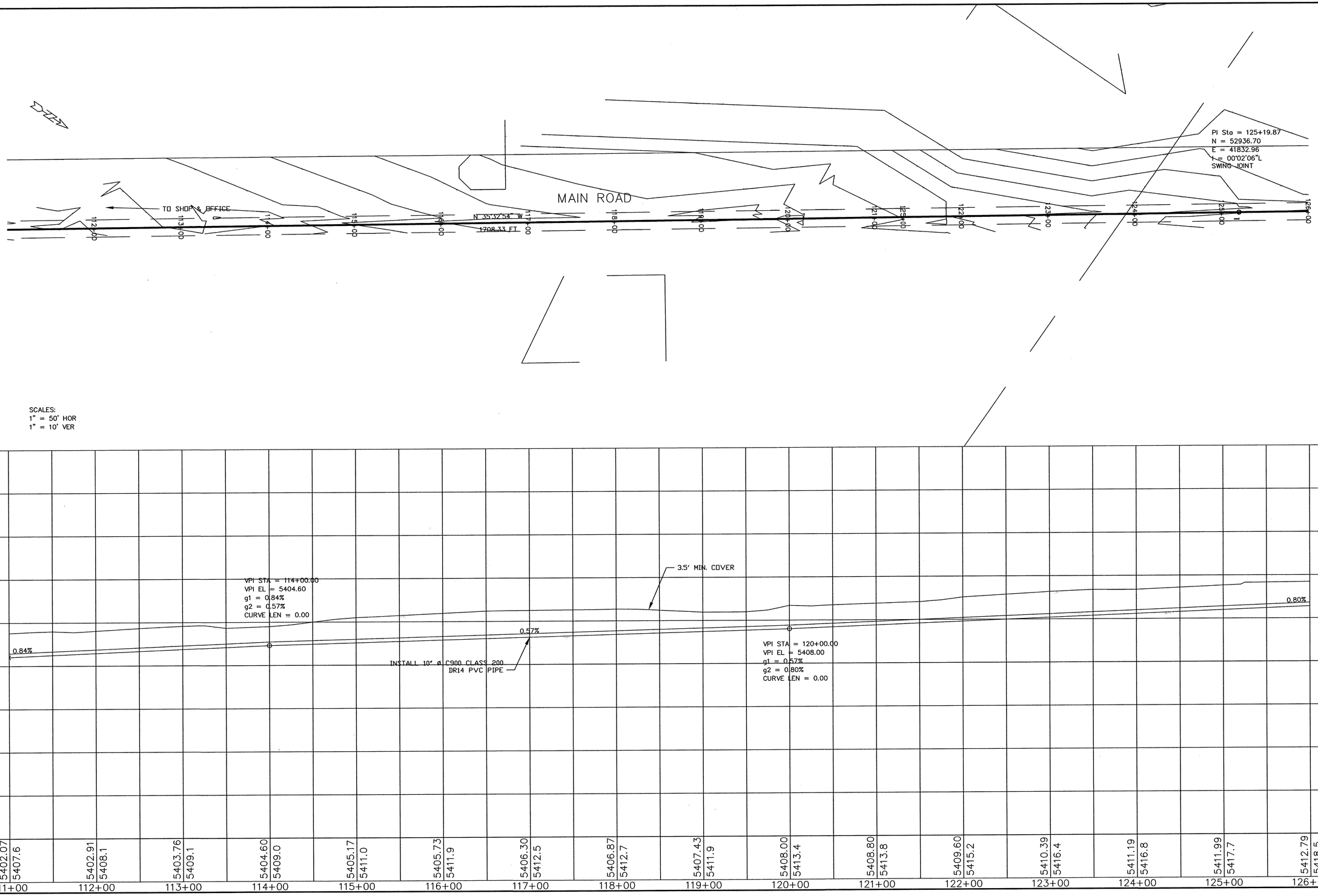
DRAWING NAME:

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

PLAN AND PROFILE

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET PP 8



REVISED:

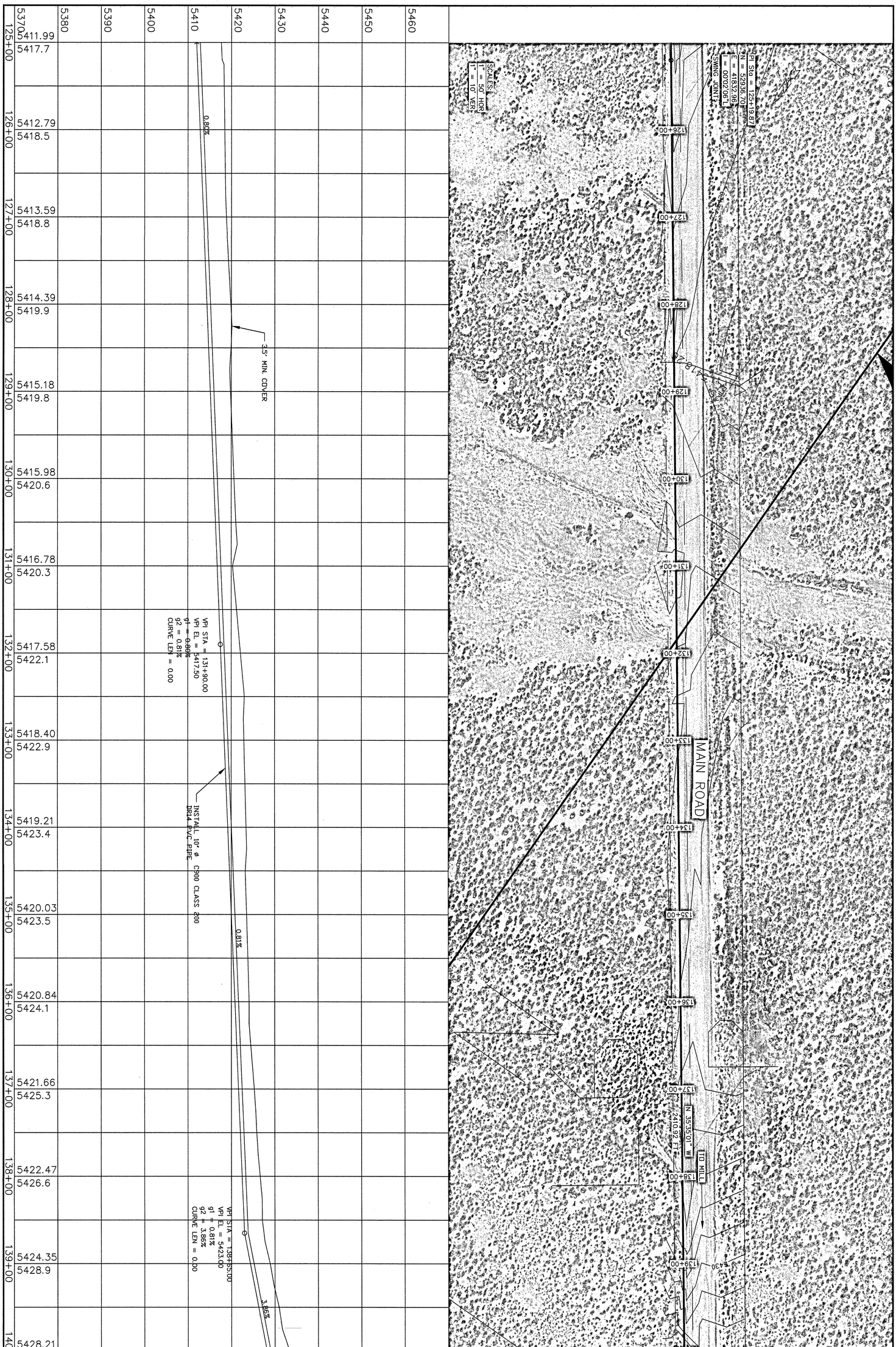
DRAWN BY	DATE	SCALE
K.L. NELSON	FEB., 2013	1" = 50'

DRAWING NAME:

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 9



PLAN AND PROFILE

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET
PP 10

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

REVISED:

DRAWN BY	DATE	SCALE
K.L. NELSON	FEB., 2013	1" = 50'

DRAWING NAME:

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

REVISED:

DRAWN BY: K.L. NELSON

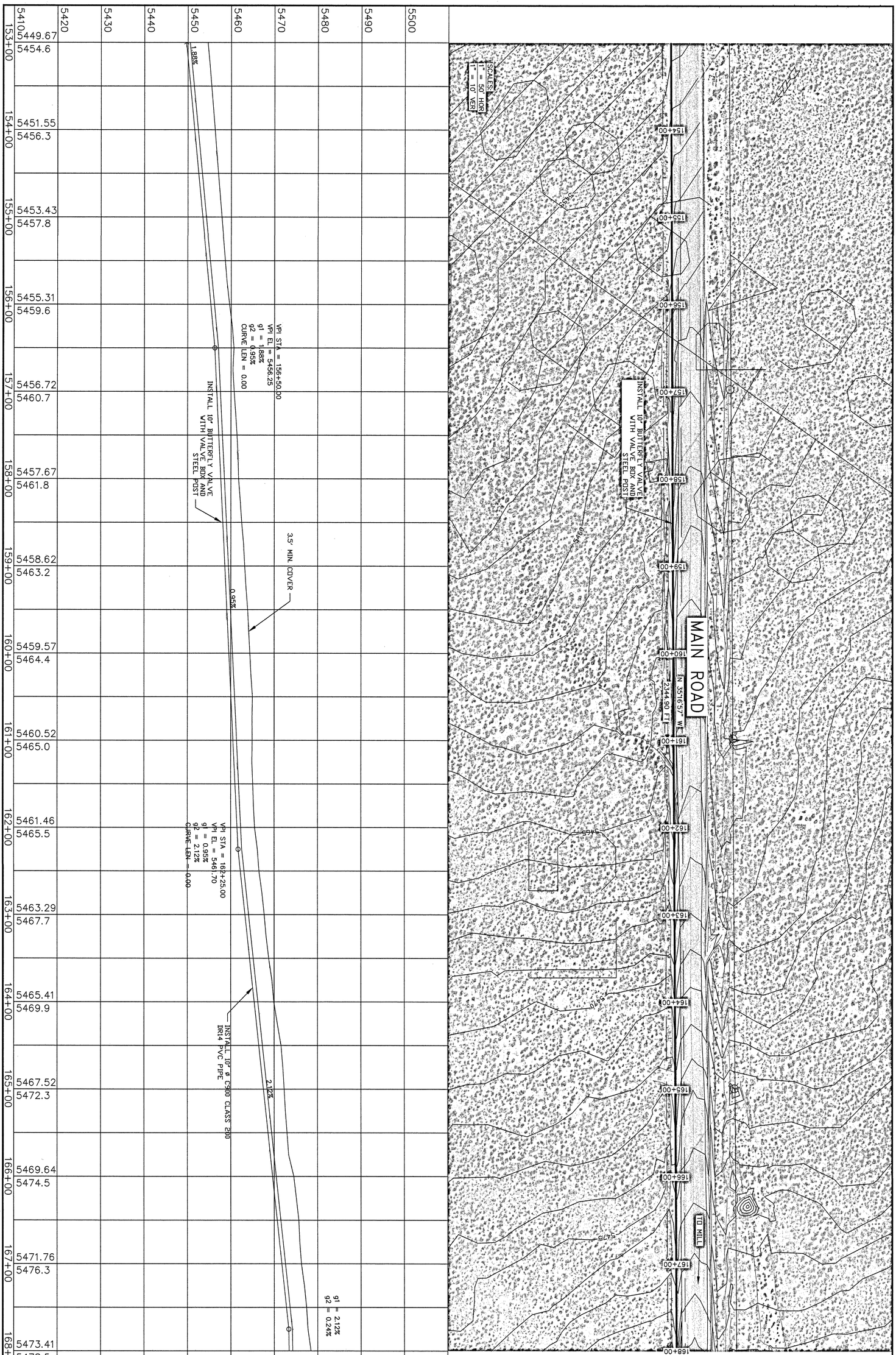
DATE: FEB., 2013

SCALE: 1" = 50'

DRAWING NAME:

PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 11


SCALES:
1" = 50' HORZ
1" = 10' VERT
154+00
155+00
156+00
157+00
158+00
159+00
160+00
161+00
162+00
163+00
164+00
165+00
166+00
167+00
168+00
MAIN ROAD
INSTALL 10" BUTTERFLY VALVE WITH VALVE BOX AND STEEL POST
INSTALL 10" BUTTERFLY VALVE WITH VALVE BOX AND STEEL POST
IN 35°16'57" W
2144.90 FT
TO MILL
5495
5485
5465
5445
5425
5405
5385
5365
5345
5325
5305
5285
5265
5245
5225
5205
5185
5165
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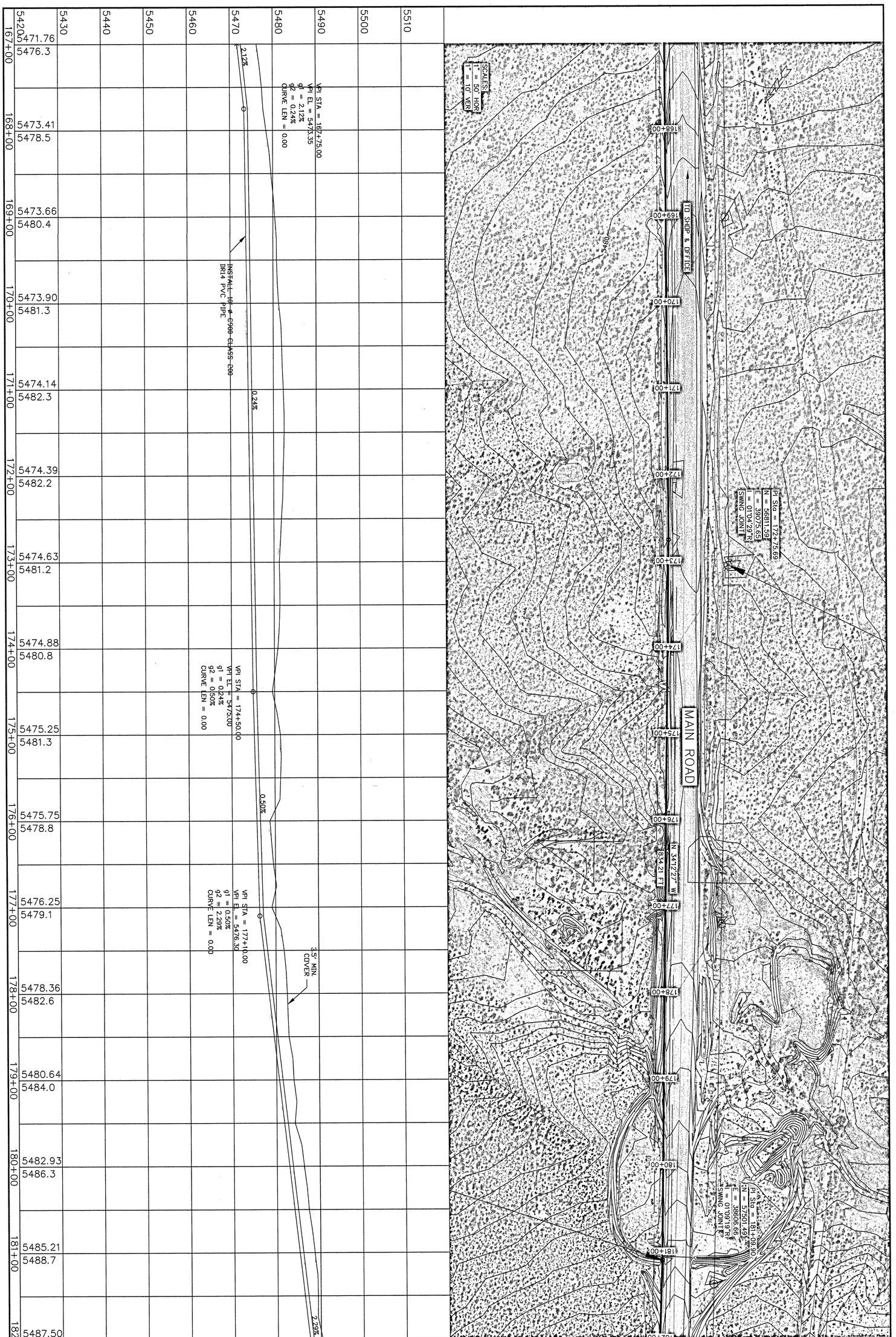
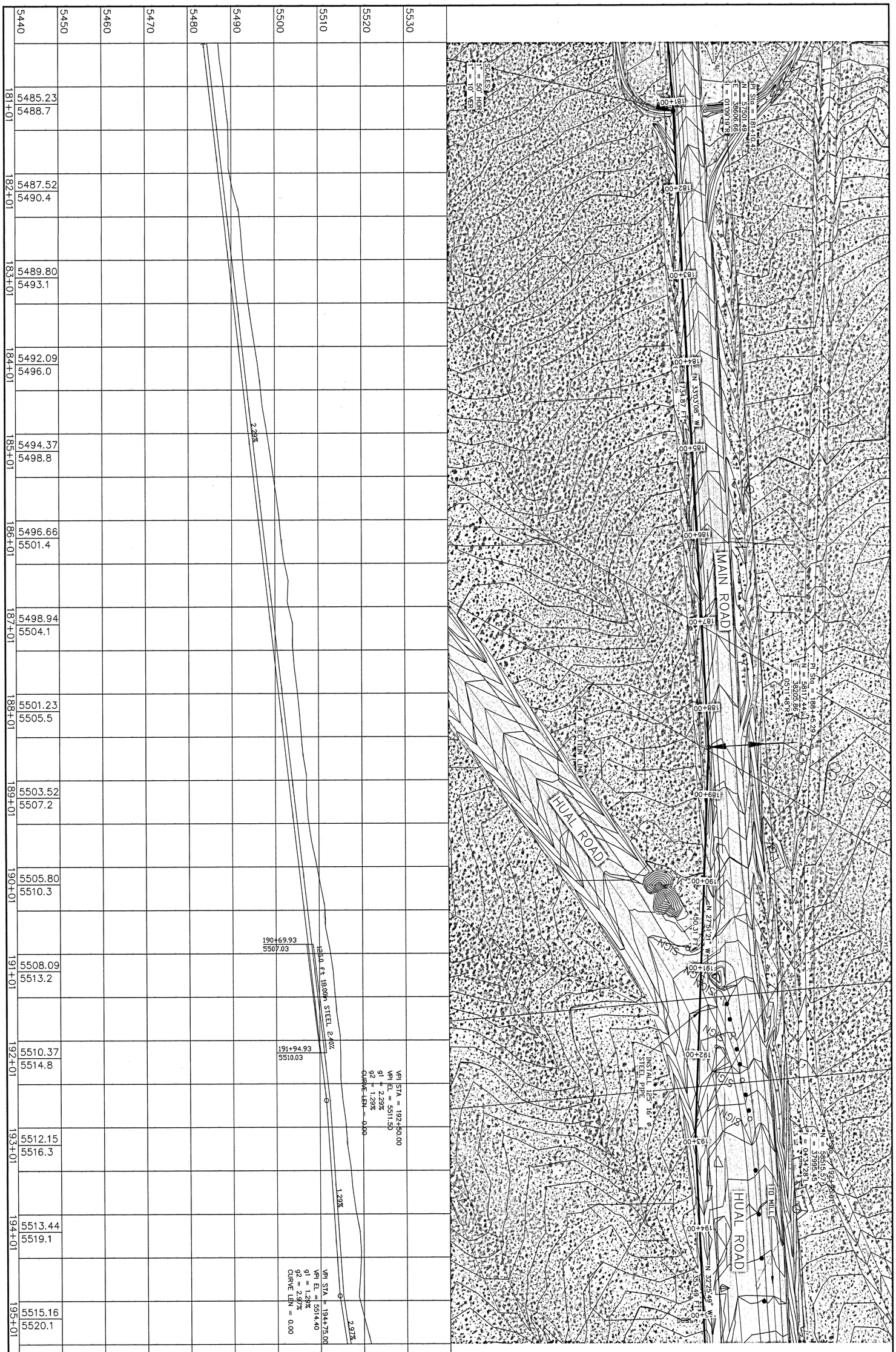


SHEET PP 13	PLAN AND PROFILE TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC	BY: PLATT AND PLATT INC. CONSULTING ENGINEERS & SURVEYORS 195 NORTH 100 EAST, CEDAR CITY, UTAH 84720 P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151	REVISED: DRAWN BY K.L. NELSON | DATE FEB., 2013 | SCALE 1" = 50' DRAWING NAME:



SHEET PP 14	PLAN AND PROFILE TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC	BY: PLATT AND PLATT INC. CONSULTING ENGINEERS & SURVEYORS 195 NORTH 100 EAST, CEDAR CITY, UTAH 84720 P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151	REVISED: DRAWN BY K.L. NELSON | DATE FEB., 2013 | SCALE 1" = 50' DRAWING NAME:

REVISED:

DRAWN BY K.L. NELSON

DATE FEB., 2013

SCALE 1" = 50'

DRAWING NAME:

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 15

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
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REVISED:	DRAWN BY	DATE	SCALE
	K.L. NELSON	FEB., 2013	1" = 50'

DRAWING NAME:

PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET
PP 16

BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
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REVISED:

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TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 17

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DRAWN BY	DATE	SCALE
K.L. NELSON	FEB., 2013	1" = 50'

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BY: PLATT AND PLATT INC.
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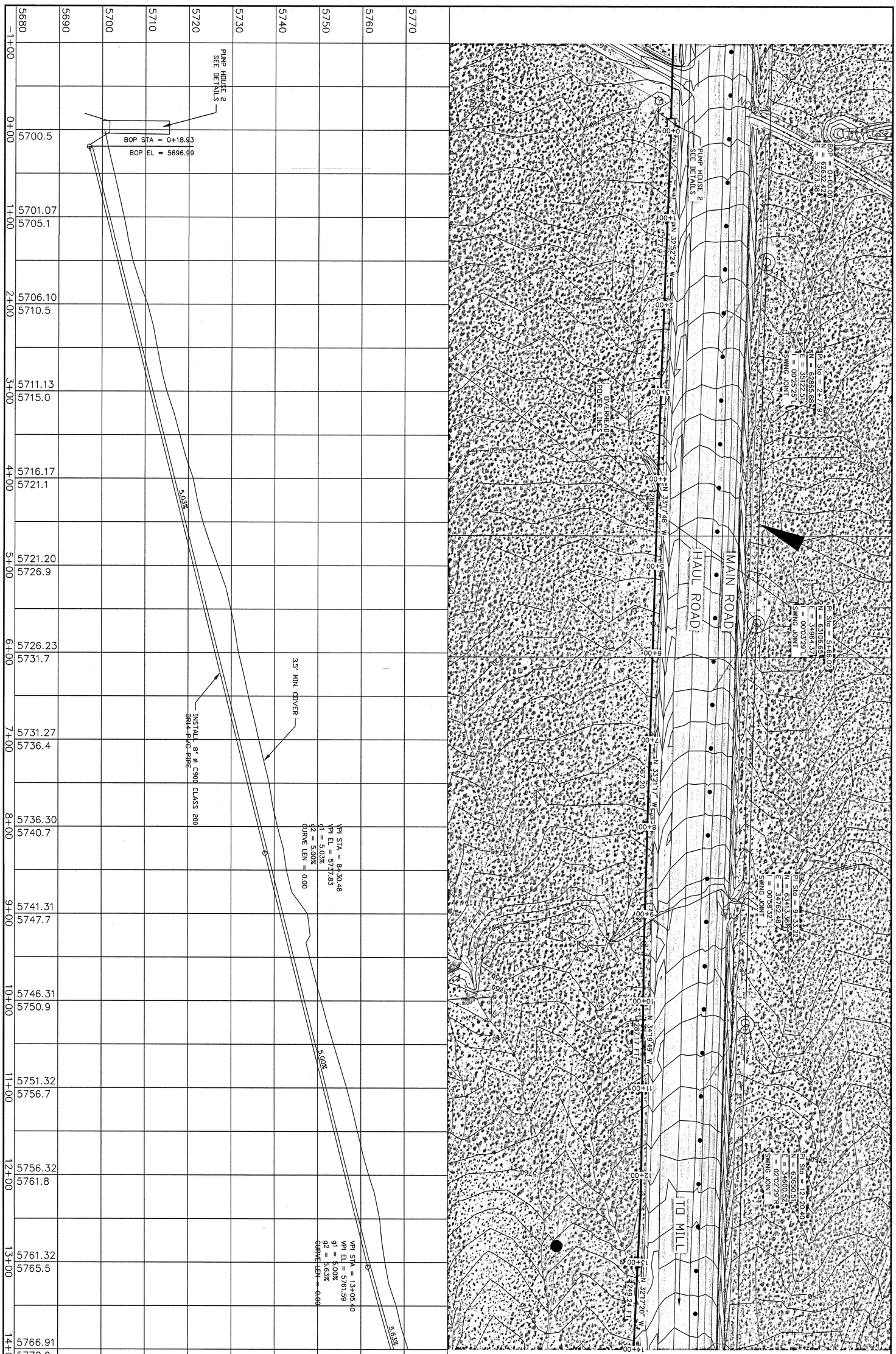
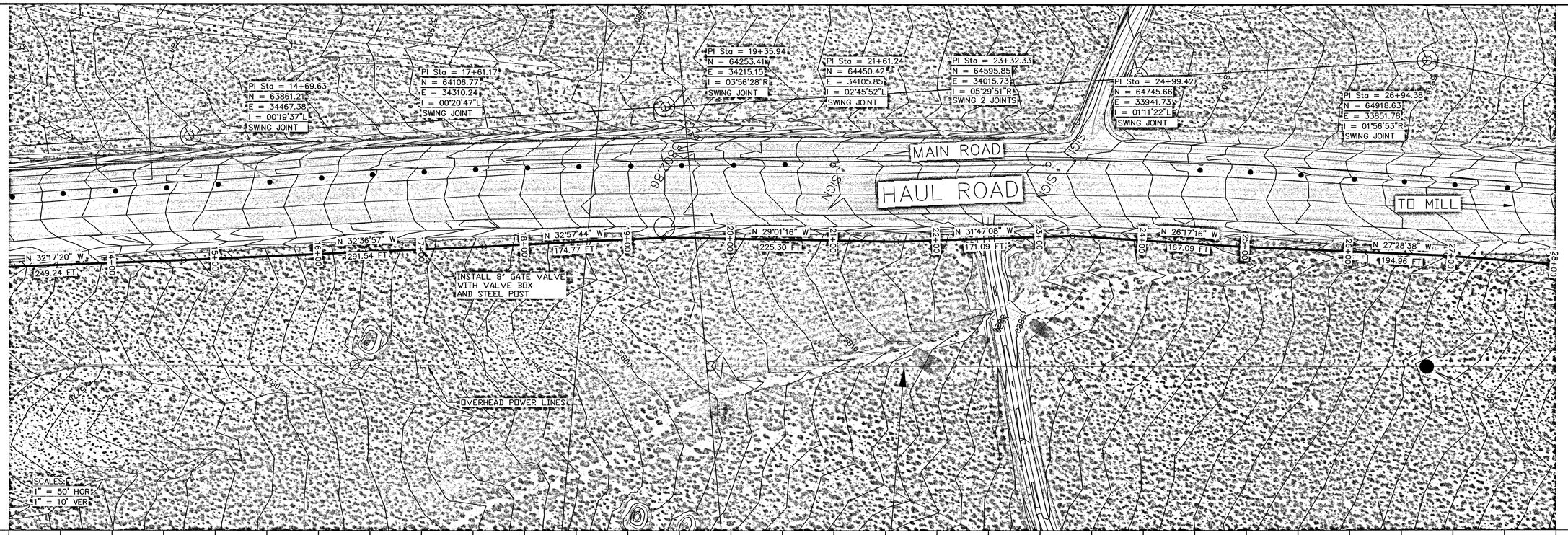
PLAN AND PROFILE
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 18



SHEET PP 19	PLAN AND PROFILE TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC	BY: PLATT AND PLATT INC. CONSULTING ENGINEERS & SURVEYORS 195 NORTH 100 EAST, CEDAR CITY, UTAH 84720 P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151	REVISED: DRAWN BY K.L. NELSON | DATE FEB., 2013 | SCALE 1" = 50' DRAWING NAME:



BY: PLATT AND PLATT INC.
CONSULTING ENGINEERS & SURVEYORS
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REVISED:

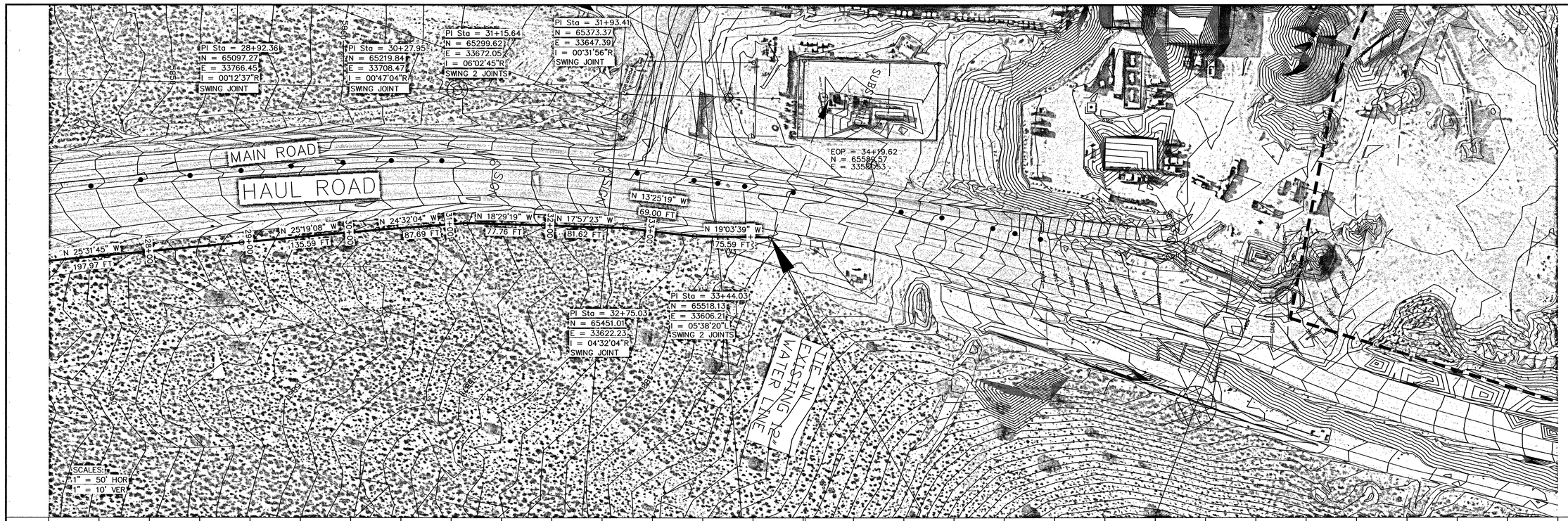
DRAWN BY	DATE	SCALE
K.L. NELSON	FEB., 2013	1" = 50'

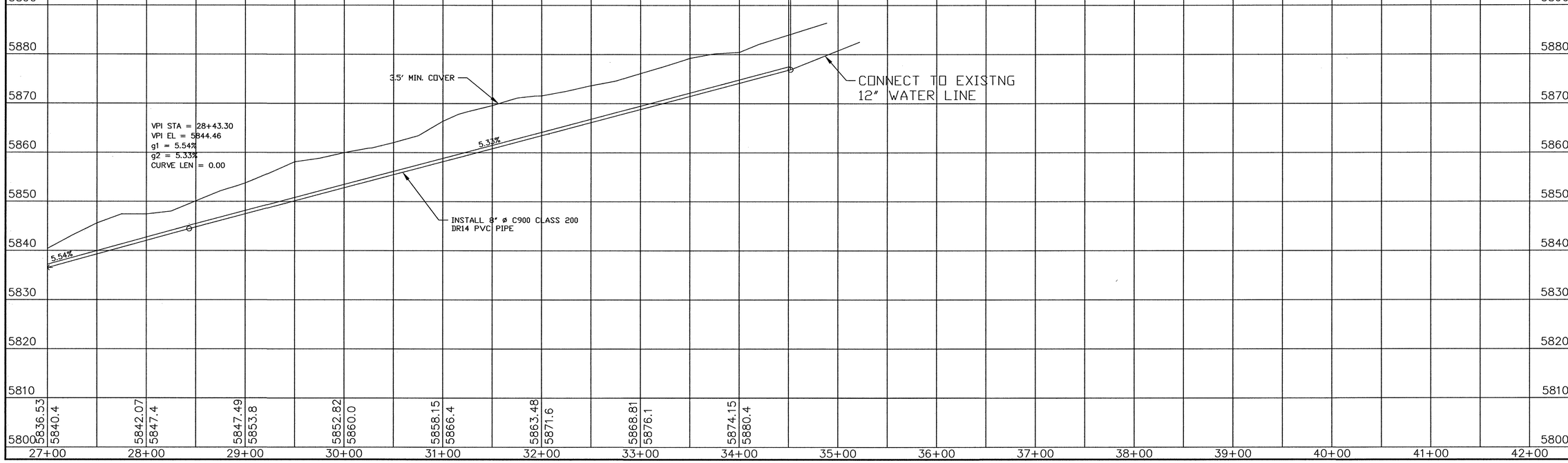
DRAWING NAME:

PLAN AND PROFILE

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET
PP 20





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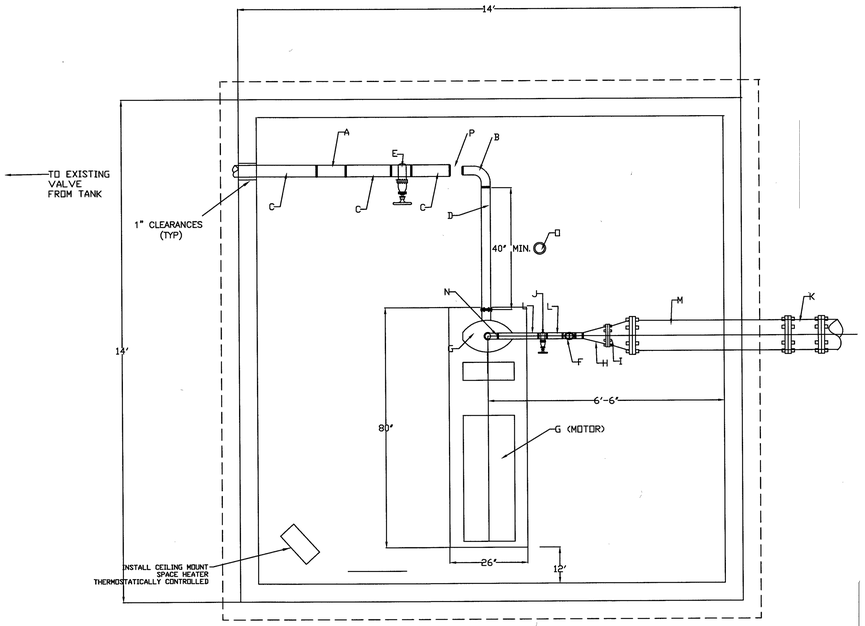
PLAN AND PROFILE

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
PP 21

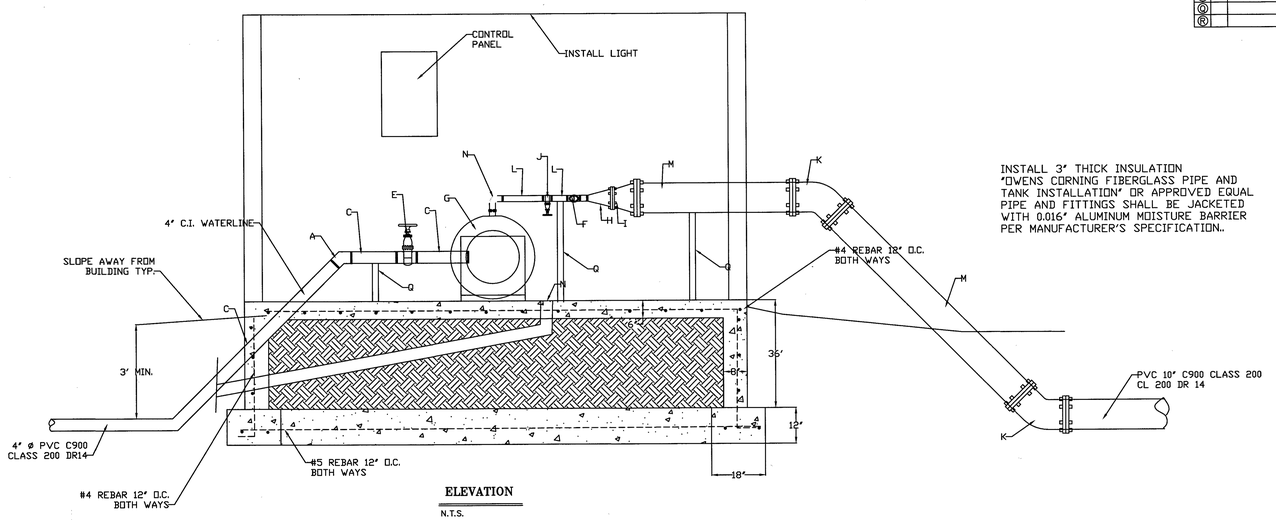


PLAN

N.T.S.

LEGEND

NO.	ITEM	DESCRIPTION
A	4" 45° BEND THREADED	
B	□ 3" 90° BEND THREADED	□
C	4" SPOOLS VARIOUS LENGTHS THREADED	
D	3" SPOOL 40" LENGTH THREADED, FLANGED	
E	4" THREADED BALL VALVE	W-K-M DYNA SEAL BALL VALVE
F	2" THREADED CHECK VALVE	FRANK FLO SWINGING CHECK VALVE FWI INC.
G	PUMP AND MOTOR	GOULDS PUMP MODEL 3196 LTI
H	6" FLANGED x 2" THREADED REDUCER	
I	10" FLANGED x 6" FLANGED REDUCER	
J	2" THREADED BALL VALVE	
K	10" 45° BEND FLANGED	
L	2" THREADED SPOOL	
M	10" FLANGED SPOOL	
N	2" 90° BEND THREADED	
O	4" FLOOR DRAIN & PIPE TO DAYLIGHT	
P	4" THREADED x 3" THREADED REDUCER	
Q	PIPE BRACE	
R	NOT USED	



ELEVATION

N.T.S.

INSTALL 3" THICK INSULATION "OWENS CORNING FIBERGLASS PIPE AND TANK INSTALLATION" OR APPROVED EQUAL PIPE AND FITTINGS SHALL BE JACKETED WITH 0.016" ALUMINUM MOISTURE BARRIER PER MANUFACTURER'S SPECIFICATION..

N

REVISED:

DRAWN BY K.L. NELSON

DATE JAN., 2009

SCALE 1/2" = 1'

DRAWING NAME:

BY: PLATT AND PLATT, INC.
CONSULTING ENGINEERS & SURVEYORS
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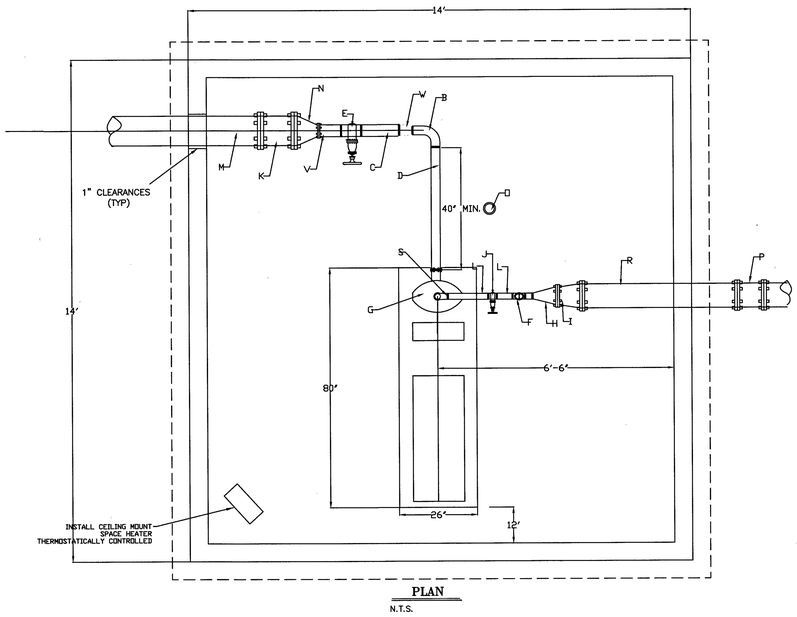
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

PUMP HOUSE #1 DETAILS

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA FOR CS MINING LLC

SHEET D 1



PLAN

N.T.S.



LEGEND

NO.	*	ITEM	DESCRIPTION
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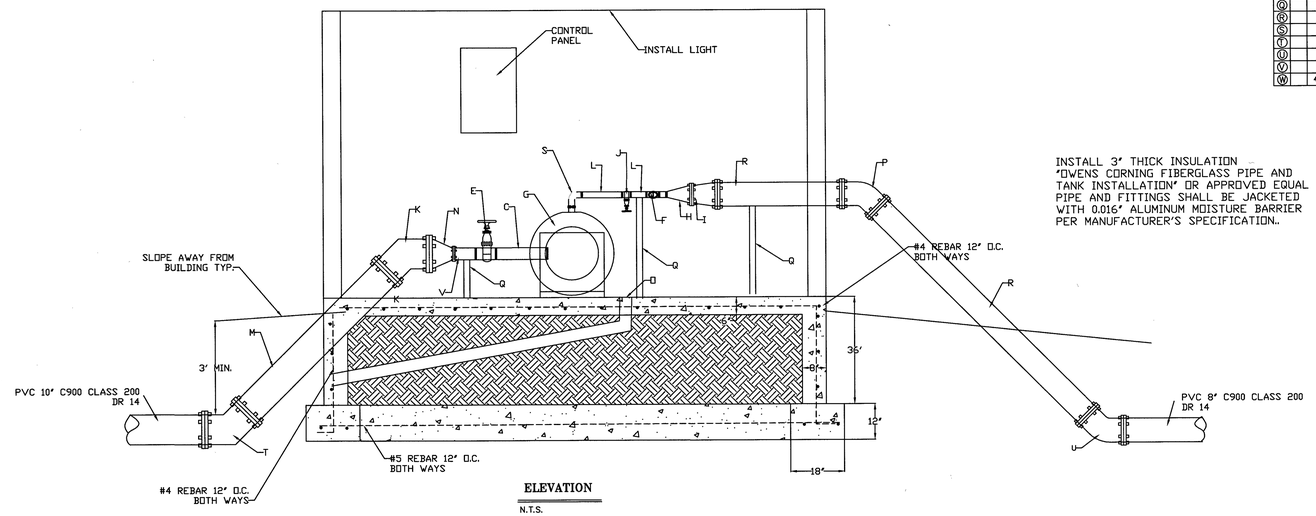
H		6" FLANGED x 2" THREADED REDUCER	
I		8" FLANGED x 6" FLANGED REDUCER	
J		2" THREADED BALL VALVE	
K		10" 45° BEND FLANGED	
L		2" THREADED SPOOL	
M		10" FLANGED SPOOL	
N		10" FLANGED x 4" FLANGED REDUCER	
O		4" FLOOR DRAIN & PIPE TO DAYLIGHT	
P		8" 45° BEND FLANGED	
Q		BRACE	
R		8" FLANGED SPOOL	
S		2" 90° BEND THREADED	
T		45° BEND FLANGED MAGALAG	
U		8" 45° BEND FLANGED MAGALAG	
V		3" SPOOL THREADED, FLANGED	
W		4" THREADED x 3" THREADED REDUCER	



ELEVATION

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REVISED:

DRAWN BY
K.L. NELSON

DATE
JAN., 2009

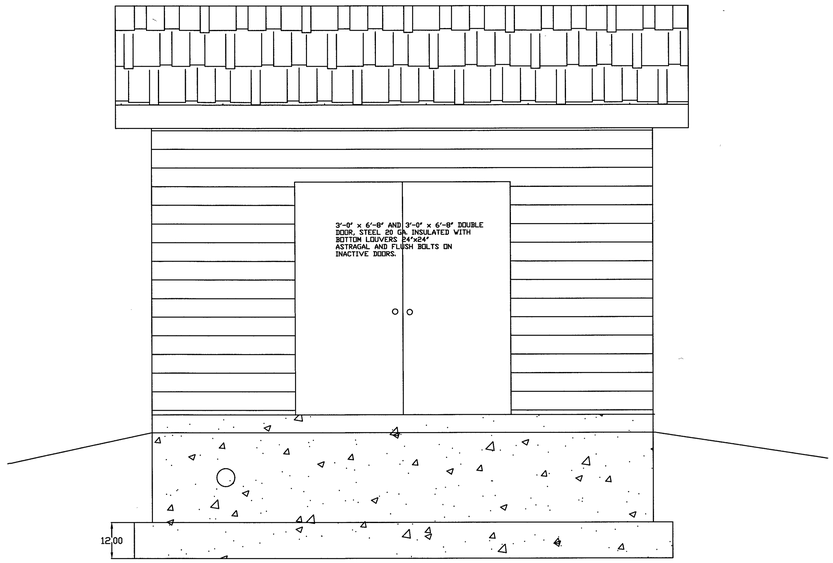
SCALE
1/2" = 1'

DRAWING NAME:

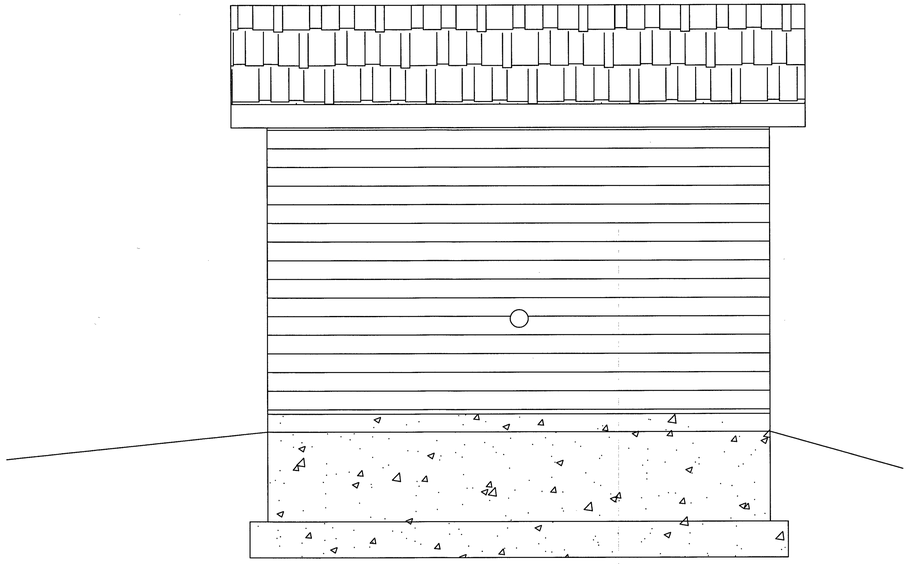
PUMP HOUSE #2 DETAILS

TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

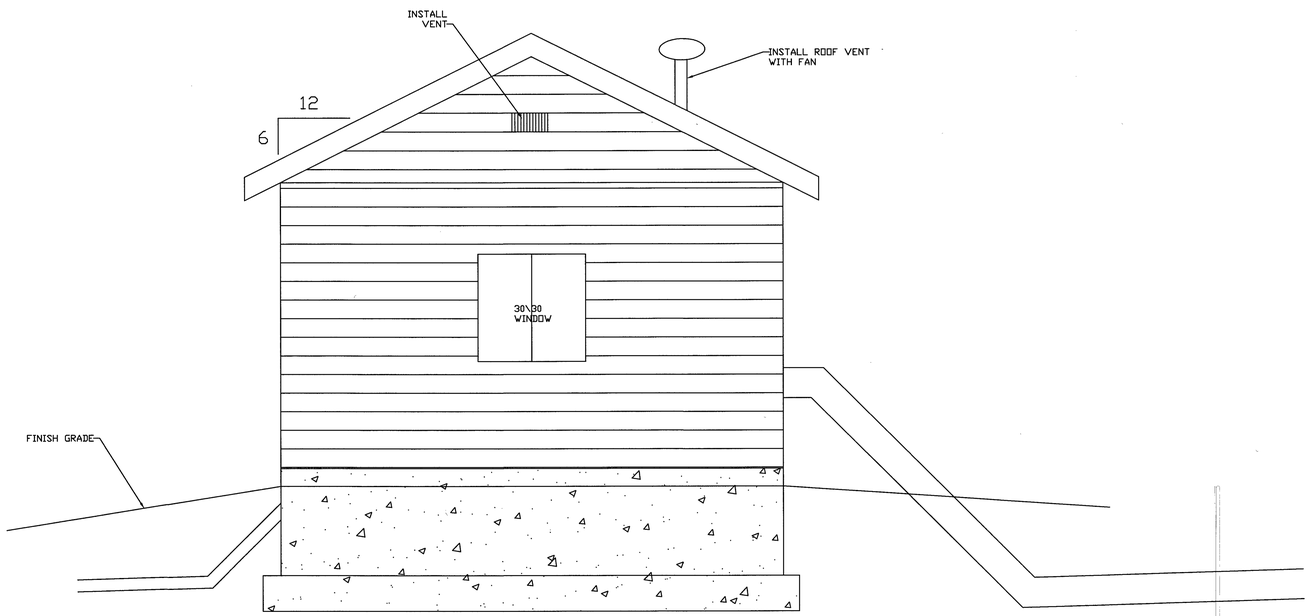
SHEET
D 2



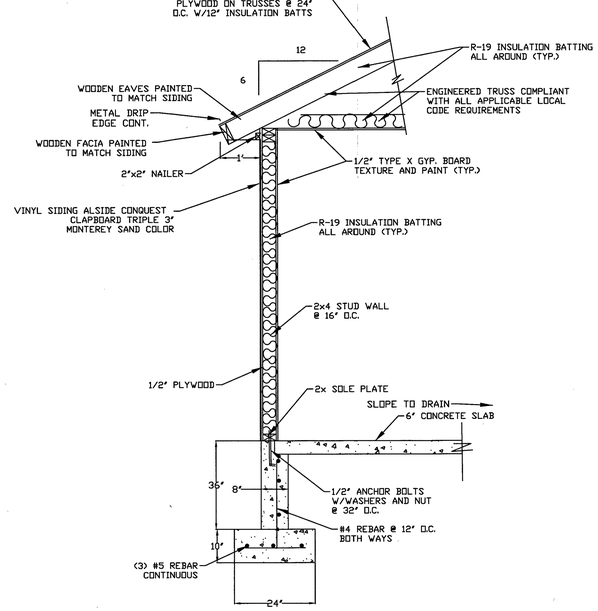
FRONT VIEW (EAST SIDE PUMP HOUES #1)
FRONT VIEW (SOUTH SIDE PUMP HOUES #2)



REAR VIEW (WEST SIDE) PUMP HOUSE #1)
REAR VIEW (NORTH SIDE) PUMP HOUSE #2)



SIDE VIEW



TYPICAL WALL SECTION

REVISED:

DRAWN BY
K.L. NELSON

DATE
JAN., 2009

SCALE
1/2" = 1'

DRAWING NAME:

BY: PLATT AND PLATT, INC.
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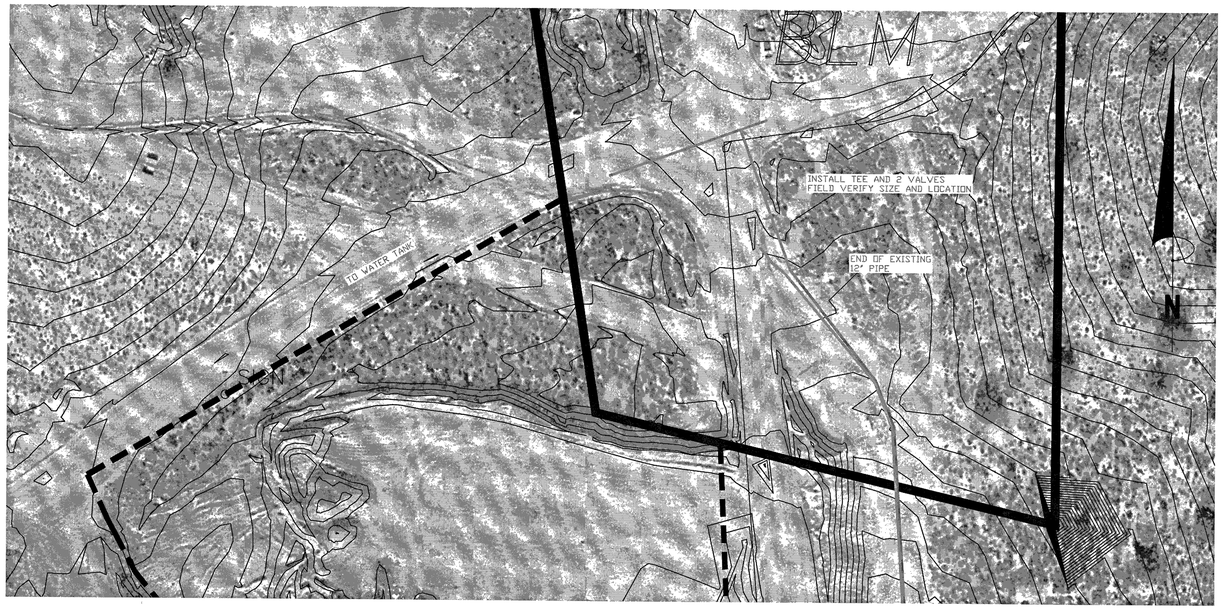
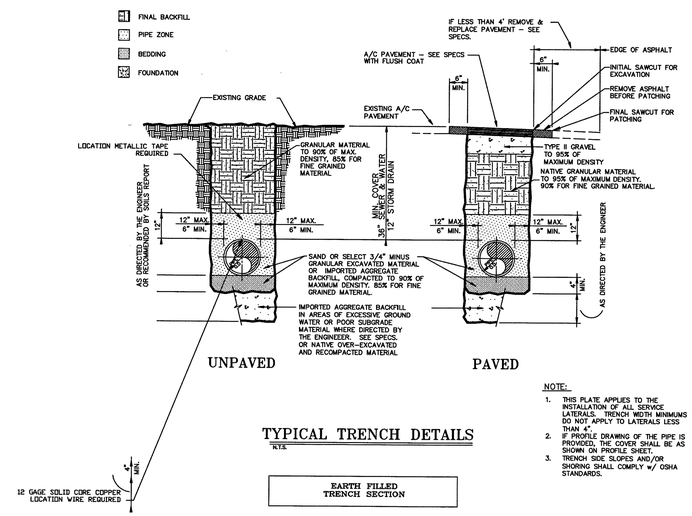
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

PUMP HOUSE ELEVATIONS
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET
D 3



UPPER TANK TIE IN
SCALE 1" = 40'

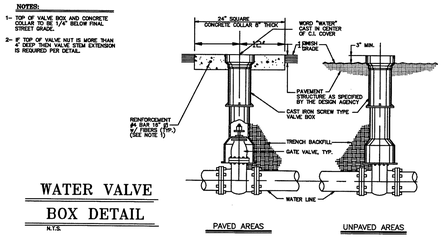


TYPICAL TRENCH DETAILS
N.T.S.

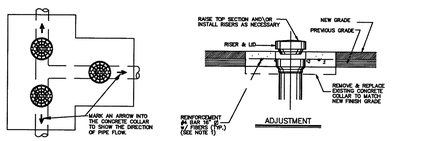
EARTH FILLED TRENCH SECTION

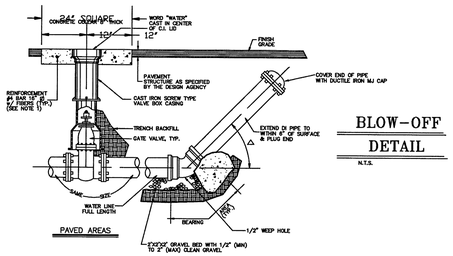
NOTE:
1. THIS PLATE APPLIES TO THE INSTALLATION OF ALL SERVICE LATERALS. TRENCH WIDTH MINIMUMS DO NOT APPLY TO LATERALS LESS THAN 4".
2. IF PROFILE DRAWING OF THE PIPE IS PROVIDED, THE COVER SHALL BE AS SHOWN ON PROFILE SHEET.
3. TRENCH SIDE SLOPES AND/OR SHORING SHALL COMPLY W/ OSHA STANDARDS.

NOTES:
1- TOP OF VALVE BOX AND CONCRETE COLLAR TO BE 1/4" BELOW FINAL STREET GRADE.
2- IF TOP OF VALVE NUT IS MORE THAN 42 INCHES FROM VALVE STEM EXTENSION IS REQUIRED PER DETAIL.



WATER VALVE BOX DETAIL
N.T.S.





BLOW-OFF DETAIL
N.T.S.

WATER VALVE BOX AND BLOW-OFF

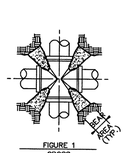


FIGURE 1
CROSS

(ONLY REQ'D IF ANY LEG IS LESS THAN 60 FT. LONG)

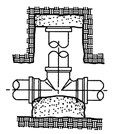


FIGURE 2
TEE, PLUG OR CAP

NOTE:
MECHANICAL JOINTS AT ALL FITTINGS IE: BENDS, TEES, CROSSES, AND VALVES SHALL HAVE THRUST BLOCKS AND THRUST RESTRAINT. (MEGA-LUG OR APPROVED EQUAL).

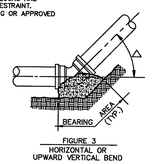


FIGURE 3
HORIZONTAL OR UPWARD VERTICAL BEND

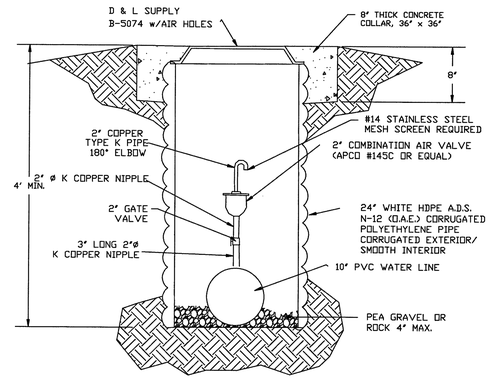


FIGURE 4
DOWNWARD VERTICAL BEND

GENERAL NOTES:
1. ALL FITTINGS & EXPOSED REBAR TO BE WRAPPED W/ TWO LAYERS OF 8 MIL. POLYETHYLENE WHERE COVERED WITH CONCRETE.
2. ALL CONCRETE SHALL BE CLASS C 3000 P.S.I. MINIMUM 28 DAYS COMPRESSIVE STRENGTH.
3. PLACE CONCRETE AGAINST UNDISTURBED EARTH.
4. TABLE DENOTES MINIMUM BEARING AREA OR VOLUME OF THRUST BLOCK. SPECIAL DESIGN FOR EACH INSTALLATION IS REQUIRED IF ALLOWABLE SOIL BEARING CAPACITY IS LESS THAN 3000 P.S.F.
5. VERTICAL SURFACES NOT BEARING AGAINST UNDISTURBED EARTH SHALL BE FORMED.
6. KEEP CONCRETE AWAY FROM FLANGE BOLTS AND FITTINGS.

PIPE I.D.	BEARING AREA, SQUARE FEET						VOLUME OF CONC. CU.YD.		
	FIGURE 1	FIGURE 2	FIGURE 3, A				FIGURE 4, A		
			90°	45°	22-1/2°	11-1/4°	45°	22-1/2°	11-1/4°
4"	2	2	4	2	1	1	1.0	.5	.5
6"	2	3	8	3	2	1	1.5	1.0	.5
8"	3	5	8	5	2	1	2.0	1.0	.5
10"	3	7	10	5	3	2	4.0	2.0	1.0
12"	3	10	14	8	4	2			
14"	4	14	20	10	5	3			
16"	4	20	24	12	6	4			
18"	5	24	30	16	10	5			
20"	5	28	40	20	12	6			

THRUST BLOCKS



COMBINATION AIR VALVE DETAIL
N.T.S.

1
14

REVISED:

DRAWN BY K.L. NELSON

DATE MARCH, 2013

SCALE N.T.S.

DRAWING NAME:

BY: PLATT AND PLATT, INC.
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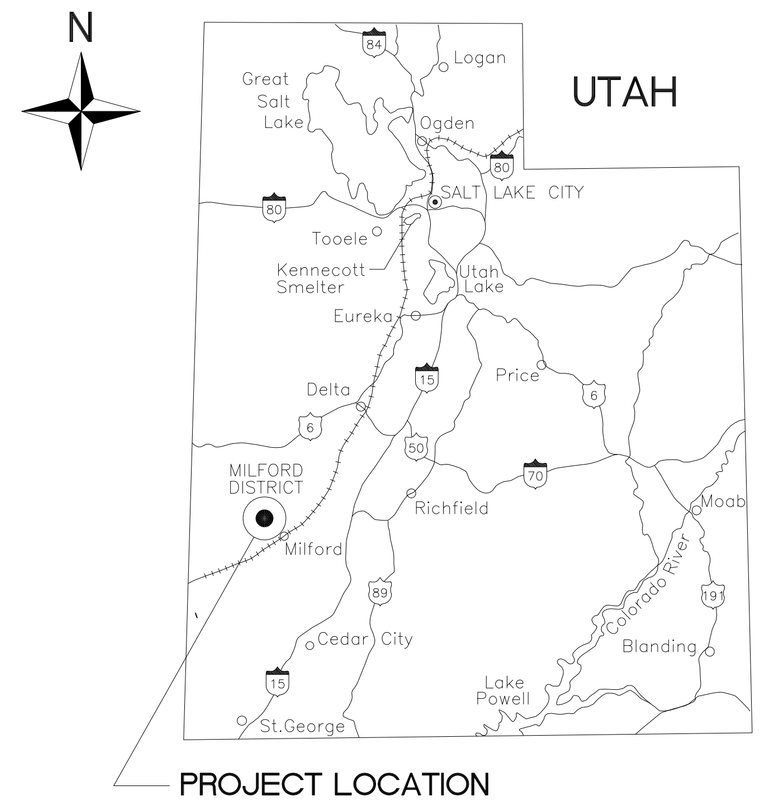
DETAIL SHEET
TRANSMISSION WATERLINE FROM LOWER TRUCK SHOP TO MILL SITE AREA
FOR CS MINING LLC

SHEET D 4

CS MINING LLC

TAILINGS LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

MILFORD, UTAH



INDEX OF DRAWINGS

DRAWING NUMBER	DESCRIPTION
GENERAL ARRANGEMENT	
00-GA-00	INDEX OF DRAWINGS AND SPECIFICATIONS
00-GA-01	PROCESS PLANT SITE LAYOUT
SOLVENT EXTRACTION	
30-FS-01	FLOWSHEET
30-GA-01	UNIT LAYOUT
30-GA-02	UNIT CONCRETE PLAN
ELECTROWINNING	
40-FS-01	FLOWSHEET
40-GA-01	UNIT LAYOUT
40-CN-02	POLYMER CONCRETE - CELL DETAILS
40-M-02	CATHODE AND ANODE DETAILS
TANK FARM	
50-GA-01	UNIT LAYOUT
LEACH CIRCUIT TANKS/CCD	
60-FS-01	FLOWSHEET
60-GA-01	LEACH CIRCUIT TANKS LAYOUT
61-GA-01 (SHT-1)	CCD THICKENERS CIRCUIT LAYOUT
61-GA-01 (SHT-2)	CCD THICKENERS CIRCUIT SECTION
62-GA-01	ACID STORAGE UNIT LAYOUT
63-GA-01	MILL THICKENER LAYOUT
PONDS	
80-GA-01	RAFFINATE POND LAYOUT
80-GA-02	SECTIONS AND DETAILS
80-GA-03	SECTIONS AND DETAILS
80-GA-04	SECTIONS AND DETAILS
80-GA-05	SECTIONS AND DETAILS

ABBREVIATIONS

ANCHOR BOLT	AB	GRADE	GR
AT	AT	GRATING	GRTG
BLIND FLANGE	BF	HIGH POINT	H.P.
BEAM	BM	HIGH STRENGTH BOLT	H.S.B.
BOTTOM	BOT	HORIZONTAL	HORIZ.
BOTTOM OF BASE PLATE	B.O.BP	INCH	IN
BOTTOM OF PIPE	B.O.P.	INSIDE DIAMETER	I.D.
BOLT CIRCLE	BC	INSIDE RADIUS	I.R.
BUILDING	BLDG	JOINT	JT
CENTERLINE	CL	LONG	LG
CLEAR	CLR	MAXIMUM	MAX.
CHECKERED PLATE CONVEYOR	CHKD PL CONV	MINIMUM	MIN.
COLUMN	COL	MODIFIED	MOD.
CONCENTRIC REDUCER	CONC. RED.	NEAR SIDE	NS
CONCRETE	CONC	NOT IN CONTRACT	N.I.C.
CONTROL PANEL	CP	NOT TO SCALE	N.T.S.
CONTINUOUS	CONT.	ON CENTER	O.C.
CUBIC FOOT	CU FT	OUTSIDE DIAMETER	O.D.
DIAMETER	DIA	PLATE	PL
DIMENSION	DIM	POUND	LB
DOWN	DN	RADIUS	RAD
DRAWING	DWG	REFERENCE	REF
EACH	EA	RELOCATED	RELOC.
EACH WAY	EW	SQUARE FOOT	SQ FT
ELBOW	ELL	STANDARD	STD
ELEVATION	ELEV	STEEL	STL
EQUAL	EQ	STIFFENER	STFNR
EQUIPMENT	EQUIP	TOP AND BOTTOM	T AND B
EXISTING	E.	TOP OF CONCRETE	T.O.C.
EXPANSION	EXP	TOP OF GRATING	T.O.G.
EXPANSION JOINT	EJ	TOP OF STEEL	T.O.S.
FINISH GRADE	FIN. GR.	TYPICAL	TYP.
FOOT	FT	UNLESS NOTED OTHERWISE	U.N.O.
FOOTING	FTG	VERTICAL	VERT.
FOUNDATION	FND	WEATHERPROOF	WP
GAGE	GA	WITH	W/
GALLON	GAL	WORK POINT	W.P.

PRELIMINARY
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CS Mining LLC

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PROJECT NO 2012-01
WESTERN STATES ENGINEERING
5210 E. Williams Circle, Suite 700
TUCSON, AZ 85711
PHONE: 520-889-2040 FAX: 520-889-2733

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SAFETY			PROCESS ENGR.		
ENVIRONMENTAL			PROJECT ENGR.		
MAINTENANCE			ENGR. MNGR.		
PRODUCTION			PLANT MNGR.		
QLTY. CONTROL					

DESIGN	DATE
DRAWN BY AM	11/06/13
PROJ. ENGR. HM	
ENGR. MNGR.	

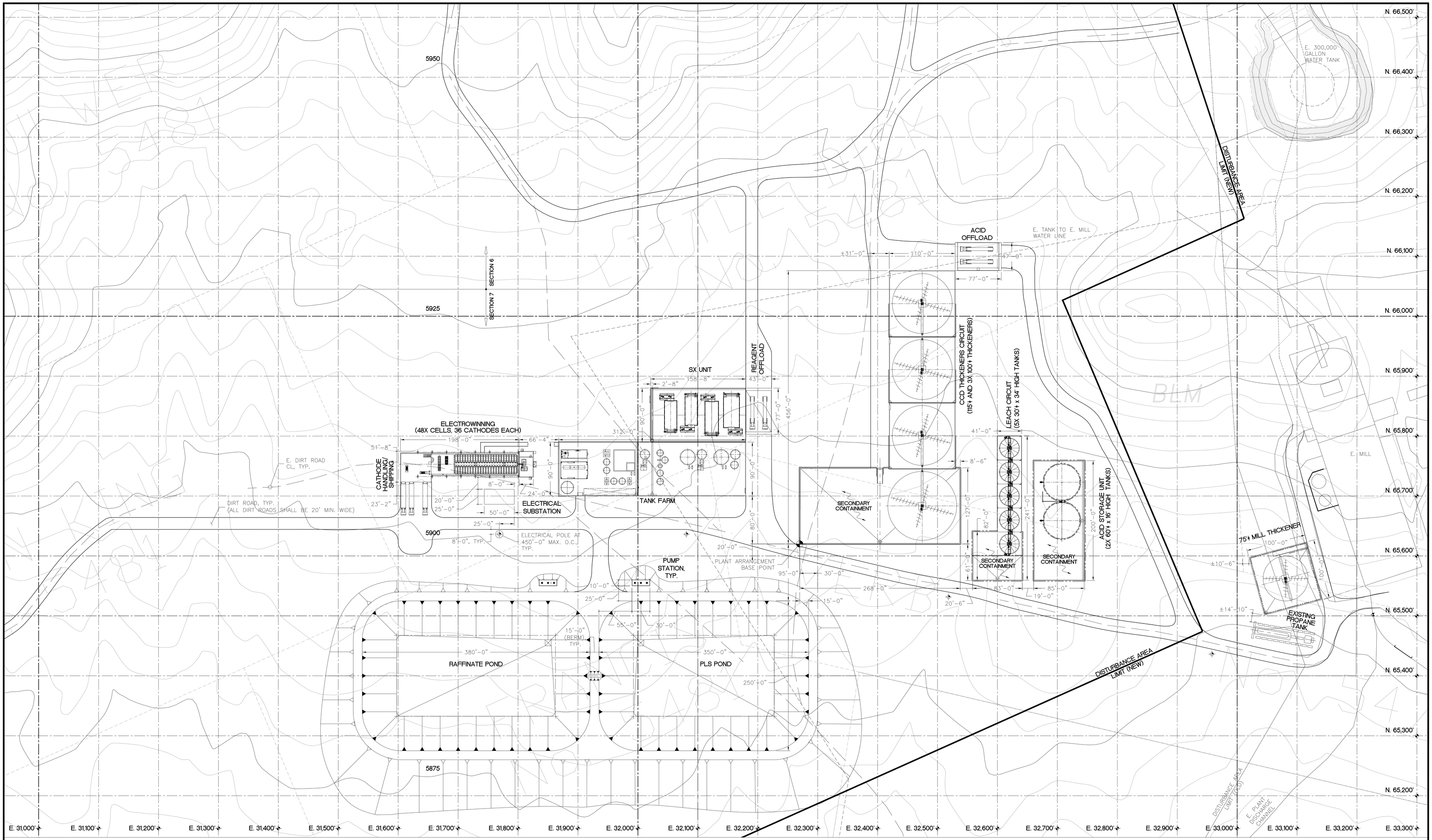
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
GENERAL ARRANGEMENT
INDEX OF DRAWINGS AND SPECIFICATIONS

SCALE: AS NOTED

DRAWING NO. 00-GA-00

SHEET 1 OF 1

REVISION P1



PROCESS PLANT SITE PLAN

SCALE: 1" = 60'-0"

2,500 TPD ORE DESIGN RATE – PHASE 1a OPTION,
3,500 TPD ORE DESIGN RATE – PHASE 1b OPTION.

PROJECT NORTH

PRELIMINARY
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11-06-2013

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ENGR. MNGR.	

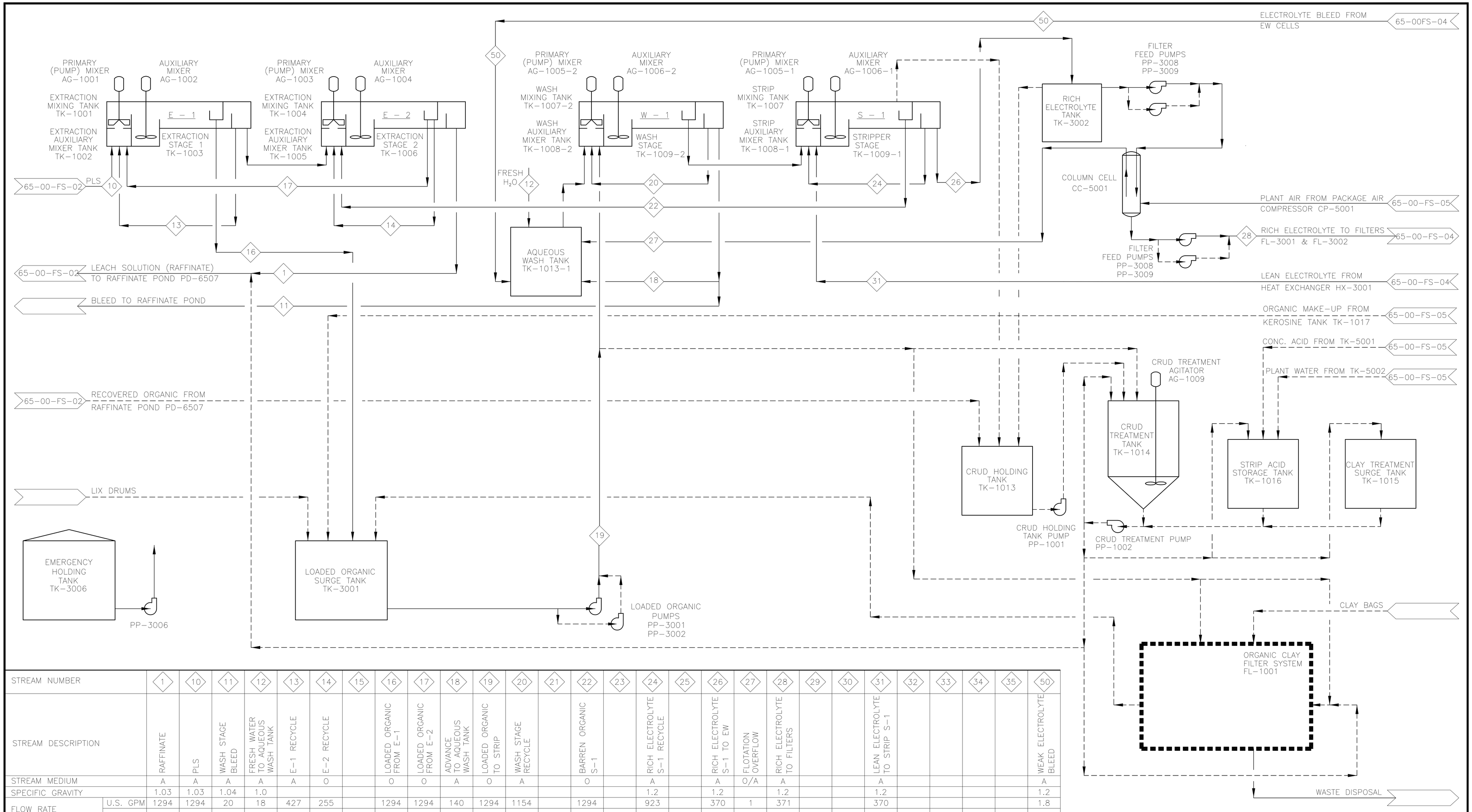
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
GENERAL ARRANGEMENT
PROCESS PLANT SITE LAYOUT

SCALE: AS NOTED

DRAWING NO. 00-GA-01

SHEET 1 OF 1

REVISION P1



STREAM NUMBER		1	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	50
STREAM DESCRIPTION		RAFFINATE	PLS	WASH STAGE BLEED	FRESH WATER TO AQUEOUS WASH TANK	E-1 RECYCLE	E-2 RECYCLE		LOADED ORGANIC FROM E-1	LOADED ORGANIC FROM E-2	ADVANCE TO AQUEOUS WASH TANK	LOADED ORGANIC TO STRIP	WASH STAGE RECYCLE		BARREN ORGANIC S-1		RICH ELECTROLYTE S-1 RECYCLE		RICH ELECTROLYTE S-1 TO EW	FLOTATION OVERFLOW	RICH ELECTROLYTE TO FILTERS			LEAN ELECTROLYTE TO STRIP S-1					WEAK ELECTROLYTE BLEED
STREAM MEDIUM		A	A	A	A	A	O		O	O	A	O	A		O		A		A	O/A	A			A					A
SPECIFIC GRAVITY		1.03	1.03	1.04	1.0												1.2		1.2		1.2			1.2					1.2
FLOW RATE	U.S. GPM	1294	1294	20	18	427	255		1294	1294	140	1294	1154		1294		923		370	1	371			370					1.8
COPPER CONTENT	LBS/MIN	0.55	31.3	0.15					52.1	26.4		52.1			23.1				131	0.4	131			102					
	GPL	0.05	2.8	0.9					4.74	2.40		4.74			2.10		45		45	45	45			35					35
ACID CONTENT	LBS/MIN	38.5	5.4	2.5																									
	GPL	3.5	0.49	15															180		180			189					189
DESIGN TEMPERATURE	°F																				60			60					

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OTHERWISE SPECIFIED 0.00 ±
0.000 ±

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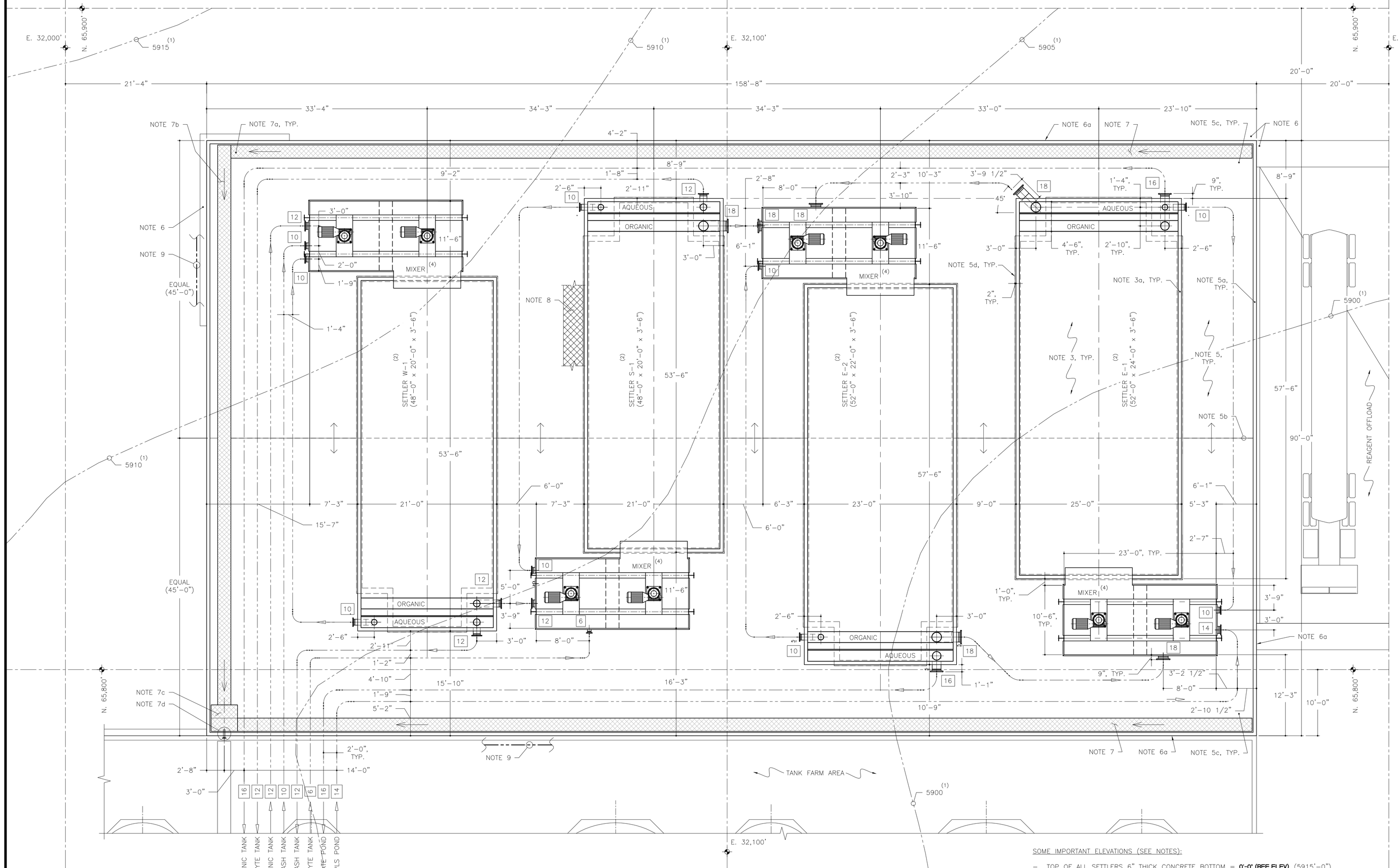
ENGR. MNGR.	

COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

SOLVENT EXTRACTION FLOWSHEET

SCALE: AS NOTED

DRAWING NO.	SHEET	REVISION
30-FS-01	1 OF 1	P1



SOLVENT EXTRACTION UNIT PLAN

SCALE: 1/8" = 1'-0"

PROJECT NORTH

F.V. ALL DIMENSIONS AND E. CONDITIONS.

TOPOGRAPHY DATA FROM OVERALL MAP FOR WESTERN UTAH COPPER CO. BY PLATT AND PLATT, INC. (DATE: NOVEMBER 2008, DRAWING: NAMtopoGRID.dwg).

SEE DRAWING 30-GA-02 FOR UNIT CONCRETE PLAN.

——— — PIPE LINE/PIPE LINE FLOW DIRECTION, TYP.

10 – SETTLERS/MIXERS FLANGE AND PIPE DIAMETER, INCHES.
C.O.F. OF ALL MIXERS = -3'-5".
SEE SETTLERS C.O.F. ELEV SCHEDULE FOR SETTLERS C.O.F. ELEV.

NOTES:

(1) GROUND CONTOUR ELEVATION, FEET.

(2) ALL SETTLERS ARE CONCRETE CONSTRUCTION W/SS SKIN/WEIRS.
ALL SETTLER SHALL HAVE ROOF COVER. COVERS AREN'T PART OF THIS REVISION.

(3) TOP OF ALL SETTLERS 6" THICK CONCRETE BOTTOM = **0'-0" (REF ELEV)** = ±5915'.

(3a) ALL SETTLERS WALLS T.O.C. = 3'-6".

(4) SEE MIXERS SCHEDULE FOR MIXER INFORMATION.
SEE E. DWG's M103, M104 AND M105 (YERINGTON PROJECT) FOR E. MIXERS INFORMATION.
TOP OF ALL MIXERS BOXES ELEV = 3'-7".
BOTTOM OF ALL MIXERS BOXES ELEV = -4'-5".

(5) 6" THICK (U.N.O.) CONCRETE SLAB. ↓ – SLAB SLOPE.

(5a) 6" WIDE CURB. T.O.C. ELEV = -3'-9".

(5b) T.O.C. HIGH ELEV OF SLAB (EAST-WEST RIDGE) = -4'-0".

(5c) T.O.C. LOW ELEV OF SLAB (EAST-WEST) = -5'-0".

(5d) 10" WIDE CONCRETE WALL (SETTLER SUPPORT).
T.O.C. ELEV = -6".

(6) 1'-0" WIDE RETAINING WALL (WHERE NECESSARY).

(6a) RESTRAINING WALL BELOW (WHERE NECESSARY).

(7) 2'-0" WIDE EAST-WEST CONCRETE GUTTER (NORTH SIDE AND SOUTH SIDE).

(7a) T.O.C. LOW ELEV OF EAST-WEST GUTTER = -7'-0".

→ – EAST-WEST AND NORTH-SOUTH (NOTE 7b) GUTTERS SLOPE.

(7b) 2'-0" WIDE NORTH-SOUTH GUTTER
(T.O.C. LOW ELEV OF GUTTER = -9'-0" – SOUTH END).

(7c) 4'-0" x 4'-0" SUMP. SUMP BOTTOM T.O.S. ELEV = -10'-0".

(7d) 3"ø SCHEDULE 80 STAINLESS STEEL PIPE WITH FLANGE AND BLIND FLANGE, PLACED THROUGH SUMP CONCRETE WALL THIS PLACE. C.O.P. ELEV = ±-9'-0".

(8) WALKWAY (STEEL SUPPORT – T.O.S. ELEV = -5 3/4").
WALKWAY DESIGN (STEEL SUPPORT, GRATING, HANDRAIL, LADDER) ISN'T PART OF THIS REVISION.

(9) HANDRAIL, WHERE NECESSARY.

SETTLERS C.O.F. ELEV SCHEDULE:

SETTLER \ FLANGE	10"ø	12"ø	16"ø	18"ø
C.O.F OF E-1	-2'-0"		-3'-3"	-3'-5"
C.O.F OF E-2	-2'-0"		-2'-9"	-3'-5"
C.O.F OF S-1	-2'-0"	-2'-3"		-3'-5"
C.O.F OF W-1	-2'-0"	-2'-3" (*)		-3'-5"

(*) 12"ø C.O.F. (CONNECTION W/ MIXER) = -3'-5".

MIXERS SCHEDULE:

SETTLER	EXISTING MIXER	MODIFICATION	NEW MIXER
E-1 EAST	M-105	ALL FLANGES SHALL BE AS SHOWN ON PLAN	
E-2 EAST	M-105		
S-1 EAST	M-103 OR M-104		
W-1 EAST			SIM. TO M-105

SOME IMPORTANT ELEVATIONS (SEE NOTES):

- TOP OF ALL SETTLERS 6" THICK CONCRETE BOTTOM = **0'-0" (REF ELEV)** (5915'-0").
- TOP OF SETTLERS WALLS = 3'-6" (5918'-6").
- TOP OF CONCRETE SLAB RIDGE (EAST-WEST) = -4'-0" (5911'-0"),
- TOP OF CONCRETE SLAB AT NORTH/SOUTH CURBS = -5'-0" (5910'-0").
- TOP OF CONCRETE SLAB CURB = -3'-9" (5911'-3").
- TOP OF CONCRETE SUMP BOTTOM = -10'-0" (5905'-0").
- C.O.F. OF ALL MIXERS = -3'-5" (5911'-7").
- C.O.F. OF ALL SETTLERS – SEE SETTLERS C.O.F. ELEV SCHEDULE.
- BOTTOM OF ALL PIPES AT SOUTH CONCRETE CURB = -3'-9" MAX. (5911'-3" MAX).

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NOT FOR CONSTRUCTION
11-06-2013

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FRACTIONS ±
0.00 ±
0.000 ±

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CS Mining LLC

PROJECT NO 2012-01
WESTERN STATES ENGINEERING
5210 E. Williams Circle, Suite 700
TUCSON, AZ 85711
PHONE: 520-889-2040 FAX: 520-889-2733

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SAFETY			PROCESS ENGR.		
ENVIRONMENTAL			PROJECT ENGR.		
MAINTENANCE			ENGR. MNGR.		
PRODUCTION			PLANT MNGR.		
QLTY. CONTROL					

DESIGN	DATE
DRAWN BY AM	11/06/13
PROJ. ENGR. HM	
ENGR. MNGR.	

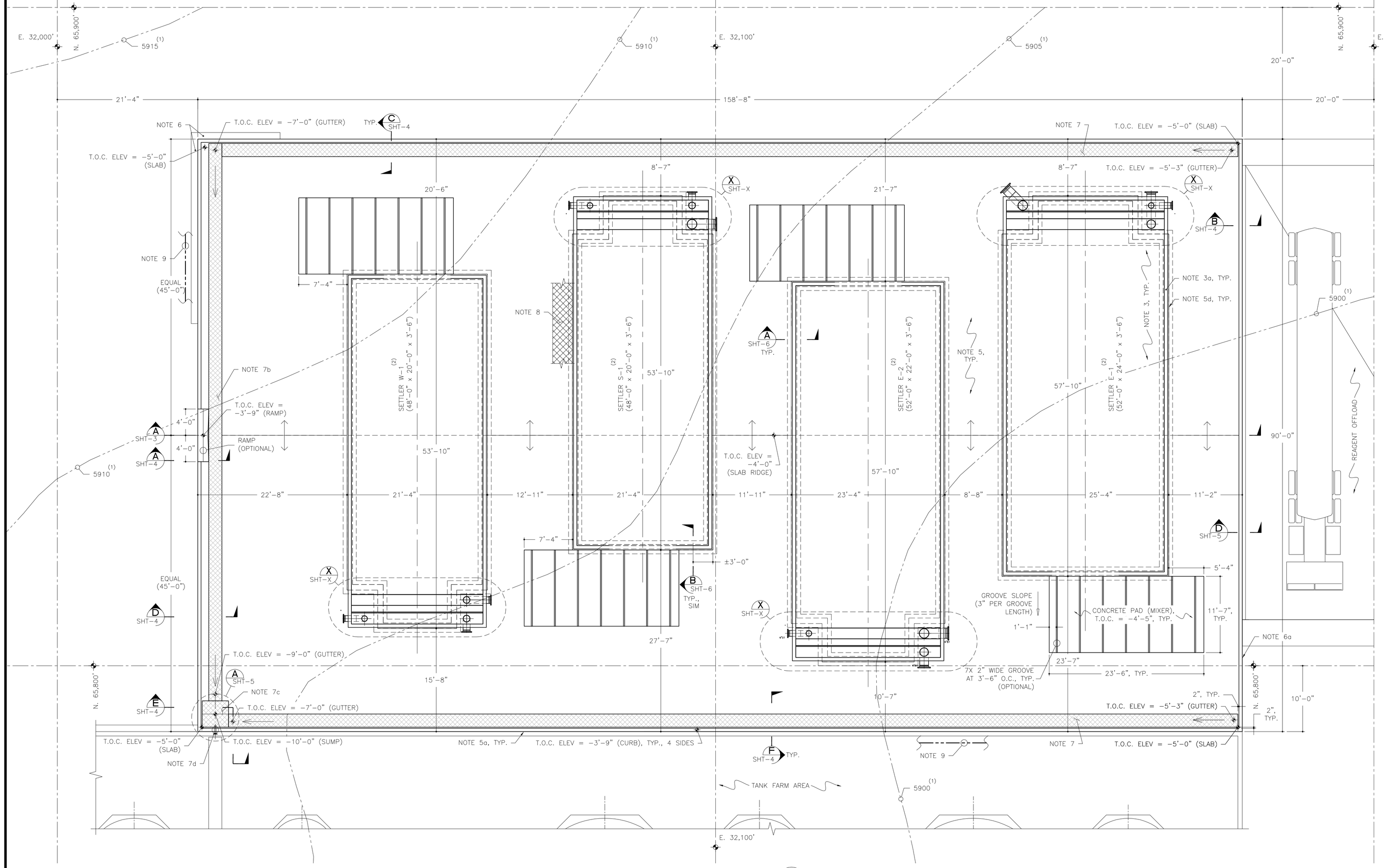
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
SOLVENT EXTRACTION
UNIT LAYOUT

SCALE: AS NOTED

DRAWING NO. 30-GA-01

SHEET 1 OF X

REVISION P1



CONCRETE PLAN

SCALE: 1/8" = 1'-0"

PROJECT NORTH

F.V. ALL DIMENSIONS AND E. CONDITIONS.

TOPOGRAPHY DATA FROM OVERALL MAP FOR WESTERN UTAH COPPER CO. BY PLATT AND PLATT, INC. (DATE: NOVEMBER 2008, DRAWING: NAMtopoGRID.dwg).

PIPING SUPPORTS ARE NOT SHOWN IN THIS REVISION. SEE DWG 30-GA-01 FOR PIPING INFORMATION.

CHAMFER EXPOSED CONCRETE CORNERS: 3/4" x 45°.

REGRADE AREA FOR CONCRETE SLAB AS NECESSARY. SOIL PREPARATION SHALL BE AS FOLLOW:
a) REMOVE EXISTING TOP SOIL. THE DEPTH MAY BE ADJUSTED BASED UPON ACTUAL FIELD CONDITION AFTER EXCAVATION IS COMPLETED.
b) PROVIDE A WELL ENGINEERED FILL MATERIAL (I.E. TYPE II SOIL).
c) PROVIDE A MINIMUM OF 95% COMPACTION (ASTM D1557).
d) MAXIMUM LIFT IS NOT TO EXCEED 10" OF LOOSE DEPTH.

EARTH ADJACENT TO NEW CONCRETE TO BE WELL COMPACTED TO PREVENT FUTURE DIFFERENTIAL SETTLEMENT.
PROVIDE 3" MIN. SLOPE FROM ADJACENT CONCRETE. PROVIDE WATER DRAINAGE AROUND AS NECESSARY.
DRAINAGE SHALL BE TYPE D1 (SEE TYP. SECTION D/SHT-6) AND 5'-0" MIN. FROM CONCRETE SLAB/WALL.

PROVIDE CONCRETE AND REBAR PROTECTIVE COATING.

PROVIDE WATER STOPS AS NECESSARY.

MINIMUM CONCRETE COVER FOR REINFORCING BARS: 1 1/2", U.N.O.

SEE DTL C/SHT-5 FOR TYP. FOOTING AND WALL REINFORCING AT INTERSECTION.

NOTES:

(1) GROUND CONTOUR ELEVATION, FEET.

(2) ALL SETTLERS ARE CONCRETE CONSTRUCTION W/SS SKIN/WEIRS.

(3) TOP OF ALL SETTLERS 6" THICK CONCRETE BOTTOM = **0'-0" (REF ELEV)** = ±5915'.

(3a) ALL SETTLERS WALLS T.O.C. = 3'-6".

(4) NOT USED.

(5) 6" THICK (U.N.O.) CONCRETE SLAB W/ #4 AT 12" O.C., CENTERED, EW.
PROVIDE CONTROL JOINTS AT ±25'-0" O.C., EW
(JOINT SHALL BE 3/16" MAX. WIDE AND 1/4" DEEP.
THIS SIZE TROWEL CUT SHALL BE MADE SOON ENOUGH TO PREVENT CRACKING, BUT NOT SO SOON TO CAUSE SPALLING OF THE CONCRETE WHILE SAWING).
↓ – SLAB SLOPE.

(5a) 6" WIDE CURB.

(5b) THROUGH (5c) – NOT USED.

(5d) 10" WIDE CONCRETE WALL (SETTLER SUPPORT).
T.O.C. ELEV = -6".

(6) 1'-0" WIDE RETAINING WALL (WHERE NECESSARY).

(6a) RESTRAINING WALL BELOW (WHERE NECESSARY).

(7) 2'-0" WIDE EAST-WEST CONCRETE GUTTER (NORTH SIDE AND SOUTH SIDE).
→ – EAST-WEST AND NORTH-SOUTH (NOTE 7b) GUTTERS SLOPE.

(7a) NOT USED.

(7b) 2'-0" WIDE NORTH-SOUTH GUTTER

(7c) 4'-0" x 4'-0" SUMP.

(7d) 3"ø SCHEDULE 80 STAINLESS STEEL PIPE WITH FLANGE AND BLIND FLANGE, PLACED THROUGH SUMP CONCRETE WALL THIS PLACE. C.O.P. ELEV = ±-9'-0".

(8) WALKWAY (STEEL SUPPORT – T.O.S. ELEV = -5 3/4").
WALKWAY DESIGN (STEEL SUPPORT, GRATING, HANDRAIL, LADDER) ISN'T PART OF THIS REVISION.
(9) GROOVES AT TOP OF MIXER CONCRETE PADS ARE OPTIONAL (AT OWNER DISCRETION).

(9) HANDRAIL, WHERE NECESSARY.

SOME IMPORTANT ELEVATIONS (SEE NOTES):

- TOP OF ALL SETTLERS 6" THICK CONCRETE BOTTOM = **0'-0" (REF ELEV)** (5915'-0").
- TOP OF SETTLERS WALLS = 3'-6" (5918'-6").
- TOP OF CONCRETE SLAB RIDGE (EAST-WEST) = -4'-0" (5911'-0"),
- TOP OF CONCRETE SLAB AT NORTH/SOUTH CURBS = -5'-0" (5910'-0").
- TOP OF CONCRETE SLAB CURB = -3'-9" (5911'-3").
- TOP OF CONCRETE SUMP BOTTOM = -10'-0" (5905'-0").
- TOP OF CONCRETE PADS (MIXERS) = -4'-5" (5910'-7").

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QLTY. CONTROL					

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ENGR. MNGR.	

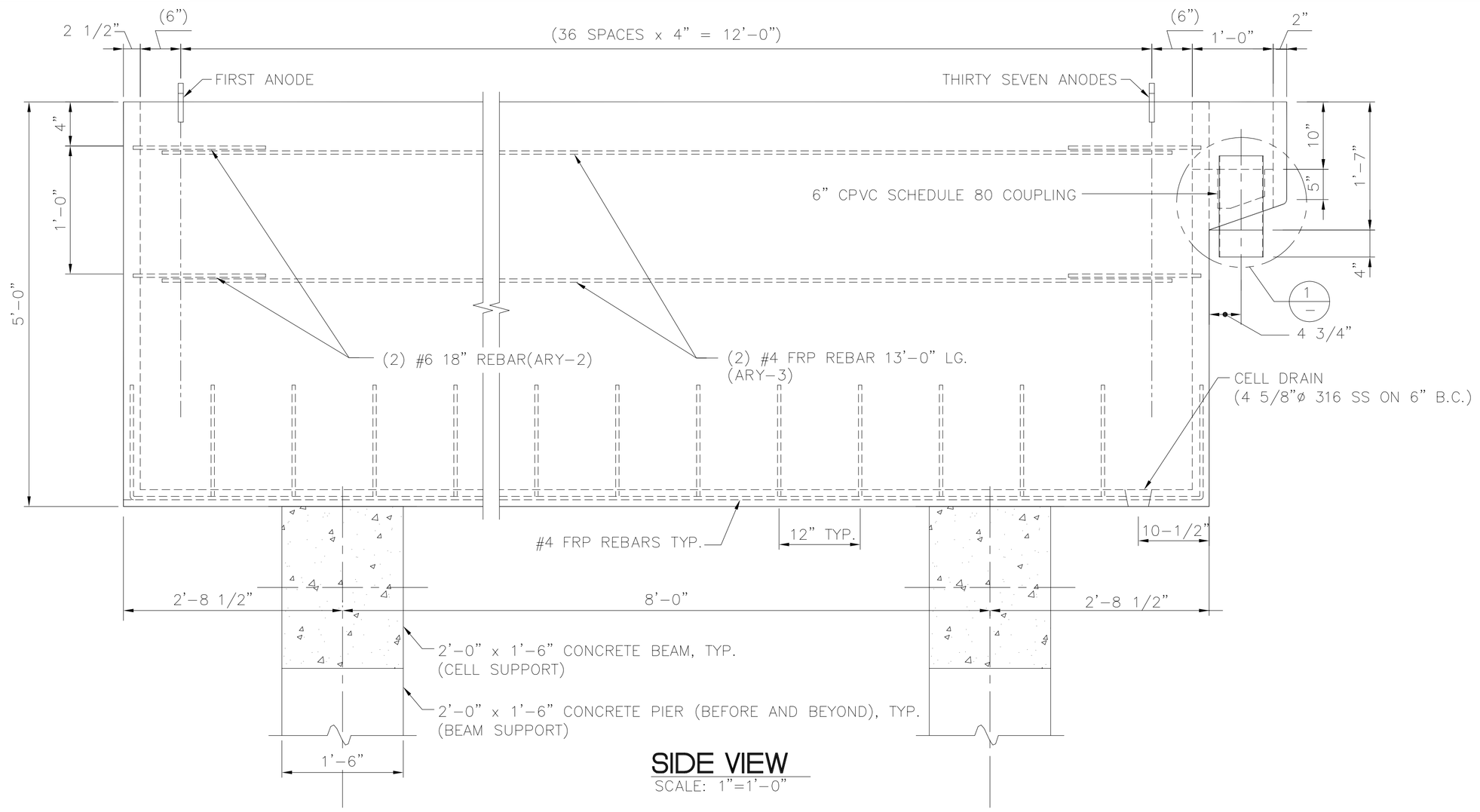
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
SOLVENT EXTRACTION
UNIT CONCRETE PLAN

SCALE: AS NOTED

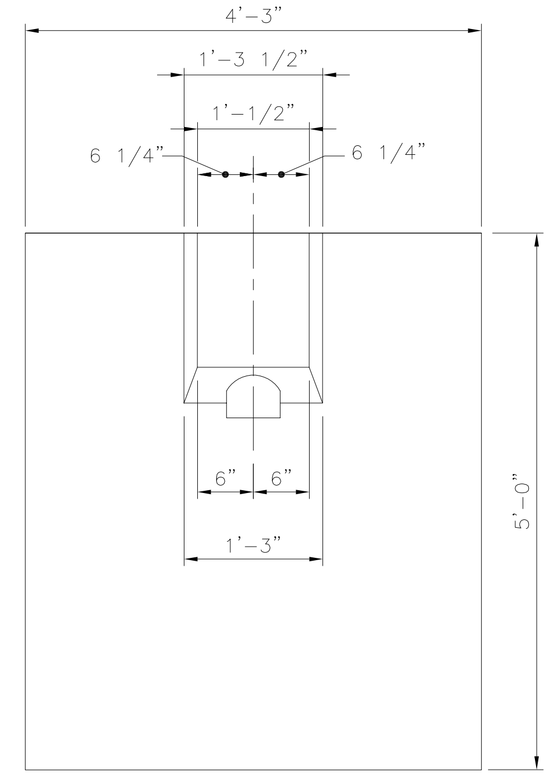
DRAWING NO. 30-GA-02

SHEET 1 OF X

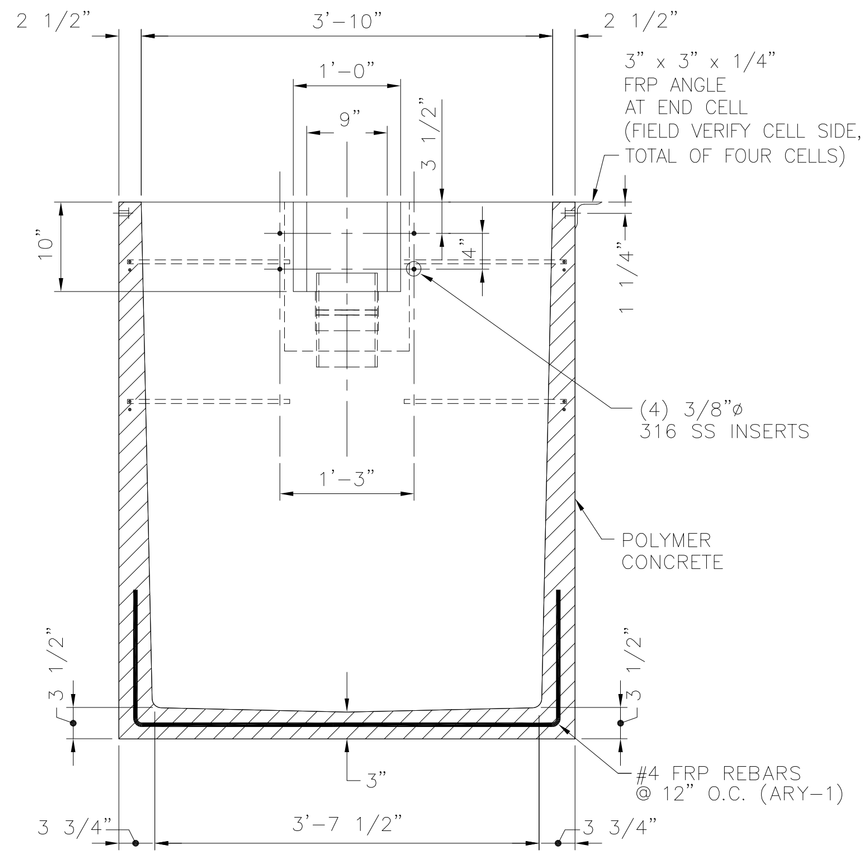
REVISION P1



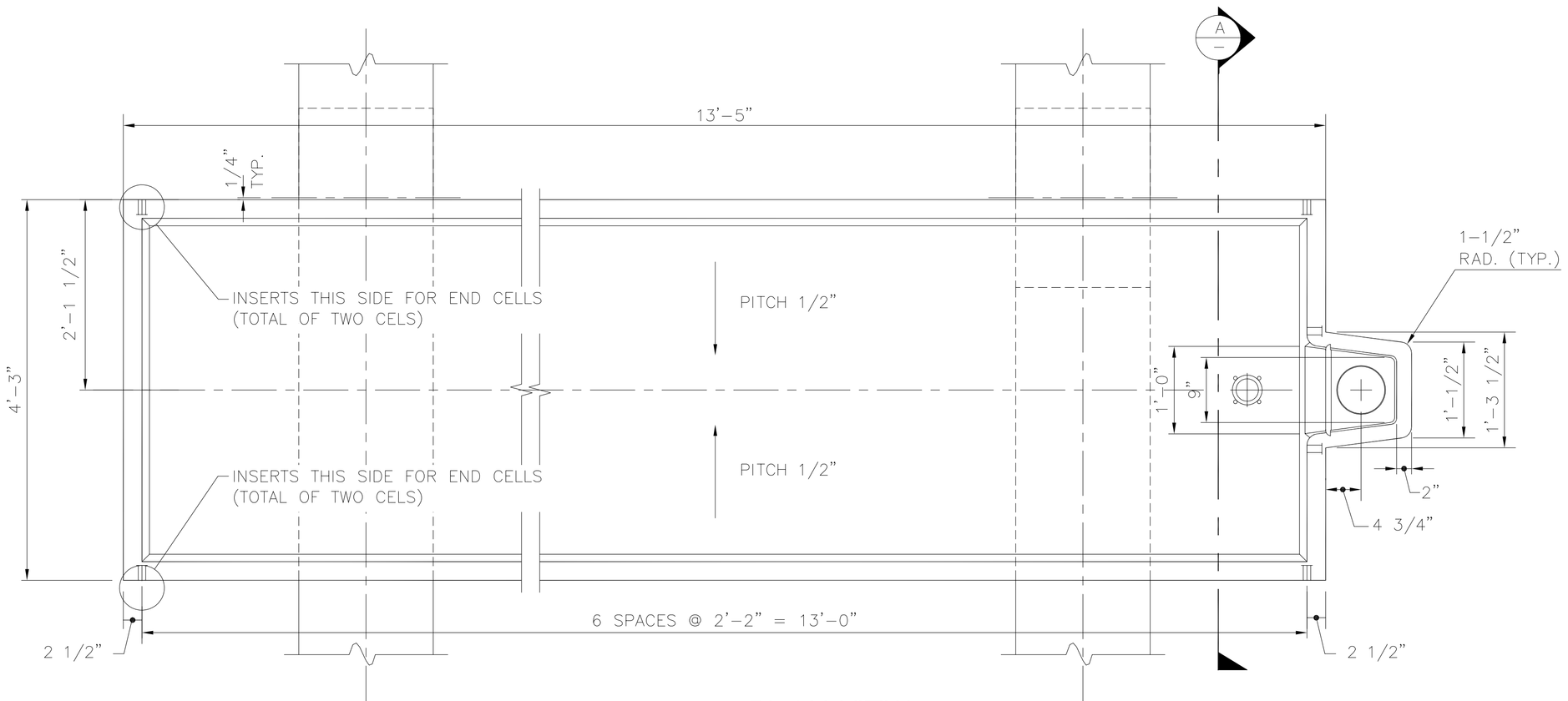
SIDE VIEW
SCALE: 1"=1'-0"



END VIEW
SCALE: 1"=1'-0"



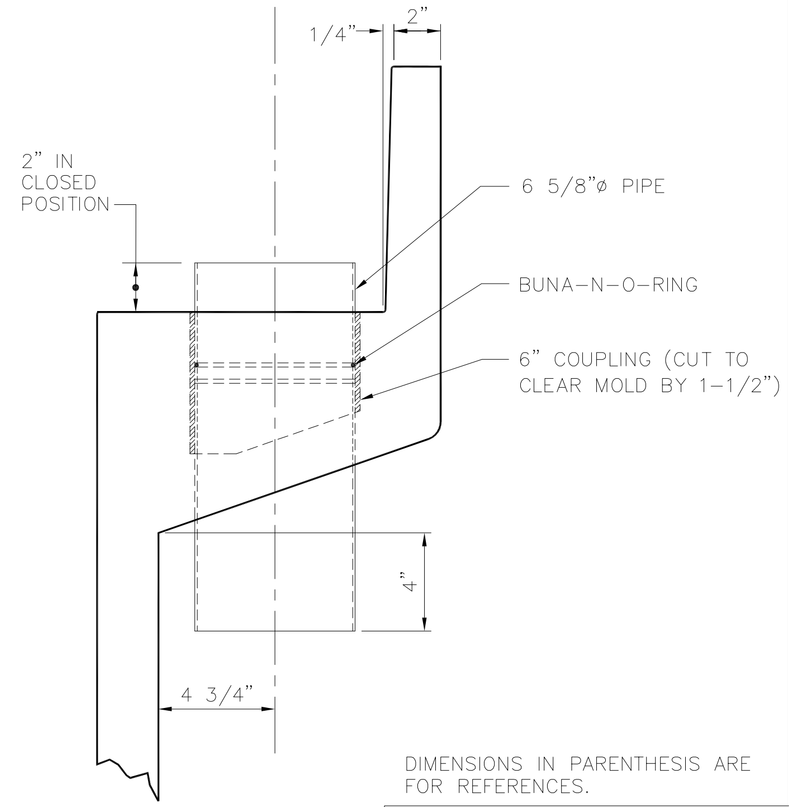
SECTION
SCALE: 1"=1'-0"
A



PLAN VIEW
SCALE: 1"=1'-0"

GENERAL NOTES:

1. SUPPORT CELLS AT 1/4" POINTS DURING SHIPMENT AND STORAGE. SUPPORTS MUST BE LEVEL OR UNIFORM SO THE CELLS ARE NOT WARPED.
2. ESTIMATED WEIGHT OF UNICELL IS 10200 LBS.
3. ALL FLANGED CONNECTIONS TO UNICELL REQUIRE FULL FACE GASKETS WITH MAXIMUM 40 DUROMETER HARDNESS 4. WHEN USING CRANES AND FORKLIFT TO HANDLE THIS PRODUCT, USE SOFT PADS AND CORNER GUARDS TO PROTECT EDGES AND GELCOAT SURFACES.



DETAIL
SCALE: 2"=1'-0"
1

DIMENSIONS IN PARENTHESIS ARE FOR REFERENCES.

REFERENCE DRAWING: 40-CN-02
(OK MINE, ELECTROWINNING, CONCRETE, CELL DETAILS, PROJECT # 98010).

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CS Mining LLC

PROJECT NO 2012-01
WESTERN STATES ENGINEERING
5210 E. Williams Circle, Suite 700
TUCSON, AZ 85711
PHONE: 520-889-2040 FAX: 520-889-2733

APPROVED FOR CONSTRUCTION	BY	DATE		BY	DATE
SAFETY			PROCESS ENGR.		
ENVIRONMENTAL			PROJECT ENGR.		
MAINTENANCE			ENGR. MNGR.		
PRODUCTION			PLANT MNGR.		
QLTY. CONTROL					

DESIGN	DATE
DRAWN BY AM	11/06/13
PROJ. ENGR. HM	
ENGR. MNGR.	

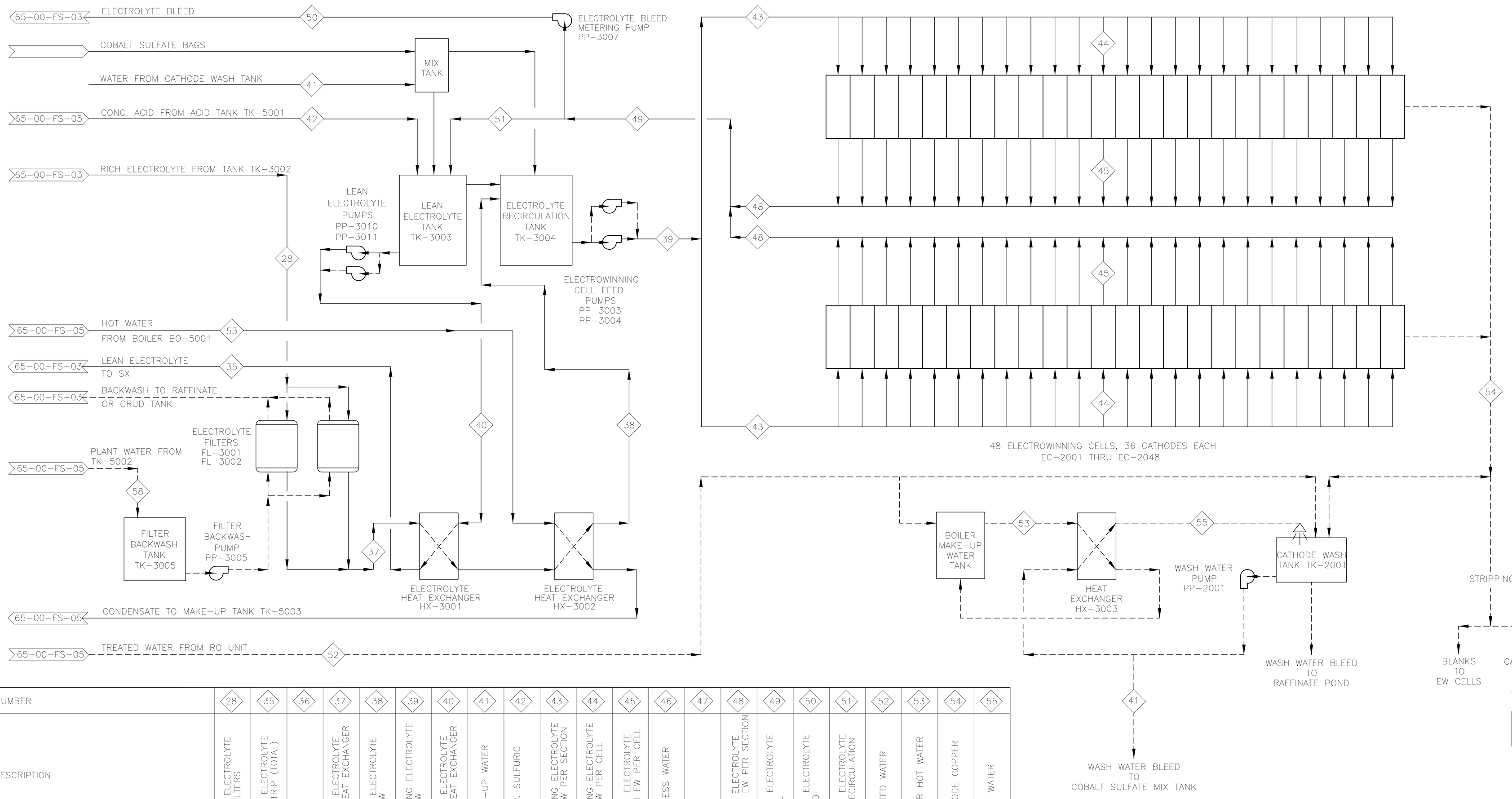
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
ELECTROWINNING
POLYMER CONCRETE - CELL DETAILS

SCALE: AS NOTED

DRAWING NO. 40-CN-02

SHEET 1 OF 1

REVISION P1



STREAM NUMBER		28	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
STREAM DESCRIPTION		RICH ELECTROLYTE TO FILTERS	LEAN ELECTROLYTE TO STRIP (TOTAL)		RICH ELECTROLYTE TO HEAT EXCHANGER	RICH ELECTROLYTE TO EW	STRONG ELECTROLYTE TO EW	LEAN ELECTROLYTE TO HEAT EXCHANGER	MAKE-UP WATER	CONC. SULFURIC ACID	STRONG ELECTROLYTE TO EW PER SECTION	STRONG ELECTROLYTE TO EW PER CELL	WEAK ELECTROLYTE FROM EW PER CELL	PROCESS WATER		WEAK ELECTROLYTE FROM EW PER SECTION	WEAK ELECTROLYTE TOTAL	WEAK ELECTROLYTE BLEED	WEAK ELECTROLYTE TO RECIRCULATION	TREATED WATER	BOILER HOT WATER	CATHODE COPPER	WASH WATER
STREAM MEDIUM																							
SPECIFIC GRAVITY		1.2	1.2		1.2	1.2	1.2	1.2	1.0	1.84	1.2	1.2	1.2			1.2	1.2	1.2	1.2				
FLOW RATE	U.S. GPM	370	370		370	370	1282	370	2.0	0.2	641	28.8	28.8			641	1382	2	1380	4	141		65
COPPER CONTENT	LBS/MIN	141.5	110.0		141.5	141.5	414	110	0.0	0.0		9.30	8.56					0.6				31.5	
	GPL	45	35		45	45	38	35	0.0	0.0	38	38	35			35	35	35	35				
ACID CONTENT	LBS/MIN								0.0	3.0		45.3	46.3					3.2					
	GPL	180	189		180	180	185	189	0.0			185	189				189	189	189				
DESIGN TEMPERATURE	°F	60	60		60	100	100	100				100	105				105		105	60	240		175

TOLERANCE UNLESS OTHERWISE SPECIFIED
FRACTIONS ±
0.00 ±
0.000 ±

REVISIONS
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11-06-2013

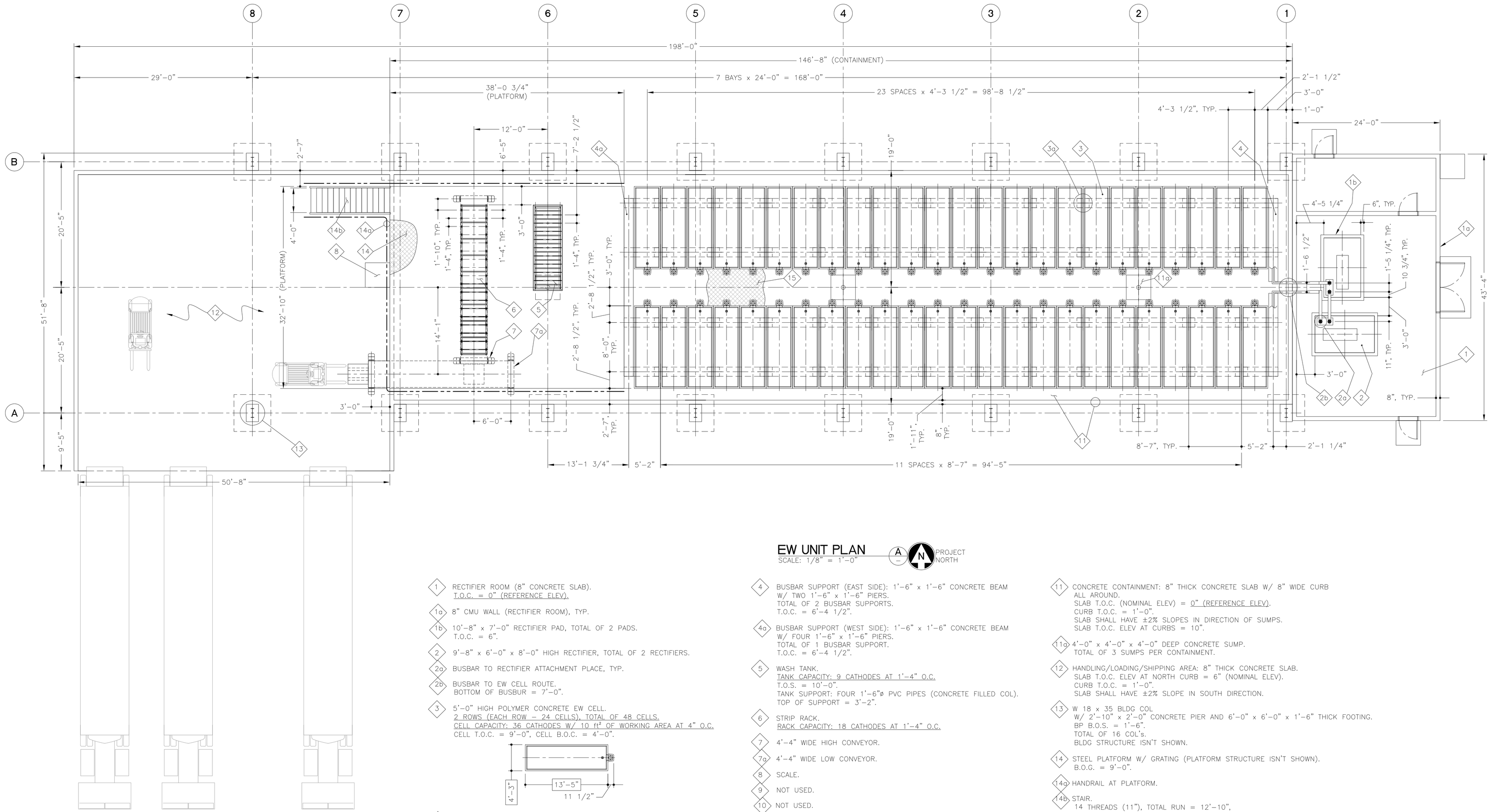
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
ELECTROWINNING
FLOWSHEET

SCALE: AS NOTED

DRAWING NO. 40-FS-01

SHEET 1 OF 1

REVISION P1



EW UNIT PLAN

SCALE: 1/8" = 1'-0"

PROJECT NORTH

1. RECTIFIER ROOM (8" CONCRETE SLAB).
   T.O.C. = 0" (REFERENCE ELEV).
- 1a. 8" CMU WALL (RECTIFIER ROOM), TYP.
- 1b. 10'-8" x 7'-0" RECTIFIER PAD, TOTAL OF 2 PADS.
  T.O.C. = 6".
2. 9'-8" x 6'-0" x 8'-0" HIGH RECTIFIER, TOTAL OF 2 RECTIFIERS.
- 2a. BUSBAR TO RECTIFIER ATTACHMENT PLACE, TYP.
- 2b. BUSBAR TO EW CELL ROUTE.
  BOTTOM OF BUSBUR = 7'-0".
3. 5'-0" HIGH POLYMER CONCRETE EW CELL.
   2 ROWS (EACH ROW – 24 CELLS), TOTAL OF 48 CELLS.
   CELL CAPACITY: 36 CATHODES W/ 10 ft² OF WORKING AREA AT 4" O.C.
   CELL T.O.C. = 9'-0", CELL B.O.C. = 4'-0".

- 3a. EW CELLS ROW SUPPORT: 1'-6" WIDE x 2'-0" HIGH CONCRETE BEAM
  W/ TWELVE 2'-0" x 1'-6" PIERS,
  TWO BEAMS PER CELLS ROW.
  BEAM T.O.C. = 4'-0".
4. BUSBAR SUPPORT (EAST SIDE): 1'-6" x 1'-6" CONCRETE BEAM
   W/ TWO 1'-6" x 1'-6" PIERS.
   TOTAL OF 2 BUSBAR SUPPORTS.
   T.O.C. = 6'-4 1/2".
- 4a. BUSBAR SUPPORT (WEST SIDE): 1'-6" x 1'-6" CONCRETE BEAM
  W/ FOUR 1'-6" x 1'-6" PIERS.
  TOTAL OF 1 BUSBAR SUPPORT.
  T.O.C. = 6'-4 1/2".
5. WASH TANK.
   TANK CAPACITY: 9 CATHODES AT 1'-4" O.C.
   T.O.S. = 10'-0".
   TANK SUPPORT: FOUR 1'-6"ø PVC PIPES (CONCRETE FILLED COL).
   TOP OF SUPPORT = 3'-2".
6. STRIP RACK.
   RACK CAPACITY: 18 CATHODES AT 1'-4" O.C.
7. 4'-4" WIDE HIGH CONVEYOR.
- 7a. 4'-4" WIDE LOW CONVEYOR.
8. SCALE.
9. NOT USED.
10. NOT USED.
11. CONCRETE CONTAINMENT: 8" THICK CONCRETE SLAB W/ 8" WIDE CURB
    ALL AROUND.
    SLAB T.O.C. (NOMINAL ELEV) = 0" (REFERENCE ELEV).
    CURB T.O.C. = 1'-0".
    SLAB SHALL HAVE ±2% SLOPES IN DIRECTION OF SUMPS.
    SLAB T.O.C. ELEV AT CURBS = 10".
- 11a. 4'-0" x 4'-0" x 4'-0" DEEP CONCRETE SUMP.
  TOTAL OF 3 SUMPS PER CONTAINMENT.
12. HANDLING/LOADING/SHIPPING AREA: 8" THICK CONCRETE SLAB.
    SLAB T.O.C. ELEV AT NORTH CURB = 6" (NOMINAL ELEV).
    CURB T.O.C. = 1'-0".
    SLAB SHALL HAVE ±2% SLOPE IN SOUTH DIRECTION.
13. W 18 x 35 BLDG COL
    W/ 2'-10" x 2'-0" CONCRETE PIER AND 6'-0" x 6'-0" x 1'-6" THICK FOOTING.
    BP B.O.S. = 1'-6".
    TOTAL OF 16 COL's.
    BLDG STRUCTURE ISN'T SHOWN.
14. STEEL PLATFORM W/ GRATING (PLATFORM STRUCTURE ISN'T SHOWN).
    B.O.G. = 9'-0".
- 14a. HANDRAIL AT PLATFORM.
- 14b. STAIR.
  14 THREADS (11"), TOTAL RUN = 12'-10",
  15 RISERS (7"), TOTAL RISE 8'-9"
  (STAIR T.O.G. = 9'-2", SLAB AT STAIR T.O.C. = ±5").
15. GRATING AT EW CELLS AREA (GRATING SUPPORT ISN'T SHOWN).
    B.O.G. = 9'-0".

PRELIMINARY
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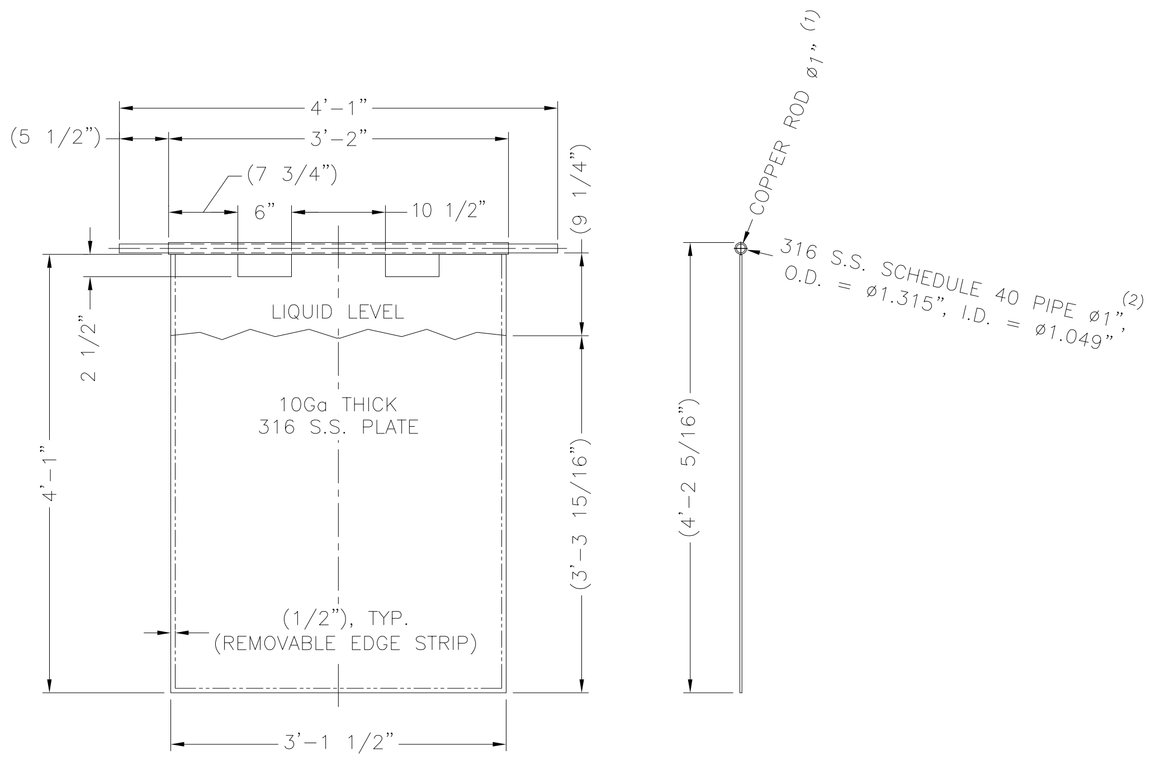
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
ELECTROWINNING
UNIT LAYOUT

SCALE: AS NOTED

DRAWING NO. 40-GA-01

SHEET 1 OF 1

REVISION P1



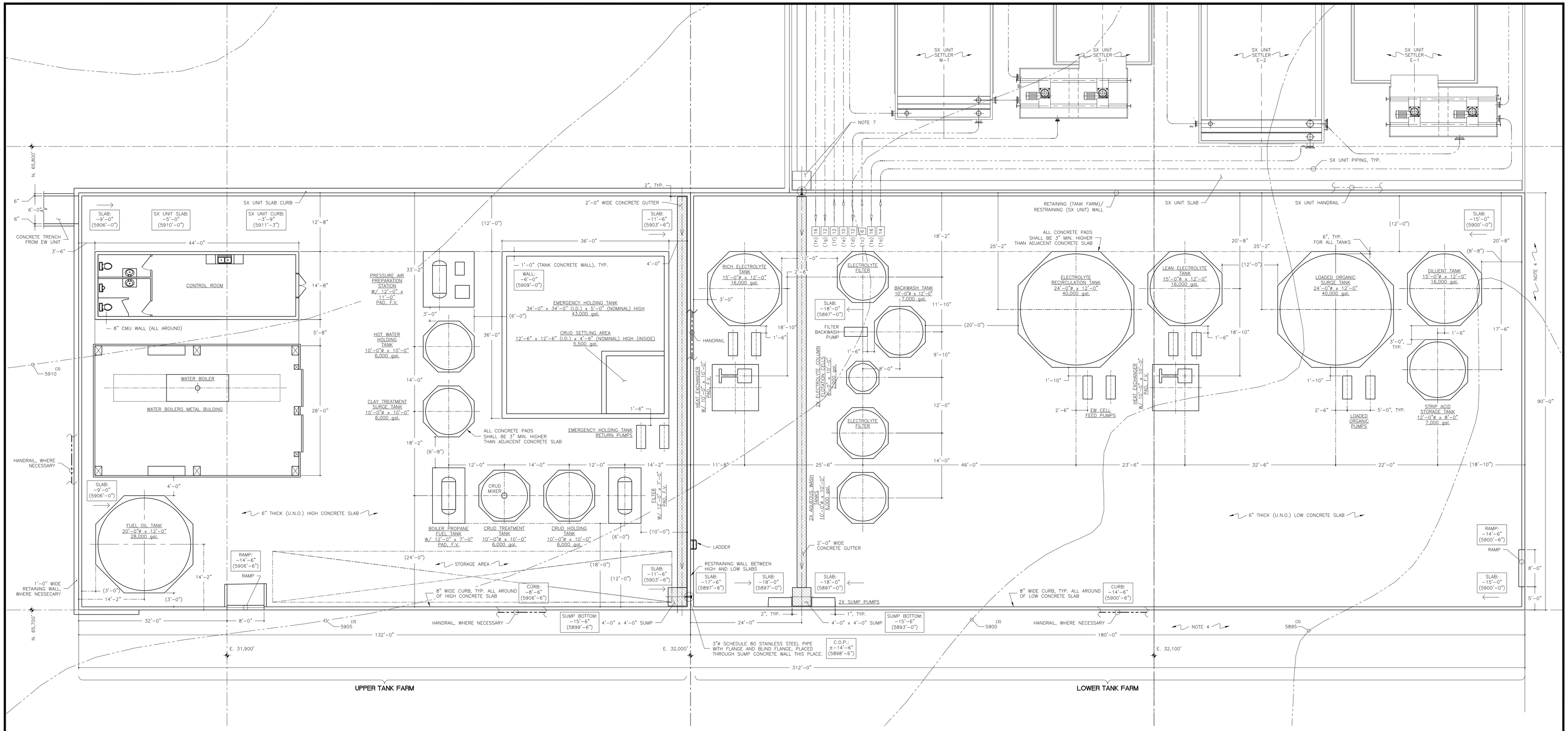
FRONT ELEVATION SIDE ELEVATION

CATHODE ASSEMBLY

SCALE: 1"=1'-0"

DIMENSIONS IN PARENTHESIS ARE FOR REFERENCES.

– – – –



TANK FARM PLAN

SCALE: 1" = 10'-0"

PROJECT NORTH

F.V. ALL DIMENSIONS AND E. CONDITIONS.

DIMENSIONS IN PARENTHESIS ARE FOR REFERENCE.

TOPOGRAPHY DATA FROM OVERALL MAP FOR WESTERN UTAH COPPER CO. BY PLATT AND PLATT, INC. (DATE: NOVEMBER 2008, DRAWING: NAMtopoGRID.dwg).

TOP OF ALL SETTLERS 6" THICK CONCRETE BOTTOM (SX UNIT) = **0'-0" (REF ELEV)** = ±5915'.

⟶ – SLAB SLOPE.

SLAB: -9'-0" (5906'-0") – ITEM NAME, ELEV, ABSOLUTE ELEV.

↓ – TRENCH SLOPE.

——→——— – PIPE LINE/PIPE LINE FLOW DIRECTION (SX UNIT), TYP.

10 – PIPE DIAMETER, INCHES.

BOTTOM OF ALL PIPES AT CONCRETE CURB OF SX UNIT ELEV = -3'-9" MAX. (5911'-3").

(1) SEE NOTES 1a THROUGH 1h FOR PIPE LINE SOURCE/DESTINATION INFORMATION:

(1a) FROM PLS POND,
(1b) TO RAFFINATE POND,
(1c) FROM LEAN ELECTROLYTE TANK,
(1d) TO AQUEOUS WASH TANK,
(1e) FROM AQUEOUS WASH TANK,
(1f) FROM LOADED ORGANIC TANK,
(1g) TO RICH ELECTROLYTE TANK,
(1h) TO LOADED ORGANIC TANK.

(3) GROUND CONTOUR ELEVATION, FEET.

(4) TOP OF SOIL (ADJACENT TO TANK FARM SLABS) AT SOUTH AND EAST SIDES SHALL BE 1'-0" MAX. BELOW TOP OF CONCRETE CURB.
BERM AT THESE PLACES (IF NECESSARY) SHALL BE CONSTRUCTED OF SOIL REMOVED FROM BOTTOM OF CONCRETE SLABS.
THE SLOPE OF ALL NEW EMBANKMENTS SHALL BE LIMITED TO A RATIO OF 3:1.
TOP OF SOIL AT RAMPS (SOUTH SIDE AND EAST SIDE) SHALL BE 6" MAX. BELOW TOP OF CONCRETE RAMP.

PRELIMINARY
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CS Mining LLC

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COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

TANK FARM
UNIT LAYOUT

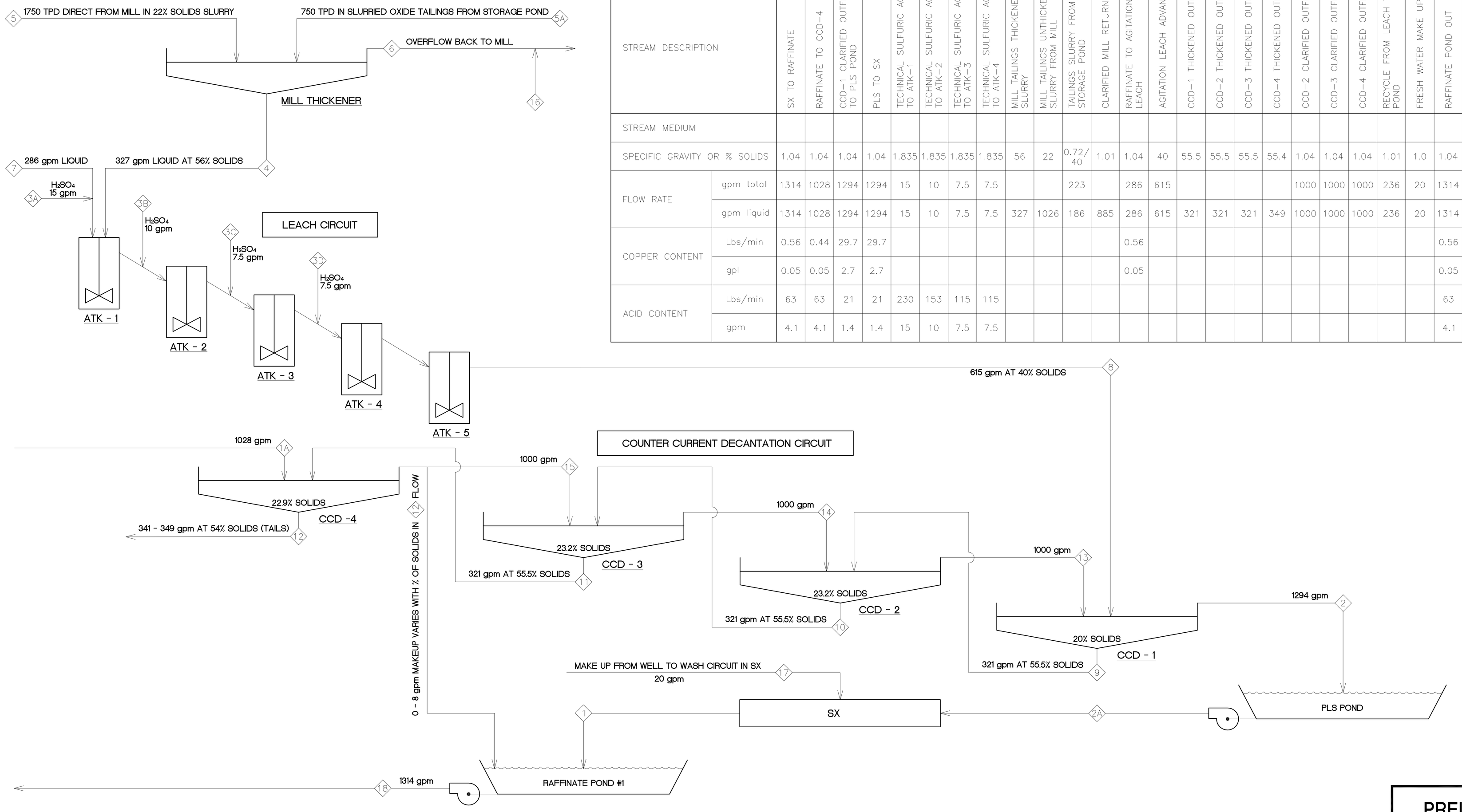
SCALE: AS NOTED

DRAWING NO. 50-GA-01

SHEET 1 OF 1

REVISION P1

2.5 : 1 WASH RATIO
2500 TPD CIRCUIT



STREAM NUMBER		1	1A	2	2A	3A	3B	3C	3D	4	5	5A	6	7	8	9	10	11	12	13	14	15	16	17	18
STREAM DESCRIPTION		SX TO RAFFINATE	RAFFINATE TO CCD-4	CCD-1 CLARIFIED OUTFLOW TO PLS POND	PLS TO SX	TECHNICAL SULFURIC ACID TO ATK-1	TECHNICAL SULFURIC ACID TO ATK-2	TECHNICAL SULFURIC ACID TO ATK-3	TECHNICAL SULFURIC ACID TO ATK-4	MILL TAILINGS THICKENED SLURRY	MILL TAILINGS UNTHICKENED SLURRY FROM MILL	TAILINGS SLURRY FROM STORAGE POND	CLARIFIED MILL RETURN	RAFFINATE TO AGITATION LEACH	AGITATION LEACH ADVANCE	CCD-1 THICKENED OUTFLOW	CCD-2 THICKENED OUTFLOW	CCD-3 THICKENED OUTFLOW	CCD-4 THICKENED OUTFLOW	CCD-2 CLARIFIED OUTFLOW	CCD-3 CLARIFIED OUTFLOW	CCD-4 CLARIFIED OUTFLOW	RECYCLE FROM LEACH TAIL POND	FRESH WATER MAKE UP	RAFFINATE POND OUT
STREAM MEDIUM																									
SPECIFIC GRAVITY OR % SOLIDS		1.04	1.04	1.04	1.04	1.835	1.835	1.835	1.835	56	22	0.72/40	1.01	1.04	40	55.5	55.5	55.5	55.4	1.04	1.04	1.04	1.01	1.0	1.04
FLOW RATE	gpm total	1314	1028	1294	1294	15	10	7.5	7.5			223		286	615					1000	1000	1000	236	20	1314
	gpm liquid	1314	1028	1294	1294	15	10	7.5	7.5	327	1026	186	885	286	615	321	321	321	349	1000	1000	1000	236	20	1314
COPPER CONTENT	Lbs/min	0.56	0.44	29.7	29.7									0.56											0.56
	gpl	0.05	0.05	2.7	2.7									0.05											0.05
ACID CONTENT	Lbs/min	63	63	21	21	230	153	115	115																63
	gpm	4.1	4.1	1.4	1.4	15	10	7.5	7.5																4.1

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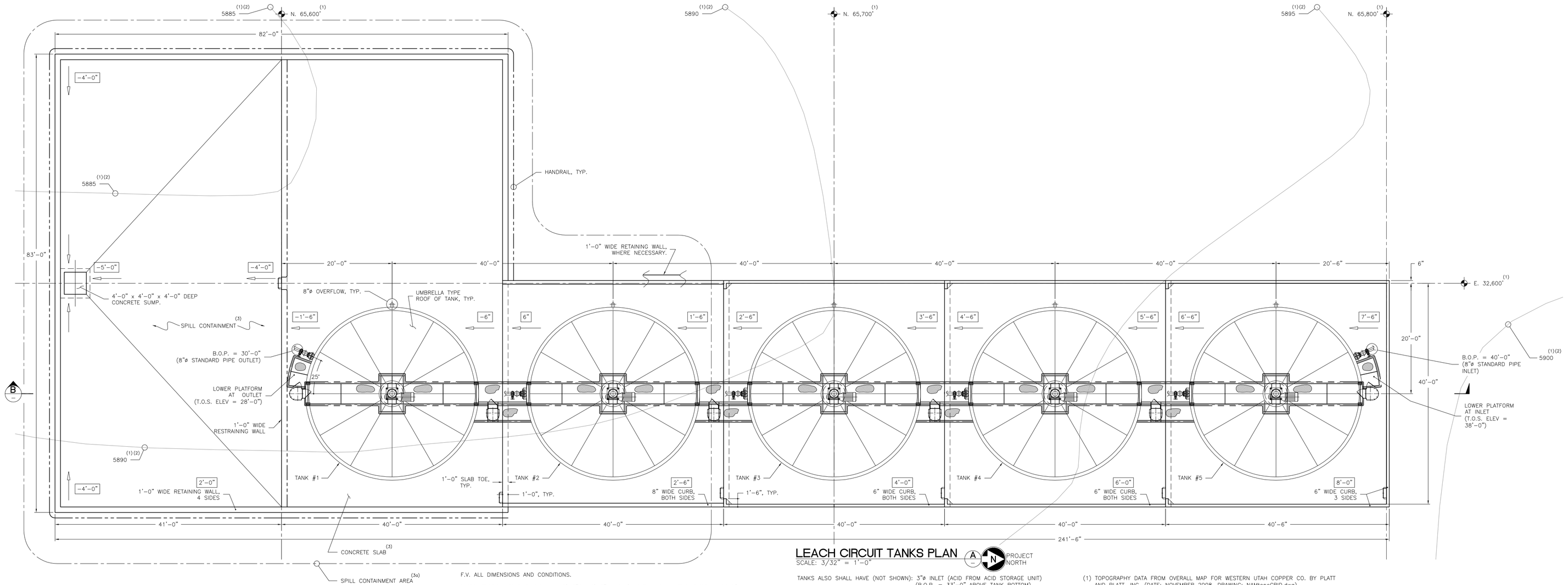
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
LEACH CIRCUIT TANKS/CCD FLOWSHEET

SCALE: AS NOTED

DRAWING NO. 60-FS-01

SHEET 1 OF 1

REVISION P1



LEACH CIRCUIT TANKS PLAN

SCALE: 3/32" = 1'-0"

PROJECT NORTH

F.V. ALL DIMENSIONS AND CONDITIONS.

LEACH CIRCUIT TANKS SHALL BE: 30'-0"ø, 34'-0" HIGH (TOP OF UPPER ROLLED SKIRT ANGLE).
TANKS SHALL HAVE UMBRELLA TYPE ROOF W/ STRUCTURAL SUPPORT FOR PLATFORM AND AGITATOR UNIT.
LIQUID LEVEL SHALL BE 30'-0" ABOVE TANK BOTTOM.
TANKS SHALL HAVE: 8"ø PIPE FLANGED INLET (B.O.P. = 32'-0" ABOVE TANK BOTTOM),
8"ø PIPE FLANGED OUTLET (B.O.P. = 30'-0" ABOVE TANK BOTTOM).
LIQUID TAKE-OFF FOR TANK OUTLET SHALL BE AT 10'-0" ABOVE TANK BOTTOM.
8"ø PIPE FLANGED OVERFLOW OUTLET (B.O.P. = 33'-0" ABOVE TANK BOTTOM).
TANK MATERIAL: 316 SS.
TANK VOLUME: ±21 THOUSANDS CUBIC FEET (OUTLET LEVEL)
±23 THOUSANDS CUBIC FEET (OVERFLOW LEVEL).
SPILL CONTAINMENT VOLUME: ±29 THOUSANDS CUBIC FEET.

TANKS ALSO SHALL HAVE (NOT SHOWN): 3"ø INLET (ACID FROM ACID STORAGE UNIT) (B.O.P. = 33'-0" ABOVE TANK BOTTOM).
MANHOLE (LOCATION AT OWNER DISCRETION).
ROOF VENT GOOSE NECK.
FLUSH TYPE CLEANOUT (NOT SHOWN).

REF ELEV = 0'-0' = 5890' (T.O.C. OF TANK #1 PAD – SEE SECTION B.

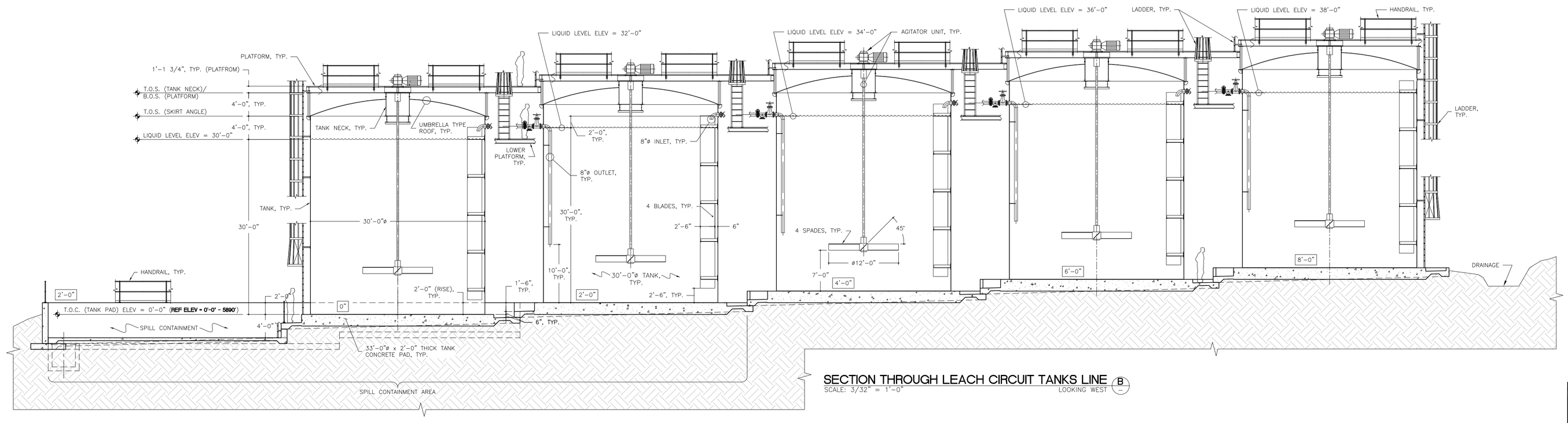
1'-6" – T.O.C. ELEV.

(1) TOPOGRAPHY DATA FROM OVERALL MAP FOR WESTERN UTAH COPPER CO. BY PLATT AND PLATT, INC. (DATE: NOVEMBER 2008, DRAWING: NAMtopoGRID.dwg).

(2) GROUND CONTOUR ELEVATION, FEET (SEE NOTE 1).

(3) 6" THICK CONCRETE SLAB AREA (FIVE STEPS AT 2'-0" RISE AND SPILL CONTAINMENT AS SHOWN).
———— – SLAB SLOPE.

(3a) SPILL CONTAINMENT AREA (INCLUDES SPILL CONTAIMENT AND FIRST TWO STEPS OF SLAB AREA).



SECTION THROUGH LEACH CIRCUIT TANKS LINE B

SCALE: 3/32" = 1'-0" LOOKING WEST

PRELIMINARY
NOT FOR CONSTRUCTION
11-06-2013

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0.00 ±
0.000 ±

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COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

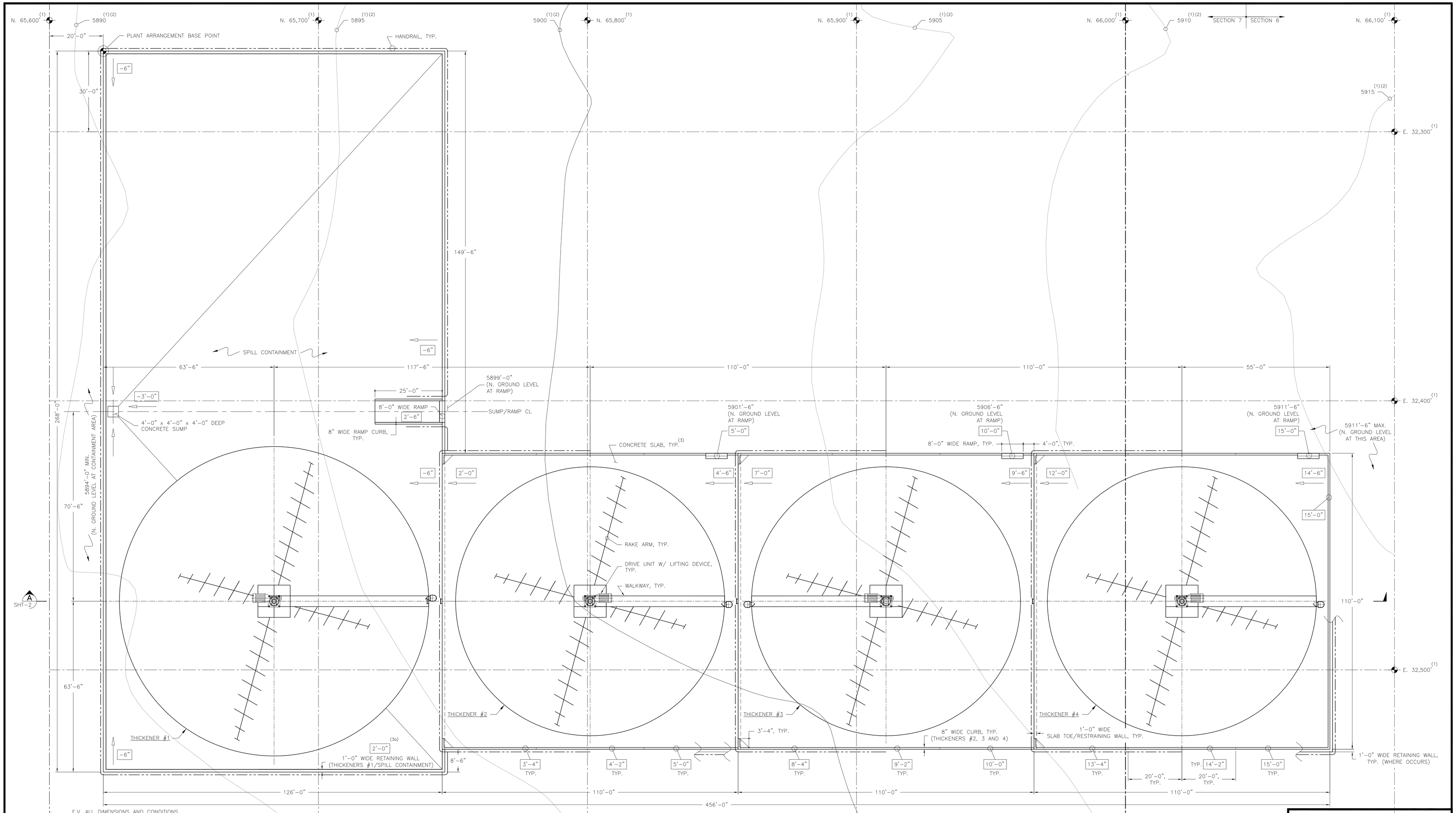
LEACH CIRCUIT TANKS/CCD
LEACH CIRCUIT TANKS LAYOUT

SCALE: AS NOTED

DRAWING NO. 60-GA-01

SHEET 1 OF X

REVISION P1



F.V. ALL DIMENSIONS AND CONDITIONS.

CCD CIRCUIT THICKENERS SCHEMATIC PROFILES ARE SHOWN.
THICKENERS #1 SHALL BE: 115'-0"ø, THICKENERS #2, 3 AND 4 SHALL BE: 100'-0"ø.
THICKENERS MATERIAL: 316 SS.

THICKENER #1 VOLUME: ±100 THOUSANDS CUBIC FEET,
SPILL CONTAINMENT VOLUME: ±120 THOUSANDS CUBIC FEET.

THICKENERS BRIDGES AREN'T SHOWN.

REF ELEV = 0'-0" = 5897' (B.O.S. OF THICKENERS #1 SUPPORT COL's BP).

1'-6" – T.O.C. ELEV.

PIPING ISN'T SHOWN.

CCD THICKENERS CIRCUIT PLAN

SCALE: 1/16" = 1'-0"

(1) TOPOGRAPHY DATA FROM OVERALL MAP FOR WESTERN UTAH COPPER CO. BY PLATT AND PLATT, INC. (DATE: NOVEMBER 2008, DRAWING: NAMtopoGRID.dwg).

(2) GROUND CONTOUR ELEVATION, FEET (SEE NOTE 1).

(3) 6" THICK CONCRETE SLAB (FOUR STEPS AT 5'-0" NOMINAL RISE).
———— – SLAB SLOPE.

(3a) TOP OF RETAINING WALL (SPILL CONTAINMENT AREA).

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TOLERANCE UNLESS	FRACTIONS	±
OTHERWISE SPECIFIED	0.00	±
	0.000	±

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COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

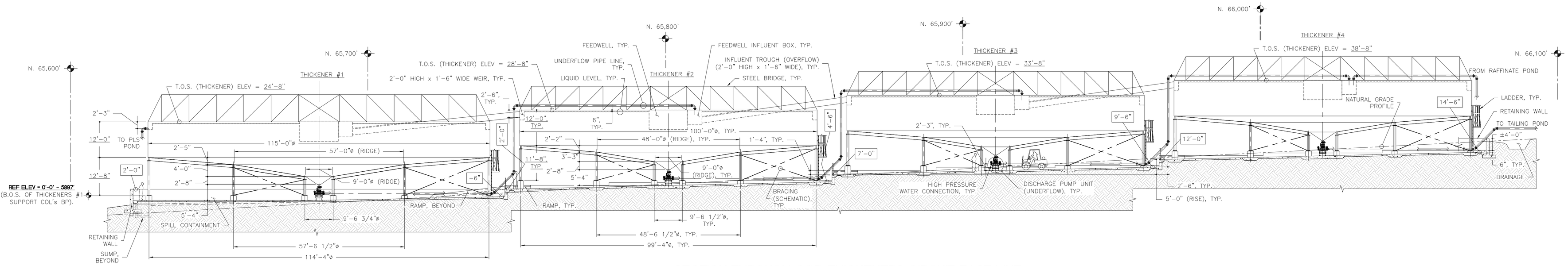
LEACH CIRCUIT TANKS/CCD
CCD THICKENERS CIRCUIT LAYOUT

SCALE: AS NOTED

DRAWING NO. 61-GA-01

SHEET 1 OF X

REVISION P1



SECTION THROUGH CCD THICKENERS CIRCUIT EAST LINE (A/SHT-1)

SCALE: 1/16" = 1'-0" LOOKING WEST

SEE PLAN A/SHT-1 FOR INFORMATION NOT SHOWN.

DRIVE UNIT W/ LIFTING DEVICE, RAKE ARMS AREN'T SHOWN.

THICKENERS BOTTOM SLOPES: EXTERNAL CIRCLE AT 1 : 12,
INTERNAL CIRCLE AT 2 : 12,
DISCHARGE CONE AT 1 : 1.

PRELIMINARY
NOT FOR CONSTRUCTION
11-06-2013

TOLERANCE UNLESS OTHERWISE SPECIFIED: FRACTIONS ±, 0.00 ±, 0.000 ±

REVISIONS (DESTROY ALL PRINTS OF AN EARLIER DATE THAN LATEST REVISION)

REV	DESCRIPTION	BY	DATE
P1	FIRST REVIEW	HM	12/06/13

REV	DESCRIPTION	BY	DATE

CS Mining LLC

PROJECT NO 2012-01

WESTERN STATES ENGINEERING
5210 E. Williams Circle, Suite 700
TUCSON, AZ 85711
PHONE: 520-889-2040 FAX: 520-889-2733

APPROVED FOR CONSTRUCTION	BY	DATE		BY	DATE
SAFETY			PROCESS ENGR.		
ENVIRONMENTAL			PROJECT ENGR.		
MAINTENANCE			ENGR. MNGR.		
PRODUCTION			PLANT MNGR.		
QLTY. CONTROL					

DESIGN	DATE
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PROJ. ENGR. HM	
ENGR. MNGR.	

COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

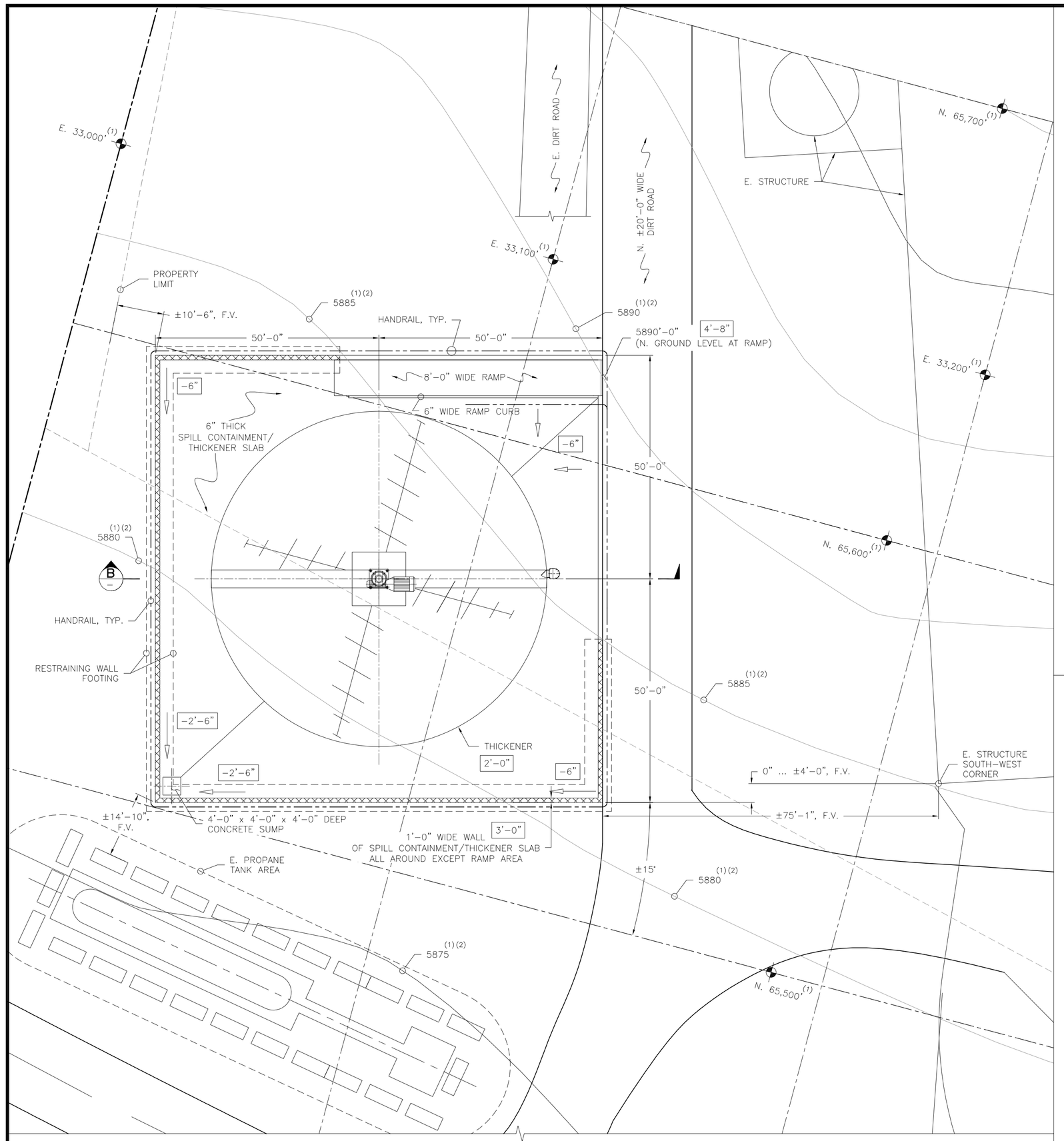
LEACH CIRCUIT TANKS/CCD
CCD THICKENERS CIRCUIT SECTION

SCALE: AS NOTED

DRAWING NO. 61-GA-01

SHEET 2 OF X

REVISION P1



MILL THICKENER PLAN

SCALE: 1/16" = 1'-0"

PROJECT NORTH

F.V. ALL DIMENSIONS AND CONDITIONS.

MILL THICKENER SCHEMATIC PROFILE IS SHOWN.

THICKENER BRIDGE ISN'T SHOWN.

THICKENERS SHALL BE: 75'-0"ø.
THICKENERS MATERIAL: 316 SS.

THICKENER VOLUME: ±36 THOUSANDS CUBIC FEET,
SPILL CONTAINMENT VOLUME: ±43 THOUSANDS CUBIC FEET.

REF ELEV = 0'-0" = 5887' (B.O.S. OF THICKENER SUPPORT COL's BP).

1'-6" – T.O.C./TOP OF GROUND LEVEL ELEV.

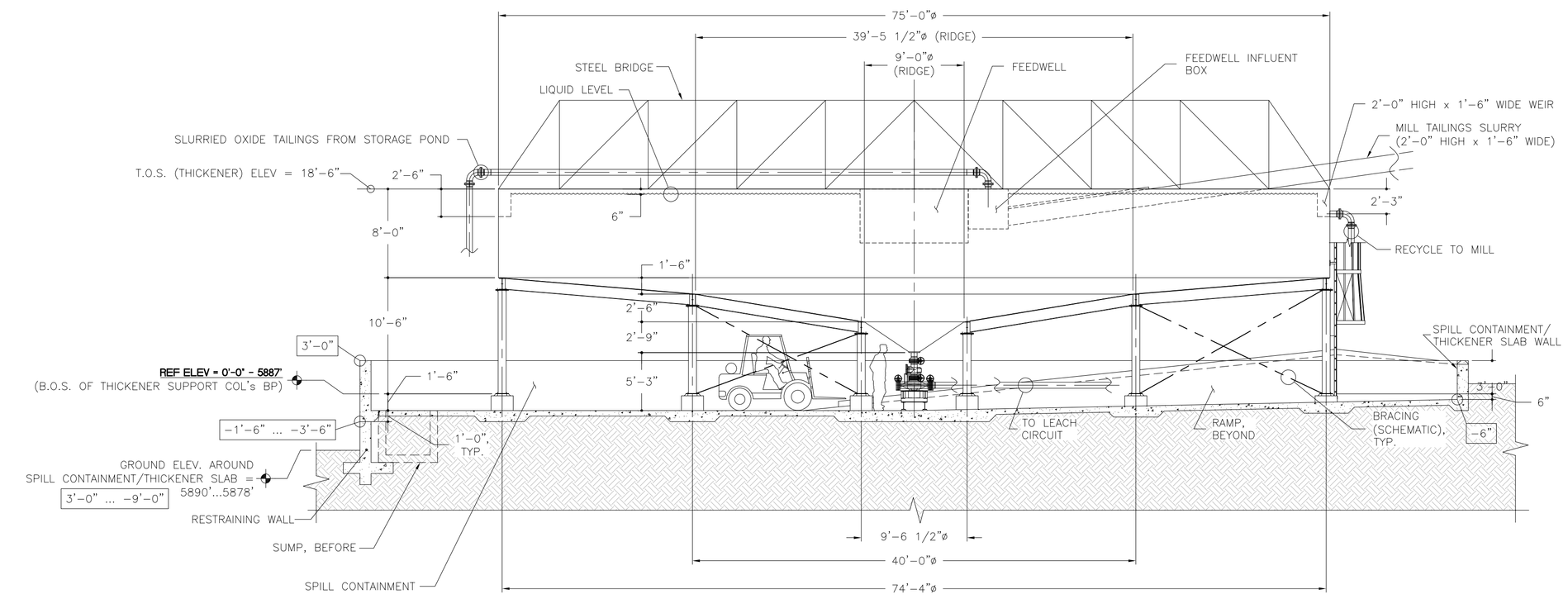
– SLAB SLOPE.

– RESTRAINING WALL BELOW (UNDER SLAB). F.V. WALL CONTINUATION.

PIPING ISN'T SHOWN.

(1) TOPOGRAPHY DATA FROM OVERALL MAP FOR WESTERN UTAH COPPER CO. BY PLATT AND PLATT, INC. (DATE: NOVEMBER 2008, DRAWING: NAMtopoGRID.dwg).

(2) GROUND CONTOUR ELEVATION, FEET (SEE NOTE 1).



SECTION THROUGH THICKENER B

SCALE: 1/8" = 1'-0" LOOKING NORTH-WEST

DRIVE UNIT W/ LIFTING DEVICE, RAKE ARMS AREN'T SHOWN.

THICKENER BOTTOM SLOPES: EXTERNAL CIRCLE AT 1 : 12,
INTERNAL CIRCLE AT 2 : 12,
DISCHARGE CONE AT 1 : 1.

PRELIMINARY
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11-06-2013

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FRACTIONS ±
0.00 ±
0.000 ±

CS Mining LLC

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QLTY. CONTROL					

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ENGR. MNGR.	

COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

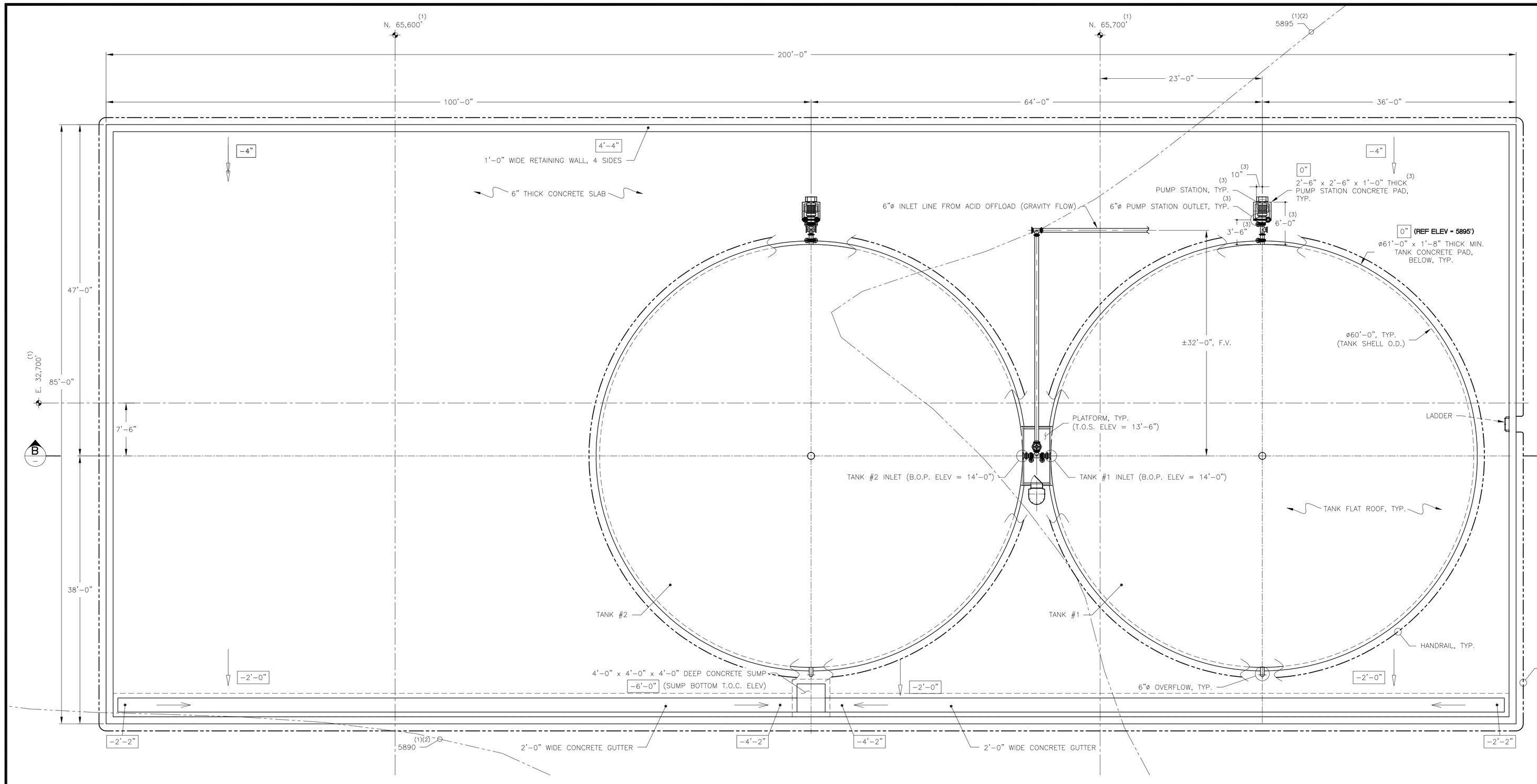
LEACH CIRCUIT TANKS/CCD
MILL THICKENER LAYOUT

SCALE: AS NOTED

DRAWING NO. 63-GA-01

SHEET 1 OF 1

REVISION P1



ACID STORAGE UNIT PLAN

SCALE: 1/8" = 1'-0"

A — N — PROJECT NORTH

F.V. ALL DIMENSIONS AND CONDITIONS.

ACID STORAGE TANKS SHALL BE: 60'-0"ø, 16'-0" HIGH (TOP OF UPPER ROLLED SKIRT ANGLE).
TANKS SHALL HAVE CONE OR FLAT TYPE ROOF W/ STRUCTURAL SUPPORT.
ACID LEVEL SHALL BE 14'-0" MAX. ABOVE TANK BOTTOM.
TANK VOLUME: ±40 THOUSANDS CUBIC FEET (OVERFLOW LEVEL).
SPILL CONTAINMENT VOLUME: ±46 THOUSANDS CUBIC FEET.
TANKS SHALL HAVE: 6"ø PIPE FLANGED INLET (B.O.P. ELEV = 14'-0" ABOVE TANK BOTTOM).
6"ø PIPE FLANGED OUTLET (COORDINATE B.O.P. W/ PUMP STATION).
6"ø PIPE FLANGED TANKS CONNECTION (C.O.P. ELEV = 2'-0" ABOVE TANK BOTTOM)..
6"ø PIPE FLANGED OVERFLOW OUTLET (B.O.P. ELEV = 14'-0" ABOVE TANK BOTTOM).
TANKS ALSO SHALL HAVE (NOT SHOWN): MANHOLE W/ ACCESS TO MANHOLE (LOCATION AT OWNER DISCRETION).
ROOF VENT GOOSE NECK W/ FLANGE TO ALLOW FOR OPTIONAL VENT LINE ATTACHMENT.
FLUSH TYPE CLEANOUT (NOT SHOWN).

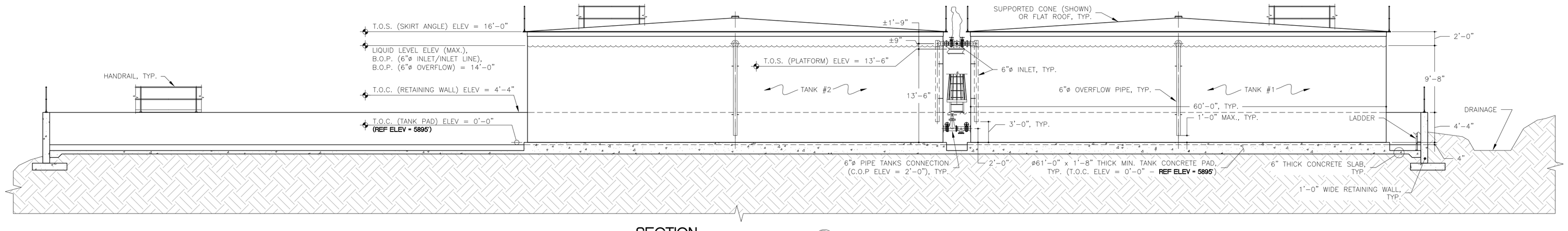
TANK MATERIAL: MILD CARBON STEEL.
REF ELEV = 0'-0" = 5895' (T.O.C. OF TANK CONCRETE PADS).

1'-6" – T.O.C. ELEV.
——▷ – SLAB SLOPE.
◁—— – GUTTER SLOPE.

(1) TOPOGRAPHY DATA FROM OVERALL MAP FOR WESTERN UTAH COPPER CO. BY PLATT AND PLATT, INC. (DATE: NOVEMBER 2008, DRAWING: NAMtopoGRID.dwg).

(2) GROUND CONTOUR ELEVATION, FEET (SEE NOTE 1).

(3) COORDINATE SIZE, ELEV AND LOCATION OF PUMP STATION CONCRETE PADS W/ PUMP STATION.
COORDINATE LOCATION OF PUMP STATION OUTLET W/ PUMP STATION.



SECTION

SCALE: 1/8" = 1'-0" LOOKING WEST B

PRELIMINARY
NOT FOR CONSTRUCTION
11-06-2013

TOLERANCE UNLESS OTHERWISE SPECIFIED — FRACTIONS ±, 0.00 ±, 0.000 ±

CS Mining LLC

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COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

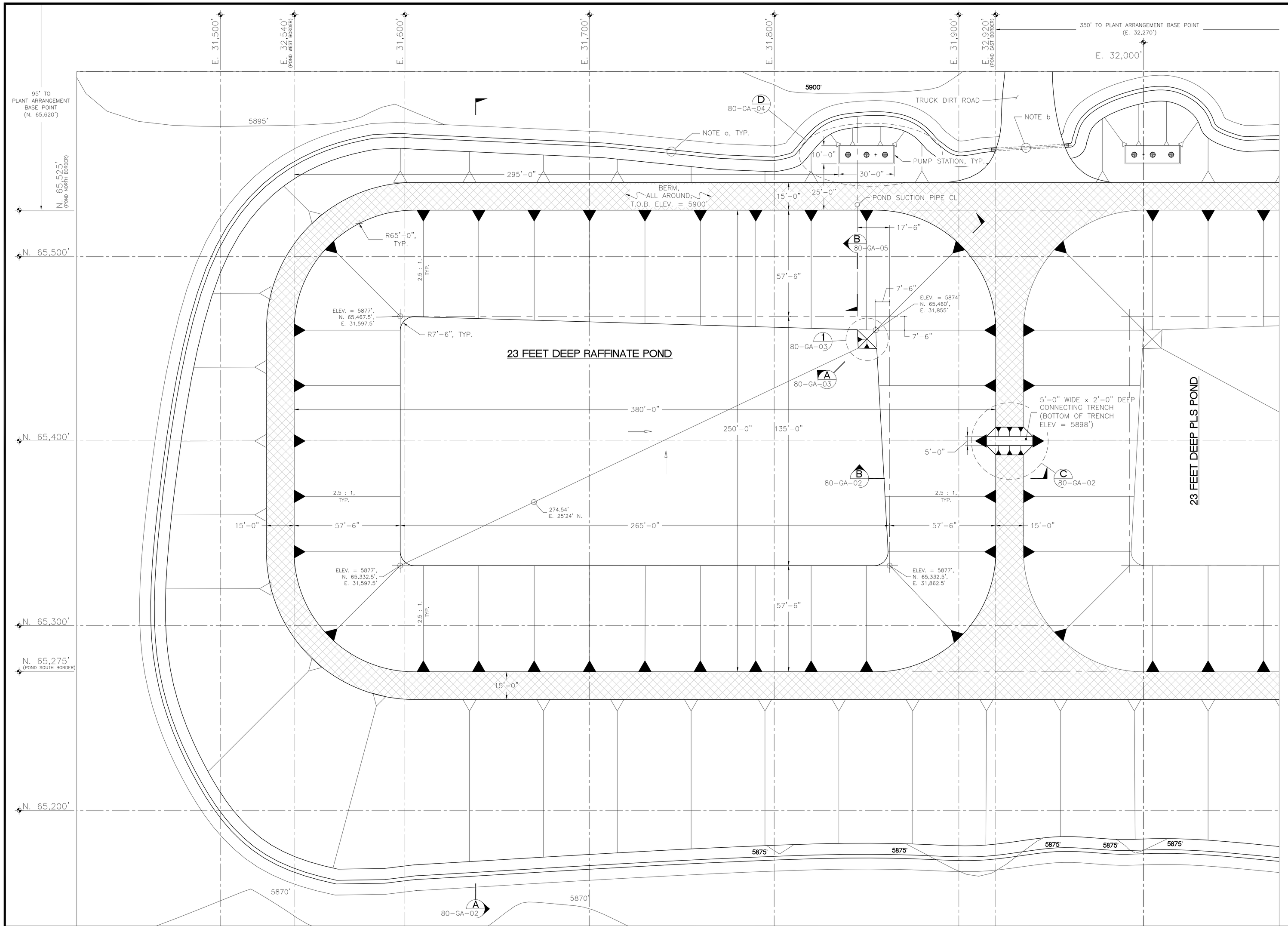
LEACH CIRCUIT TANKS/CCD
ACID STORAGE UNIT LAYOUT

SCALE: AS NOTED

DRAWING NO. 62-GA-01

SHEET 1 OF X

REVISION P1



NOTES

F.V. ALL DIMENSIONS AND CONDITIONS.

DESIGN FOR 23' DEEP RAFFINATE POND IS SHOWN.
DESIGN FOR 23' DEEP PLS POND ARE SIM.
SEE DWG 00-GA-01 FOR THESE TWO PONDS GENERAL ARRANGEMENT.

TRUCK DIRT ROAD EMBANKMENTS TOWARD E. SOIL AREN'T SHOWN.

a) DRAINAGE SWALE.
SWALE OR DRAINAGE DITCH SHALL BE BUILT AROUND PONDS SYSTEM AND TO BE SLOPED TORWARD E. DRAINAGE AS SHOWN, F.V. E. DRAINAGE LOCATION.
SWALE SLOPE SHALL BE: 0.005 ft/ft (MIN. SLOPE) ... 0.02 ft/ft (MAX. SLOPE).
SWALE SHALL BE 2'-0" MIN. DEEP AND ±2'-0" WIDE AT BOTTOM.
SWALE SIDES SHALL HAVE RATIO OF 3:1.

(b) INSTALL 1'-6"ø MIN. HDPE CULVERT UNDER TRUCK DIRT ROAD W/ A MIN. COVER A 2'-6" OVER TOP OF PIPE.

POND LINING SYSTEM:
POND LINING SYSTEM SHALL CONSISTS OF FOUR LAYERS:
- FIRST (UPPER) LAYER: 80 mils XR-5 OR HDPE AT OWNER DISCRETION,
- SECOND LAYER: GEONET (W/ FABRIC BOTH SIDES),
- THIRD LAYER: 60 mils HDPE,
- FOURTH (BOTTOM) LAYER: 32 oz GEOTEXTILE.

SEE 80-GA-03 FOR LINERS INFORMATION.

THE LEAK DETECTION SYSTEM:
THIS DRAWING DEPICTS TWO OPTIONS OF LEAK DETECTION SYSTEM:

- SYSTEM W/ LEAK DETECTION SUMP
(SEE DTL 1/80-GA-03, SECTION A/80-GA-03 AND RELATED SECTIONS AND DETAILS),
THE LEAK DETECTION SUMP AREA IS DEFINED BY 10 FEET OFFSETS OF THE BERM TOE LINES RESULTING IN A ±RHOMBUS SHAPE AT POND CORNER.
THE SLOPE WILL MAINTAIN ±2.5 TO 1 RATIO TO THE CENTER OF THE SUMP.

- SYSTEM W/ PUMP STATION
(SEE DTL D/80-GA-04, SECTION B/80-GA-05 AND RELATED SECTIONS AND DETAILS).

ONLY ONE LEAK DETECTION SYSTEM WILL BE APPLIED IN NEXT REVISION AT OWNER DISCRETION.

EMBANKMENTS:
THE BERMS ON THE SOUTH WILL BE CONSTRUCTED OF SOIL REMOVED FROM THE BOTTOM, AND THE BERM ON THE NORTH SIDE WILL CONSIST OF NATURAL SOIL LEFT IN PLACE AFTER REMOVALS ARE FINISHED.

THE SLOPE OF ALL EMBANKMENTS CONSTRUCTED OF THE SOIL CURRENTLY EXISTING ON THE SURFACE SHOULD BE LIMITED TO A RATIO OF 2.5:1 (POND EMBANKMENT) AND 3:1 (BERM EMBANKMENT).

IN THE AREA OF THE EMBANKMENTS, THE SURFACE SHOULD BE SCARIFIED TO A DEPTH OF 6 INCHES AND WATERED TO SLIGHTLY OVER THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE ASTM D1557, "PROCTOR" TEST.

ALL EMBANKMENT FILL SHOULD BE PLACED IN 10" LIFTS AND COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENISTY FOR GRANULAR SOILS AND A MINIMUM OF 90 PERCENT FOR CLAYEY SOILS.
THE SIDES OF THE EMBANKMENT SHOULD BE EITHER COMPACTED OR OVERBUILT AND TRIMMED BACK TO COMPACTED SOIL.

SOIL MATERIALS:
DRAINAGE FILL CONSISTS OF WASHED, EVENLY GRADED MIXTURE OF CRUSHED STONE, OR CRUSHED OR UNCRUSHED GRAVEL, ASTM D 448, COARSE AGGREGATE, SIZE NO. 57, WITH 100 PERCENT PASSING 1-1/2 INCH (37.5 MM) SIEVE AND NOT MORE THAN 5 PERCENT PASSING NO. 8 (2.36 MM) SIEVE.

LEGEND

- BERM.
- SWALE.
- SLOPE DIRECTION OF POND.
- SLOPE DIRECTION OF BERM EMBANKMENT TOWARD BOTTOM OF POND/LEAK DETECTION SUMP/CONNECTING TRENCH.
- SLOPE DIRECTION TOWARD NATURAL GROUND.

RAFFINATE POND PLAN (A)

SCALE: 1" = 25'-0"

PROJECT NORTH

PRELIMINARY
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11-06-2013

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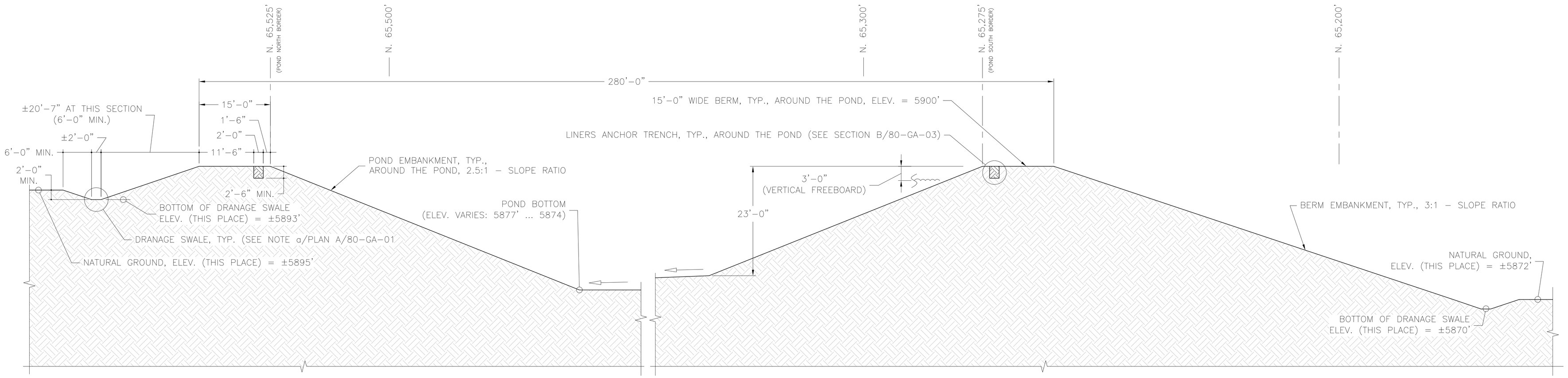
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
PONDS
RAFFINATE POND LAYOUT

SCALE: AS NOTED

DRAWING NO. 80-GA-01

SHEET 1 OF 1

REVISION P1



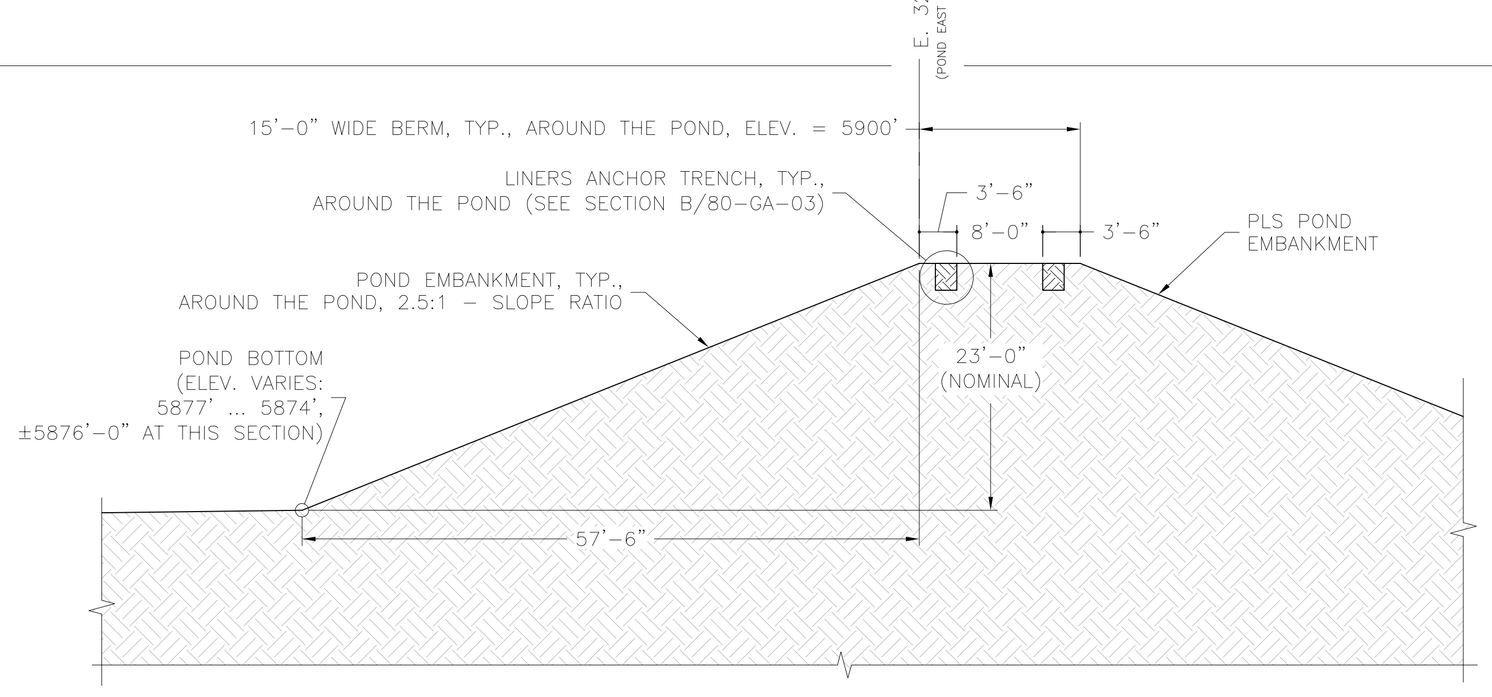
POND SECTION

SCALE: 1" = 10'-0" LOOKING EAST (A) 80-GA-01

THIS SECTION PLANE IS AT E. 31,640'.

POND LINERS AREN'T SHOWN. SEE POND LINING SYSTEM/NOTES/80-GA-01 AND 80-GA-03 FOR LINERS INFORMATION.

⟵ – SLOPE OF POND BOTTOM IN NORTH-SOUTH DIRECTION.



POND SECTION

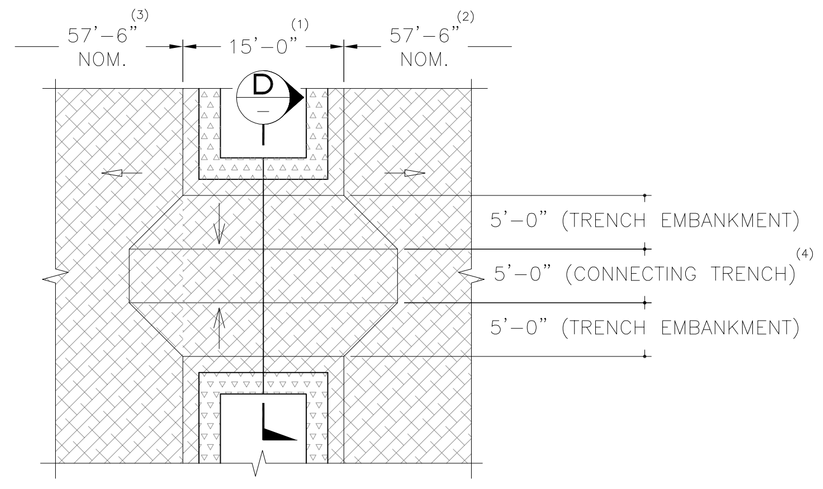
SCALE: 1" = 10'-0" LOOKING NORTH (B) 80-GA-01

THIS SECTION PLANE IS AT N. 65,400'.

POND LINERS AREN'T SHOWN. SEE POND LINING SYSTEM/NOTES/80-GA-01 AND 80-GA-03 FOR LINERS INFORMATION.

SEE SECTION A FOR INFORMATION NOT SHOWN.

⟶ – SLOPE OF POND BOTTOM IN EAST-WEST DIRECTION.



– LINER SYSTEM. SEE SECTION A/80-GA-03.

– LINER SYSTEM ANCHOR TRENCH (2'-0" WIDE x 2'-6" DEEP). SEE SECTIONS A AND B/80-GA-03.

CONNECTING TRENCH PLAN

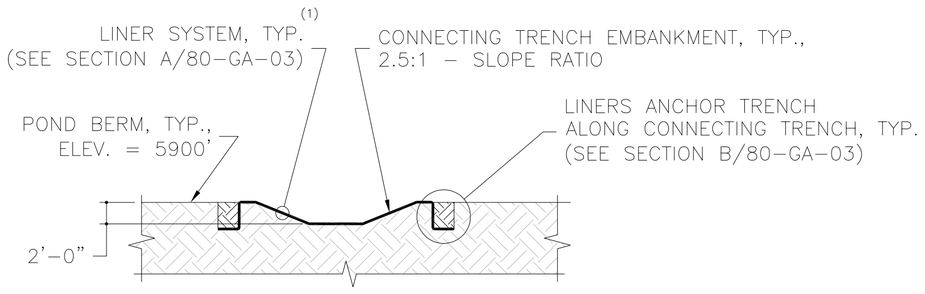
SCALE: 1" = 10'-0" (C) 80-GA-01 (N) PROJECT NORTH

(1) BERM BETWEEN RAFFINATE AND PLS PONDS.

(2) REFFINATE POND EMBANKMENT.
⟵ – POND EMBANKMENT SLOPE (2.5:1).

(3) PLS POND EMBANKMENT.
⟵ – POND EMBANKMENT SLOPE (2.5:1).

(4) BOTTOM OF CONNECTION TRENCH ELEV = 5898'.
⟵ – TRENCH EMBANKMENT SLOPE (2.5:1).



SECTION

SCALE: 1" = 10'-0" LOOKING EAST (D) –

(1) LINER SYSTEMS OF RAFFINATE POND AND PLS POND SHALL HAVE A 12" MIN. OVERLAPPING. FUSION WELD UPPER LAYERS (80 mils HR-5 OR HDPE) AND THIRD LAYERS (60 milS HDPE) PER MANUFACTURER RECOMMENDATIONS

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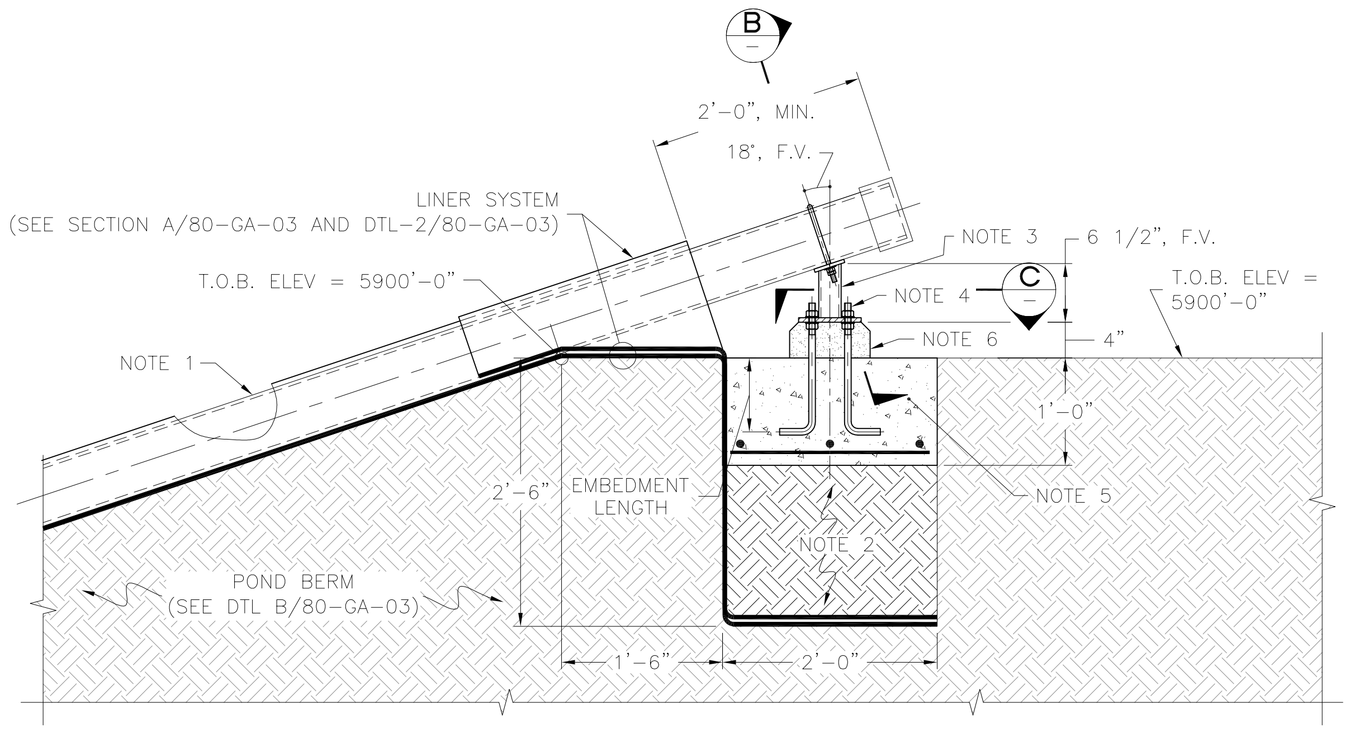
COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING
PONDS
SECTIONS AND DETAILS

SCALE: AS NOTED

DRAWING NO.	SHEET	REVISION
80-GA-02	1 OF 1	P1



PIPE SUPPORT SECTION (A)

SCALE: 1" = 1'-0"

SEE SECTION A/80-GA-03 FOR INFORMATION NOT SHOWN.

(1) 6"ø HDPE PIPE (SEE SECTION A/80-GA-03).

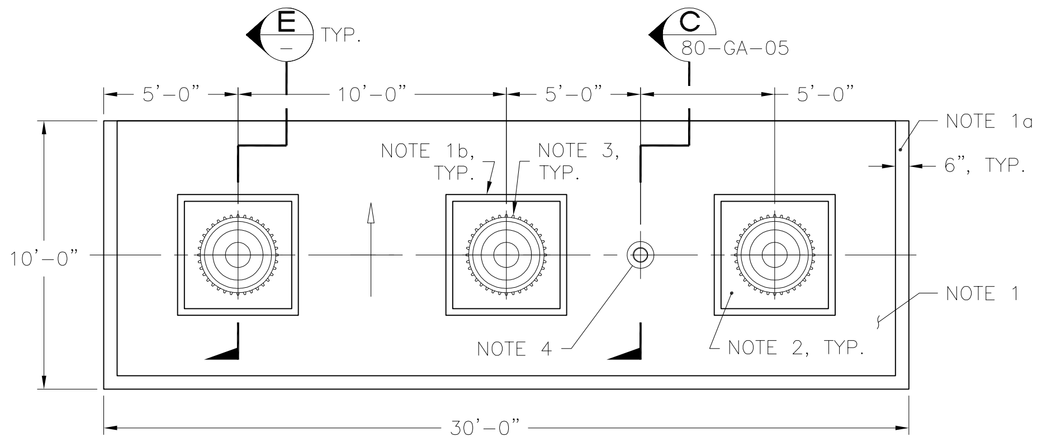
(2) COMPACTED NATIVE BACKFILL.

(3) 2"ø x REQUIRED HEIGHT SCHEDULE 40 CS PIPE.

(4) 3/4"ø "J" TYPE AB W/ LEVELING NUT AND 9" EMBEDMENT, TOTAL OF 4X AB's PER BP.
CONTRACTOR MAY USE 3/4"ø THREADED ROD W/ 9" EMBEDMENT INSTEAD AT OWNER DISCRETION.

(5) 2'-0" x 2'-0" CONCRETE FOOTING W/ 3X #4 EW BOTTOM REINFORCING.

(6) GROUT SHALL BE: 2" MIN. – 4" MAX. THICK W/ 1" x 45° CHAMFER ALL AROUND "FIVE STAR" EPOXY NOVOLAC GROUT.



PLAN

SCALE: 1/4" = 1'-0" (D 80-GA-01) (N PROJECT NORTH)

(1) 6" THICK CONCRETE SLAB (T.O.C. ELEV = 5895'-0").

⟵ – SLAB SLOPE (±1/4" PER FOOT).

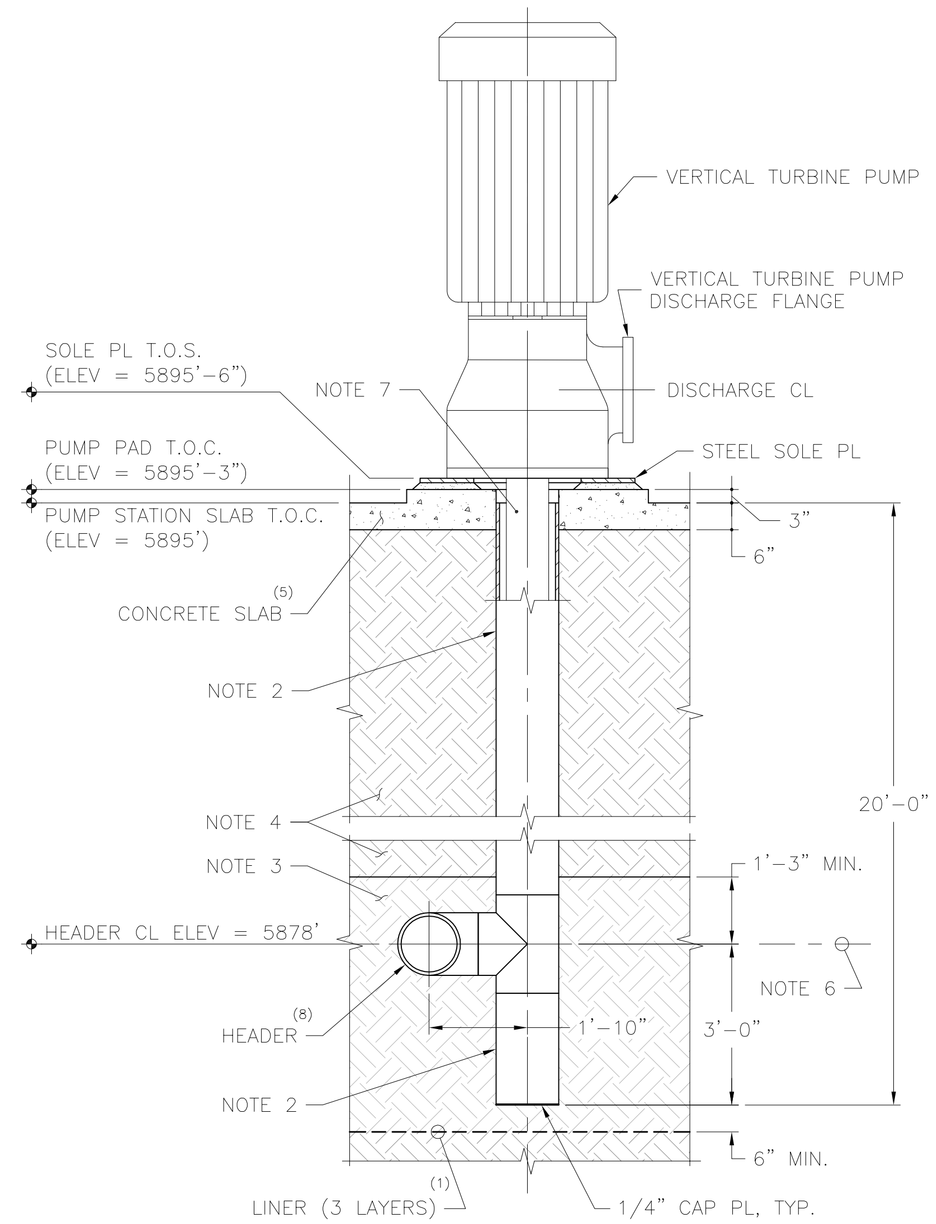
(1a) CONCRETE CURB (T.O.C. ELEV = 5897'-0" MAX.)

(1b) PUMP CONCRETE PAD (T.O.C. ELEV = 5895-3").

(2) PUMP STEEL SOLE PL (T.O.S. ELEV = 5895'-6").

(3) VERTICAL TURBINE PUMP.

(4) 6"ø PVC WELL CASING PIPE FOR LEAK RECOVER PUMP.



WELL CASING PIPE SECTION (E)

SCALE: 1/2" = 1'-0" LOOKING WEST

(1) UPPER LAYER – SECOND LAYER (GEONET WITH FABRIC BOTH SIDES) OF LINING SYSTEM,
MIDDLE LAYER – THIRD LAYER (60 mils HDPE) OF LINING SYSTEM,
BOTTOM LAYER – FOURTH LAYER (32 oz GEOTEXTILE) OF LINING SYSTEM (SEE NOTE 1/SECTION A/80-GA-03).

(2) WELL CASING PIPE = 14"ø STANDARD WEIGHT 316 SS PIPE.
PIPE SHALL HAVE WATER-PROOF JOINT W/ CONCRETE SLAB.

(3) DRAINAGE FILL – SEE NOTES (SOIL MATERIALS)/80-GA-01.

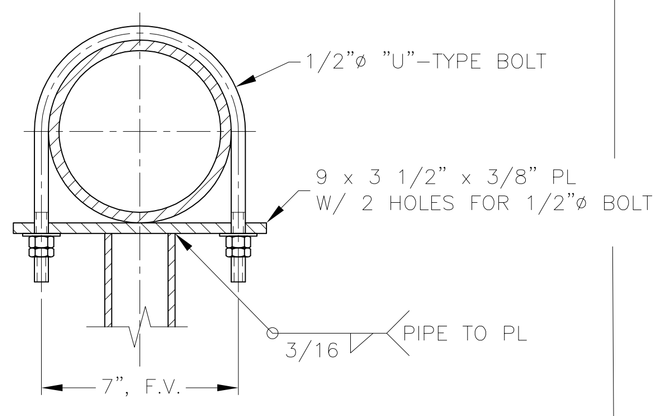
(4) EMBANKMENT FILL – SEE NOTES (EMBANKMENTS)/80-GA-01.

(5) PUMP STATION CONCRETE SLAB SHALL HAVE ADDITIONAL REINFORCEMENT AT PIPE (NOTE 2) THROUGH SLAB PENETRATION (SEE DTL F).

(6) BOTTOM OF VERTICAL TURBINE PUMPS BOWLS (BOTTOM OF STRAINER).

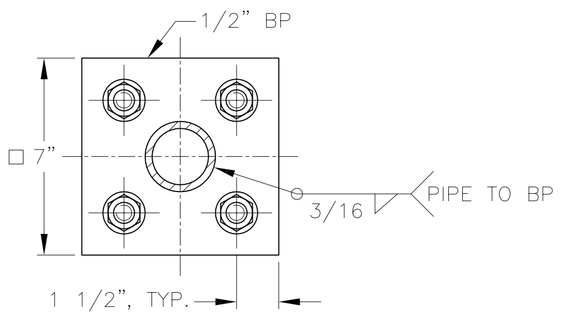
(7) SHAFT COLUMN ASSEMBLY OF VERTICAL TURBINE PUMP W/ BOWL UNIT AT THE END OF COLUMN ASSEMBLY.

(8) SEE PLAN A/80-GA-05 FOR SECTION THROUGH HEADER ELEV.



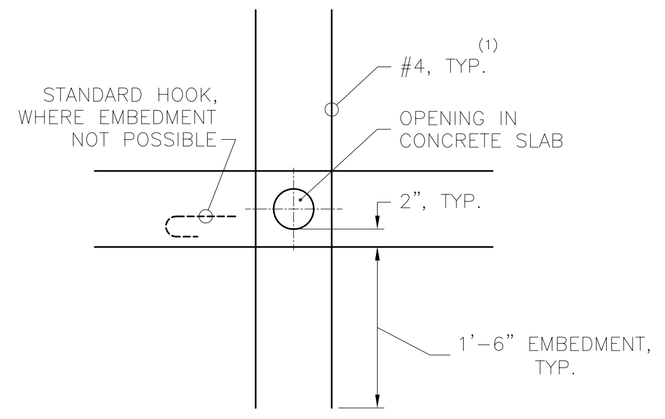
SECTION (B)

SCALE: 3" = 1'-0"



BASE PLATE PLAN (C)

SCALE: 3" = 1'-0"



WALL OPENING REINFORCING, TYPICAL (F)

SCALE: 1" = 1'-0"

(1) TWO LAYERS, ONE AT EACH FACE OF WALL.

PRELIMINARY
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11-06-2013

TOLERANCE UNLESS FRACTIONS ±
OTHERWISE SPECIFIED 0.00 ±
0.000 ±

CS Mining LLC

REVISIONS (DESTROY ALL PRINTS OF AN EARLIER DATE THAN LATEST REVISION)

REV	DESCRIPTION	BY	DATE
P1	FIRST REVIEW	HM	12/06/13

REV	DESCRIPTION	BY	DATE

PROJECT NO 2012-01
WESTERN STATES ENGINEERING
5210 E. Williams Circle, Suite 700
TUCSON, AZ 85711
PHONE: 520-889-2040 FAX: 520-889-2733

APPROVED FOR CONSTRUCTION	BY	DATE		BY	DATE
SAFETY			PROCESS ENGR.		
ENVIRONMENTAL			PROJECT ENGR.		
MAINTENANCE			ENGR. MNGR.		
PRODUCTION			PLANT MNGR.		
QLTY. CONTROL					

DESIGN	DATE
DRAWN BY AM	11/06/13
PROJ. ENGR. HM	
ENGR. MNGR.	

COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

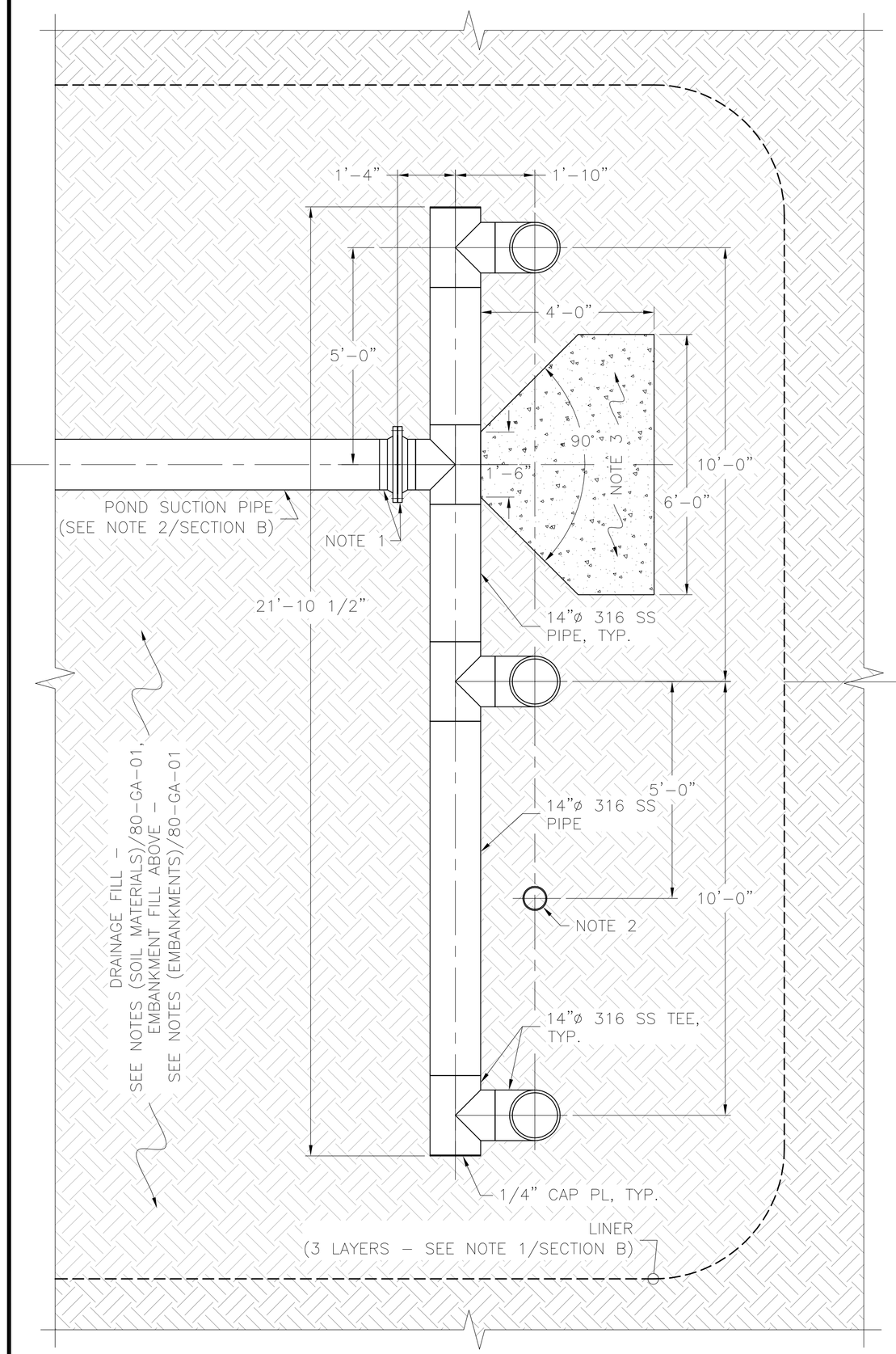
PONDS
SECTIONS AND DETAILS

SCALE: AS NOTED

DRAWING NO. 80-GA-04

SHEET 1 OF 1

REVISION P1



HEADER PLAN

SCALE: 1/2" = 1'-0" (A, 80-GA-04) PROJECT NORTH

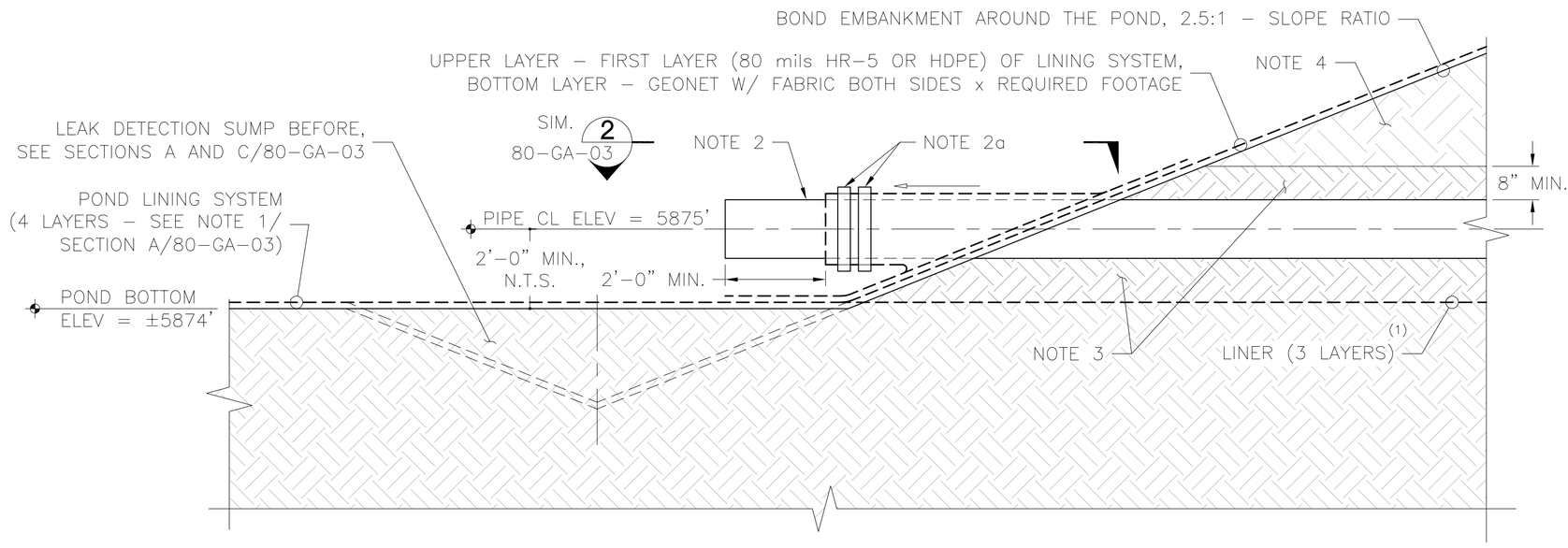
THIS SECTION IS SHOWN AT HEADER ELEV = 5878'.

WELD TEE TO PIPE/FLANGE/CAP PL SHALL BE: V-GROOVE OR BEVEL-GROOVE WELD ALL AROUND W/ 1/8" MIN. PENETRATION AND CONVEX CONTOUR.

(1) FLANGES SHALL BE 14"ø 316 SS RFWN FLANGES.

(2) 6"ø PVC WELL CASING PIPE FOR LEAK RECOVER PUMP.

(3) 2'-0" HIGH CONCRETE ANCHOR/THRUST BLOCK.
T.O.C. ELEV SHALL BE 1'-0" ABOVE POND SUCTION PIPE/TEE CL.
CONCRETE SHALL BE: TYPE "V" (3000 psi, 28 DAYS).



POND SUCTION PIPE SECTION

SCALE: 1" = 1/2 LOOKING WEST (B, 80-GA-01)

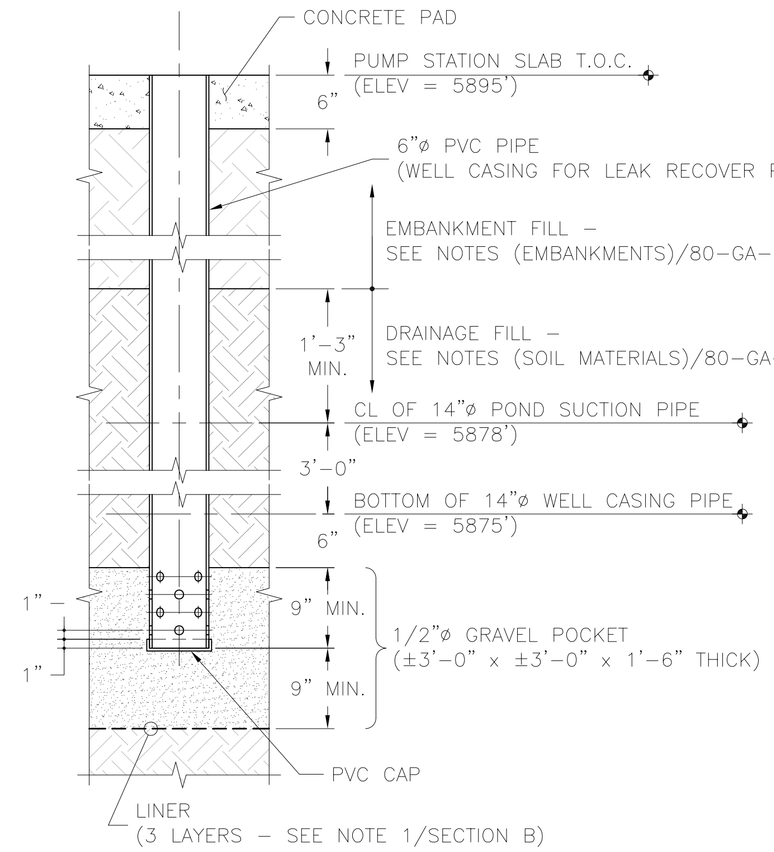
(1) UPPER LAYER – SECOND LAYER (GEONET WITH FABRIC BOTH SIDES) OF LINING SYSTEM,
MIDDLE LAYER – THIRD LAYER (60 mils HDPE) OF LINING SYSTEM,
BOTTOM LAYER – FOURTH LAYER (32 oz GEOTEXTILE) OF LINING SYSTEM (SEE NOTE 1/SECTION A/80-GA-03).

(2) POND SUCTION PIPE = 14"ø STANDARD WEIGHT 316 SS PIPE.
⟶ – PIPE SLOPE DIRECTION (1/4" MIN. PER FOOT).

(2a) SS BANDING, TYP (PIPE BOOT).

(3) DRAINAGE FILL – SEE NOTES (SOIL MATERIALS)/80-GA-01.

(4) EMBANKMENT FILL – SEE NOTES (EMBANKMENTS)/80-GA-01.



WELL CASING FOR LEAK RECOVER PUMP SECTION

SCALE: 1" = 1'-0" LOOKING WEST (C, 80-GA-04)

(1) PIPE SHALL HAVE WATER-PROOF JOINT W/ CONCRETE SLAB.
PROVIDE PERFORATION AT BOTTOM OF PIPE:
4 LAYERS MIN. AT 2" O.C. OF 4X EQUALLY SPACED 1"ø HOLES.
HOLES SHALL BE STAGGERED.

PRELIMINARY
NOT FOR CONSTRUCTION
11-06-2013

TOLERANCE UNLESS OTHERWISE SPECIFIED: FRACTIONS ±, 0.00 ±, 0.000 ±

CS Mining LLC

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WESTERN STATES ENGINEERING
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PHONE: 520-889-2040 FAX: 520-889-2733

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SAFETY			PROCESS ENGR.		
ENVIRONMENTAL			PROJECT ENGR.		
MAINTENANCE			ENGR. MNGR.		
PRODUCTION			PLANT MNGR.		
QLTY. CONTROL					

DESIGN	DATE
DRAWN BY AM	11/06/13
PROJ. ENGR. HM	
ENGR. MNGR.	

COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

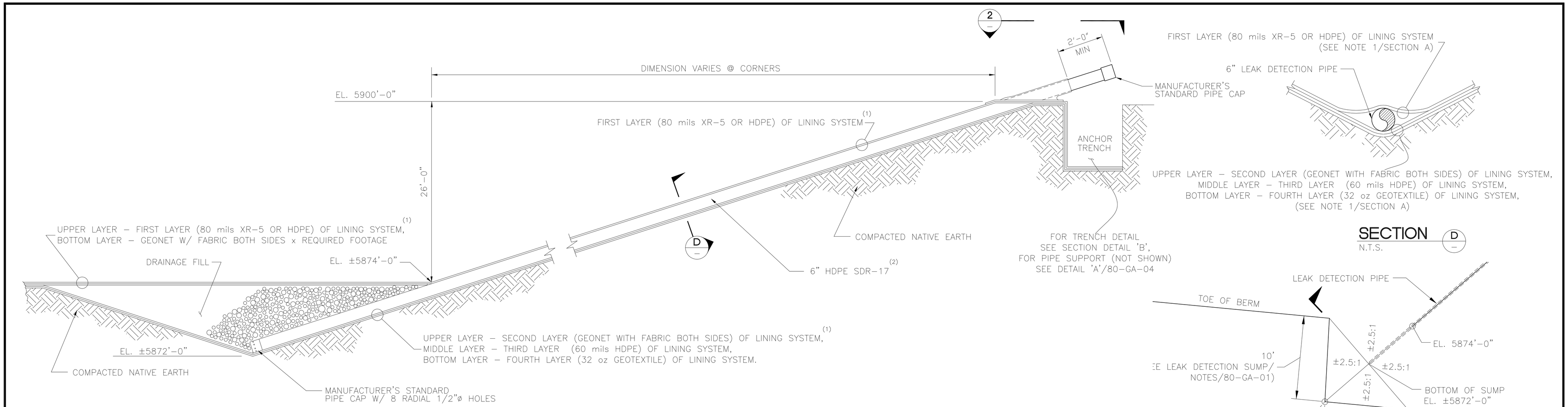
PONDS
SECTIONS AND DETAILS

SCALE: AS NOTED

DRAWING NO. 80-GA-05

SHEET 1 OF 1

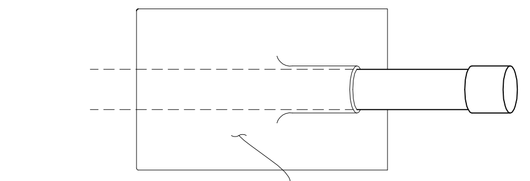
REVISION P1



SECTION A / N.T.S. / 80-GA-01

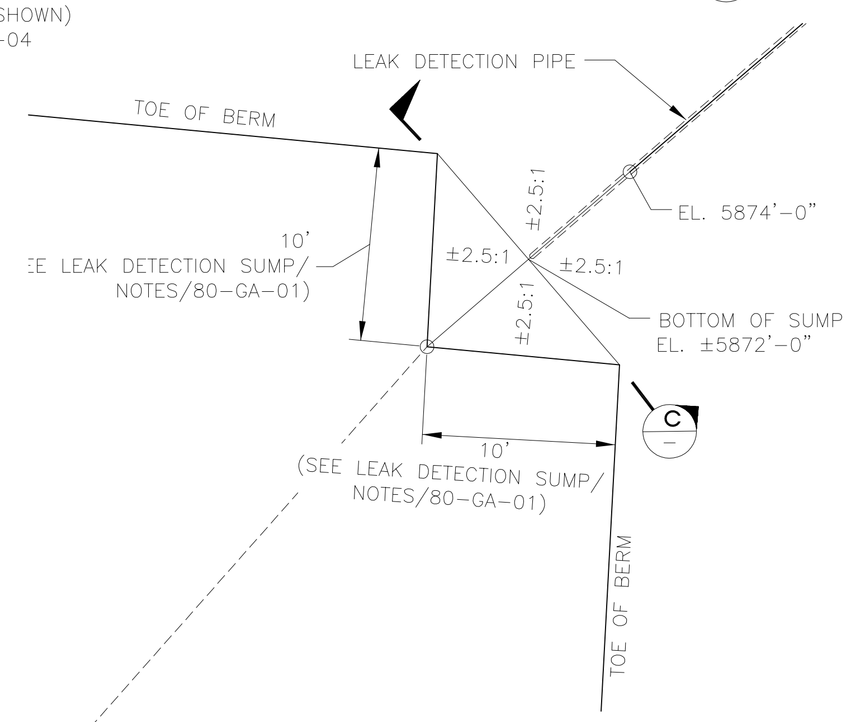
(1) POND LINING SYSTEM (BY OTHERS) SHALL CONSISTS OF FOUR LAYERS:
FIRST (UPPER) LAYER - 80 mils XR-5 OR HDPE,
SECOND LAYER - GEONET (WITH FABRIC BOTH SIDES),
THIRD LAYER - 60 mils HDPE,
FOURTH (BOTTOM) LAYER - 32 oz GEOTEXTILE.

(2) SEE DETAIL 'A'/80-GA-04 FOR PIPE SUPPORT AT ANCHOR TRENCH (NOT SHOWN).

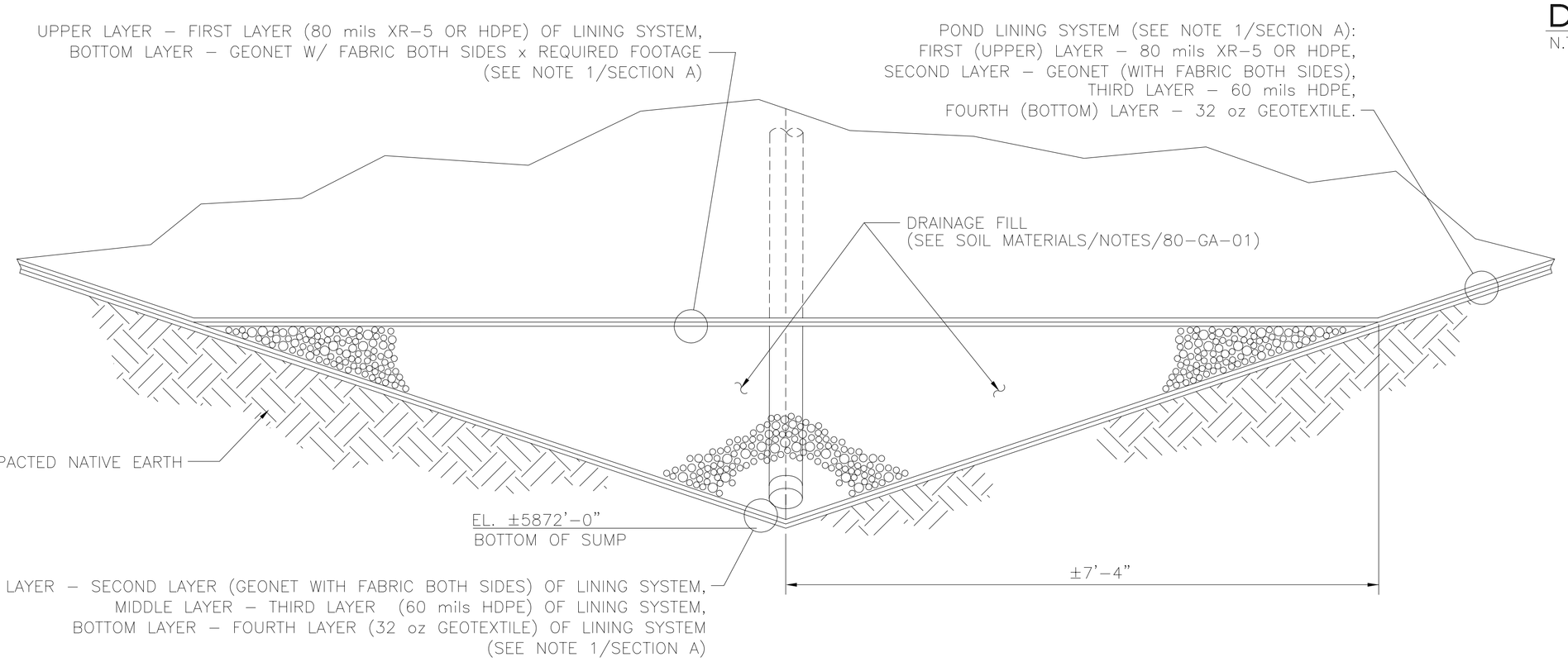


DETAIL 2 / N.T.S.

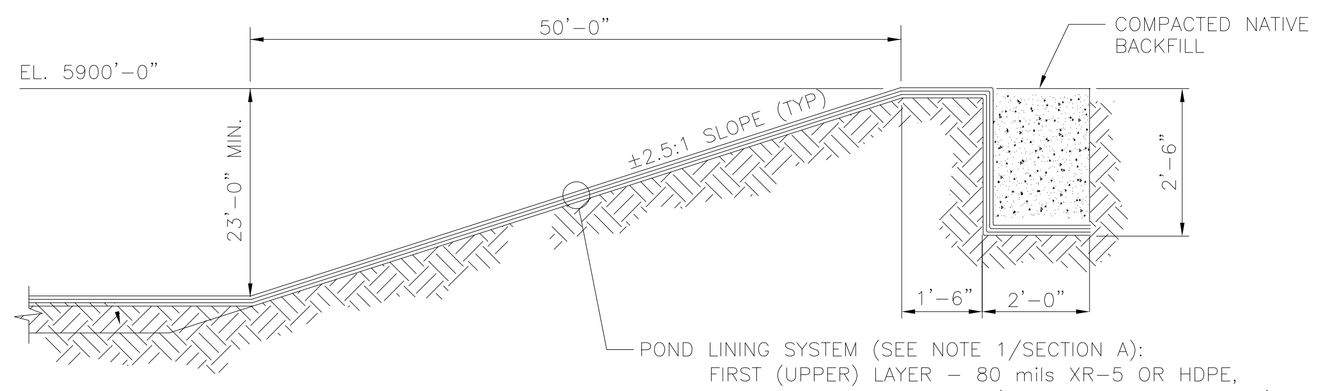
SECTION D / N.T.S.



TYPICAL LEAK DETECTION SUMP 1 / 80-GA-01 / N.T.S.



SECTION C / N.T.S.



SECTION B / N.T.S.

PRELIMINARY
NOT FOR CONSTRUCTION
11-06-2013

TOLERANCE UNLESS OTHERWISE SPECIFIED
FRACTIONS ±
0.00 ±
0.000 ±

CS Mining LLC

REVISIONS (DESTROY ALL PRINTS OF AN EARLIER DATE THAN LATEST REVISION)

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PHONE: 520-889-2040 FAX: 520-889-2733

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MAINTENANCE			ENGR. MNGR.		
PRODUCTION			PLANT MNGR.		
QLTY. CONTROL					

DESIGN	DATE
DRAWN BY AM	11/06/13
PROJ. ENGR. HM	
ENGR. MNGR.	

COPPER LEACH/CCD PROJECT - PHASE 1
SOLVENT EXTRACTION, ELECTROWINNING

PONDS
SECTIONS AND DETAILS

SCALE: AS NOTED

DRAWING NO. 80-GA-03

SHEET 1 OF 1

REVISION P1

APPENDIX C

Facilities Disturbance & Reclamation

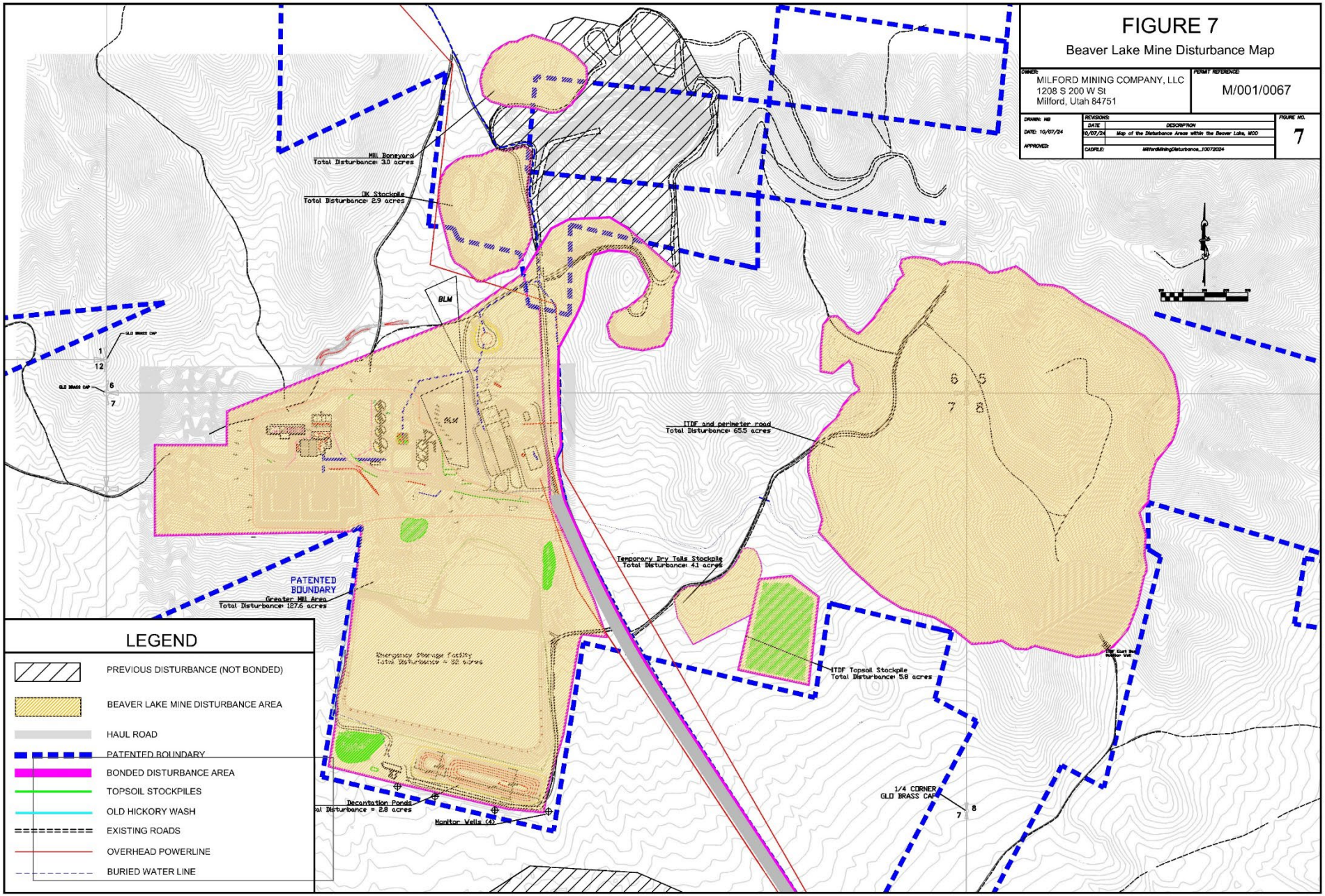


FIGURE 7
Beaver Lake Mine Disturbance Map
OWNER:
MILFORD MINING COMPANY, LLC
1208 S 200 W St
Milford, Utah 84751
PERMIT REFERENCE:
M/001/0067
DRAWN: NB
DATE: 10/07/24
APPROVED:
REVISIONS:
DATE
DESCRIPTION
10/07/24
Map of the Disturbance Areas within the Beaver Lake, MDO
DATAFILE:
MilfordMiningDisturbance_10072024
FIGURE NO.
7
Mill Boneyard
Total Disturbance: 3.0 acres
DK Stockpile
Total Disturbance: 2.9 acres
BLM
ITDF and perimeter road
Total Disturbance: 65.5 acres
Temporary Dry Tails Stockpile
Total Disturbance: 4.1 acres
PATENTED
BOUNDARY
Greater Mill Area
Total Disturbance: 127.6 acres
Emergency Storage Facility
Total Disturbance = 32 acres
ITDF Topsoil Stockpile
Total Disturbance: 5.8 acres
Decantation Ponds
Total Disturbance = 2.8 acres
Monitor Wells (4)
1/4 CORNER
GLO BRASS CAP
LEGEND
PREVIOUS DISTURBANCE (NOT BONDED)
BEAVER LAKE MINE DISTURBANCE AREA
HAUL ROAD
PATENTED BOUNDARY
BONDED DISTURBANCE AREA
TOPSOIL STOCKPILES
OLD HICKORY WASH
EXISTING ROADS
OVERHEAD POWERLINE
BURIED WATER LINE

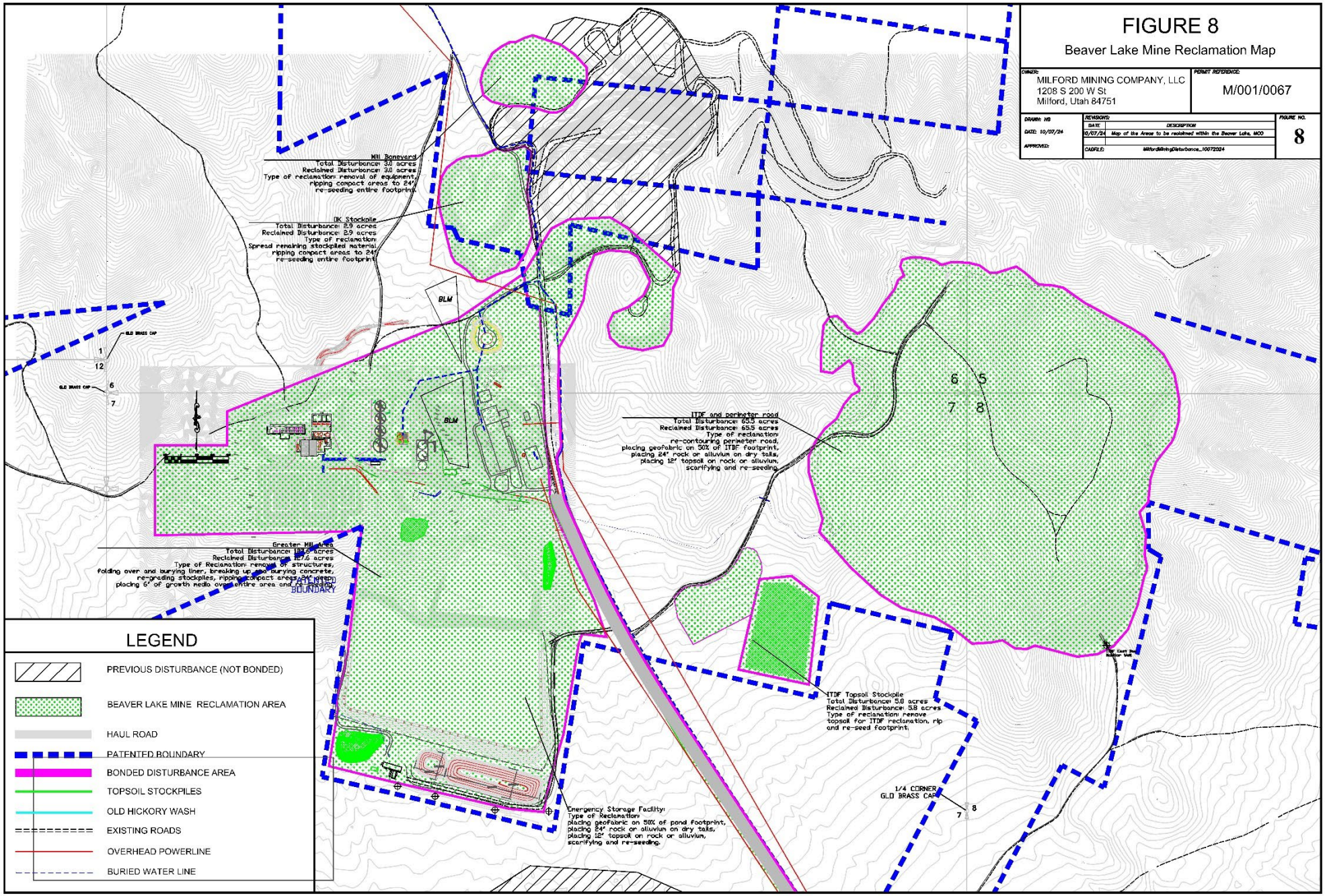


FIGURE 8
Beaver Lake Mine Reclamation Map
OWNER:
MILFORD MINING COMPANY, LLC
1208 S 200 W St
Milford, Utah 84751
PERMIT REFERENCE:
M/001/0067
DRAWN: NG
DATE: 10/07/24
APPROVED:
REVISIONS:
DATE
DESCRIPTION
10/07/24
Map of the Areas to be reclaimed within the Beaver Lake, MCO
CADFILE:
MilfordMiningDisturbance_10072024
FIGURE NO.
8
Mill Boneyard
Total Disturbance: 3.0 acres
Reclaimed Disturbance: 3.0 acres
Type of reclamation: removal of equipment, ripping compact areas to 24" re-seeding entire footprint.
DK Stockpile
Total Disturbance: 2.9 acres
Reclaimed Disturbance: 2.9 acres
Type of reclamation:
Spread remaining stockpiled material ripping compact areas to 24" re-seeding entire footprint.
BLM
BLM
GLO BRASS CAP
GLO BRASS CAP
1
12
6
7
ITDF and perimeter road
Total Disturbance: 65.5 acres
Reclaimed Disturbance: 65.5 acres
Type of reclamation:
re-contouring perimeter road, placing geofabric on 50% of ITDF footprint, placing 24" rock or alluvium on dry tails, placing 12" topsoil on rock or alluvium, scarifying and re-seeding.
6
5
7
8
Greater Mill Area
Total Disturbance: 127.6 acres
Reclaimed Disturbance: 127.6 acres
Type of Reclamation: removal of structures, folding over and burying liner, breaking up and burying concrete, re-grading stockpiles, ripping compact areas 24" deep, placing 6" of growth media over entire area and re-seeding.
PATENTED BOUNDARY
ITDF Topsoil Stockpile
Total Disturbance: 5.8 acres
Reclaimed Disturbance: 5.8 acres
Type of reclamation: remove topsoil for ITDF reclamation, rip and re-seed footprint.
1/4 CORNER
GLO BRASS CAP
7
8
Emergency Storage Facility:
Type of Reclamation:
placing geofabric on 50% of pond footprint, placing 24" rock or alluvium on dry tails, placing 12" topsoil on rock or alluvium, scarifying and re-seeding.
LEGEND
PREVIOUS DISTURBANCE (NOT BONDED)
BEAVER LAKE MINE RECLAMATION AREA
HAUL ROAD
PATENTED BOUNDARY
BONDED DISTURBANCE AREA
TOPSOIL STOCKPILES
OLD HICKORY WASH
EXISTING ROADS
OVERHEAD POWERLINE
BURIED WATER LINE

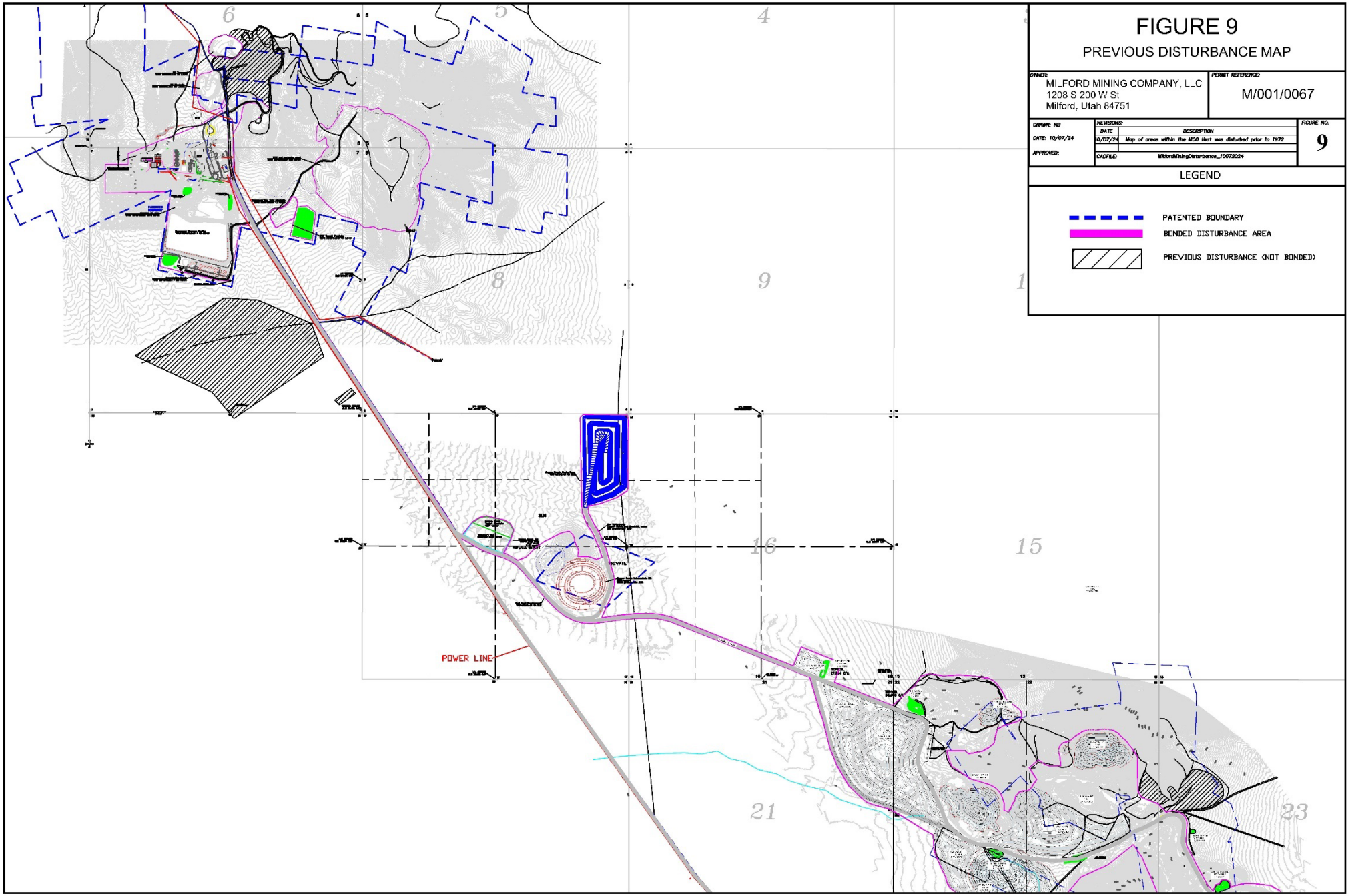
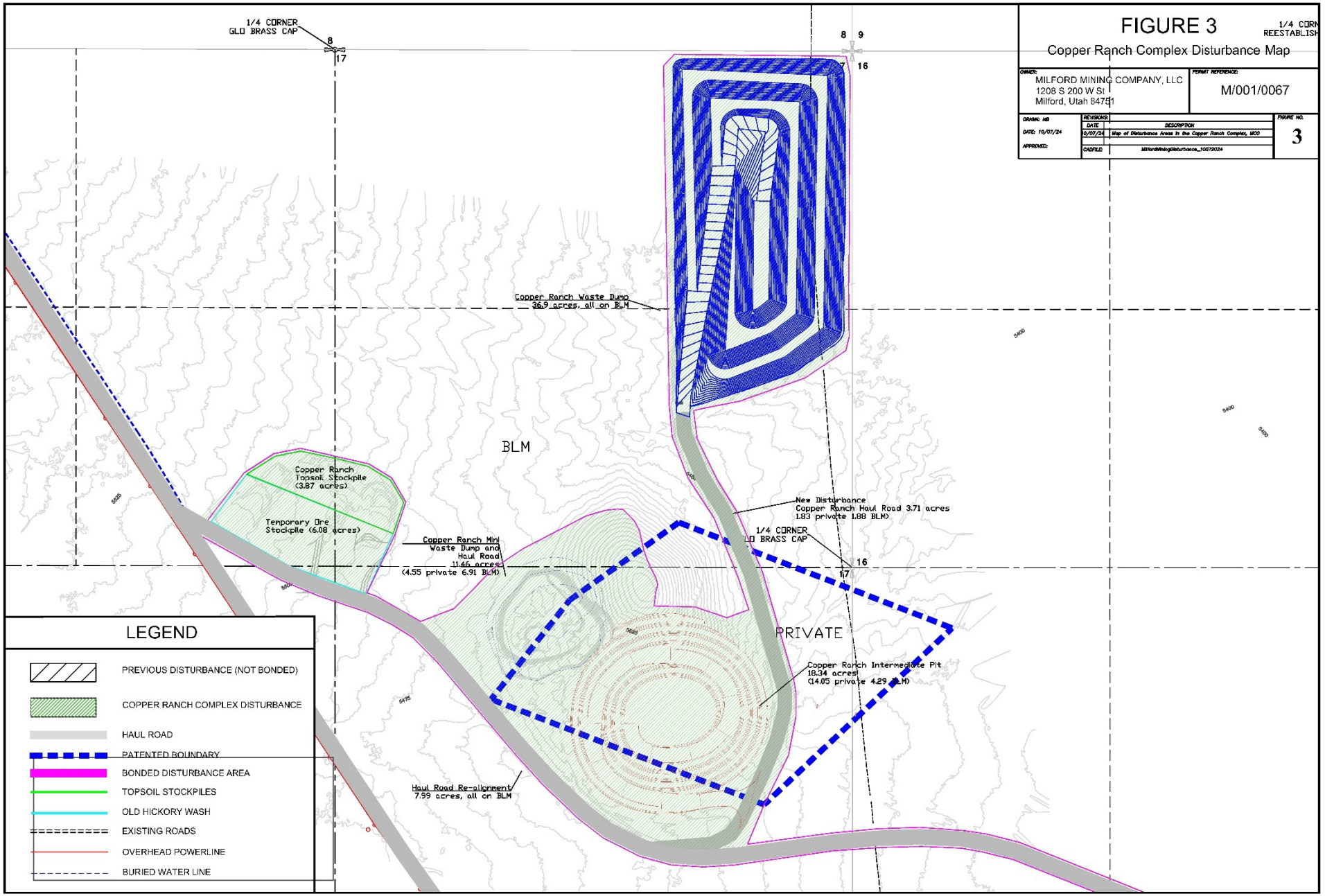
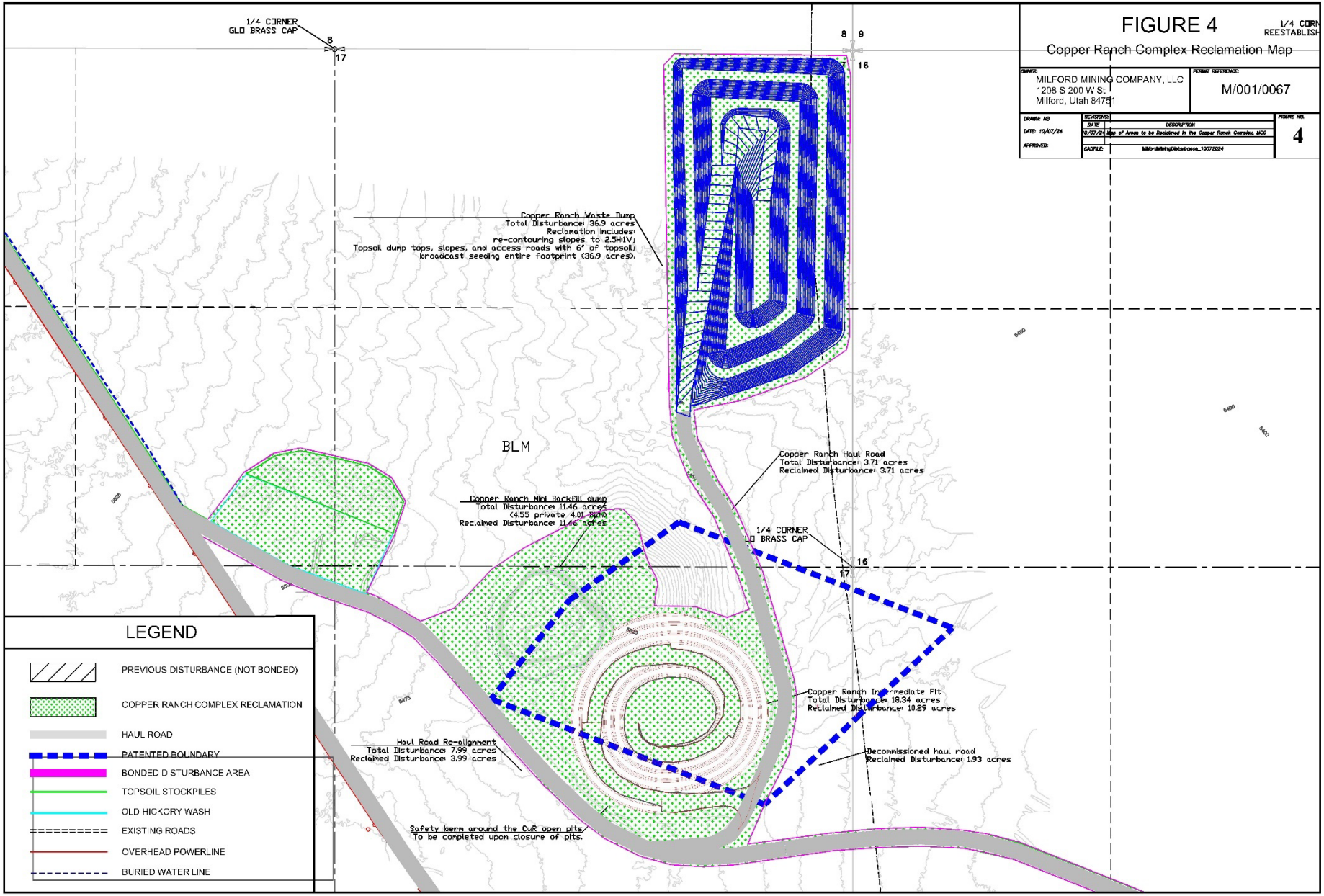


FIGURE 9
PREVIOUS DISTURBANCE MAP
OWNER:
MILFORD MINING COMPANY, LLC
1208 S 200 W St
Milford, Utah 84751
PERMIT REFERENCE:
M/001/0067
DRAWN: ND
DATE: 10/07/24
APPROVED:
REVISIONS:
DATE
DESCRIPTION
10/07/24
Map of areas within the MCO that was disturbed prior to 1972
CADFILE:
MilfordMiningDisturbance_10072024
FIGURE NO.
9
LEGEND
PATENTED BOUNDARY
BONDED DISTURBANCE AREA
PREVIOUS DISTURBANCE (NOT BONDED)
POWER LINE
6
5
4
8
9
16
15
21
23

APPENDIX D

Mine Maps – Pit & Dump Design , Disturbance & Reclamation


1/4 CORNER
GLO BRASS CAP
8
17
8 9
16
Copper Ranch Waste Dump
36.9 acres, all on BLM
BLM
Copper Ranch
Topsoil Stockpile
(3.87 acres)
Temporary Ore
Stockpile (6.08 acres)
Copper Ranch Mini
Waste Dump and
Haul Road
11.46 acres
(4.55 private 6.91 BLM)
New Disturbance
Copper Ranch Haul Road 3.71 acres
1.83 private 1.88 BLM)
1/4 CORNER
GLO BRASS CAP
16
17
PRIVATE
Copper Ranch Intermediate Pit
18.34 acres
(14.05 private 4.29 BLM)
Haul Road Re-alignment
7.99 acres, all on BLM
LEGEND
PREVIOUS DISTURBANCE (NOT BONDED)
COPPER RANCH COMPLEX DISTURBANCE
HAUL ROAD
PATENTED BOUNDARY
BONDED DISTURBANCE AREA
TOPSOIL STOCKPILES
OLD HICKORY WASH
EXISTING ROADS
OVERHEAD POWERLINE
BURIED WATER LINE
FIGURE 3
1/4 CORN
REESTABLISH
Copper Ranch Complex Disturbance Map
OWNER:
MILFORD MINING COMPANY, LLC
1208 S 200 W St
Milford, Utah 84751
PERMIT REFERENCE:
M/001/0067
DRAWN: NB
DATE: 10/07/24
APPROVED:
REVISIONS:
DATE
DESCRIPTION
10/07/24
Map of Disturbance Areas in the Copper Ranch Complex, MCO
CADFILE:
MilfordMiningDisturbance_10072024
FIGURE NO.
3


1/4 CORNER
GLO BRASS CAP
8
17
8 9
16
FIGURE 4
Copper Ranch Complex Reclamation Map
1/4 CORN
REESTABLISH
OWNER:
MILFORD MINING COMPANY, LLC
1208 S 200 W St
Milford, Utah 84751
PERMIT REFERENCE:
M/001/0067
DRAWN: MB
DATE: 10/07/24
APPROVED:
REVISIONS
DATE
DESCRIPTION
10/07/24 Map of Areas to be Reclaimed in the Copper Ranch Complex, MCO
CADFILE: MilfordMiningDisturbance_10072024
FIGURE NO.
4
Copper Ranch Waste Dump
Total Disturbance: 36.9 acres
Reclamation includes:
re-contouring slopes to 2.5H:1V;
Topsoil dump tops, slopes, and access roads with 6" of topsoil;
broadcast seeding entire footprint (36.9 acres).
BLM
Copper Ranch Haul Road
Total Disturbance: 3.71 acres
Reclaimed Disturbance: 3.71 acres
Copper Ranch Mini Backfill dump
Total Disturbance: 11.46 acres
(4.55 private 4.01 BLM)
Reclaimed Disturbance: 11.46 acres
1/4 CORNER
GLO BRASS CAP
16
17
Copper Ranch Intermediate Pit
Total Disturbance: 18.34 acres
Reclaimed Disturbance: 10.29 acres
Haul Road Re-alignment
Total Disturbance: 7.99 acres
Reclaimed Disturbance: 3.99 acres
Decommissioned haul road
Reclaimed Disturbance: 1.93 acres
Safety berm around the CuR open pits
To be completed upon closure of pits.
LEGEND
PREVIOUS DISTURBANCE (NOT BONDED)
COPPER RANCH COMPLEX RECLAMATION
HAUL ROAD
PATENTED BOUNDARY
BONDED DISTURBANCE AREA
TOPSOIL STOCKPILES
OLD HICKORY WASH
EXISTING ROADS
OVERHEAD POWERLINE
BURIED WATER LINE

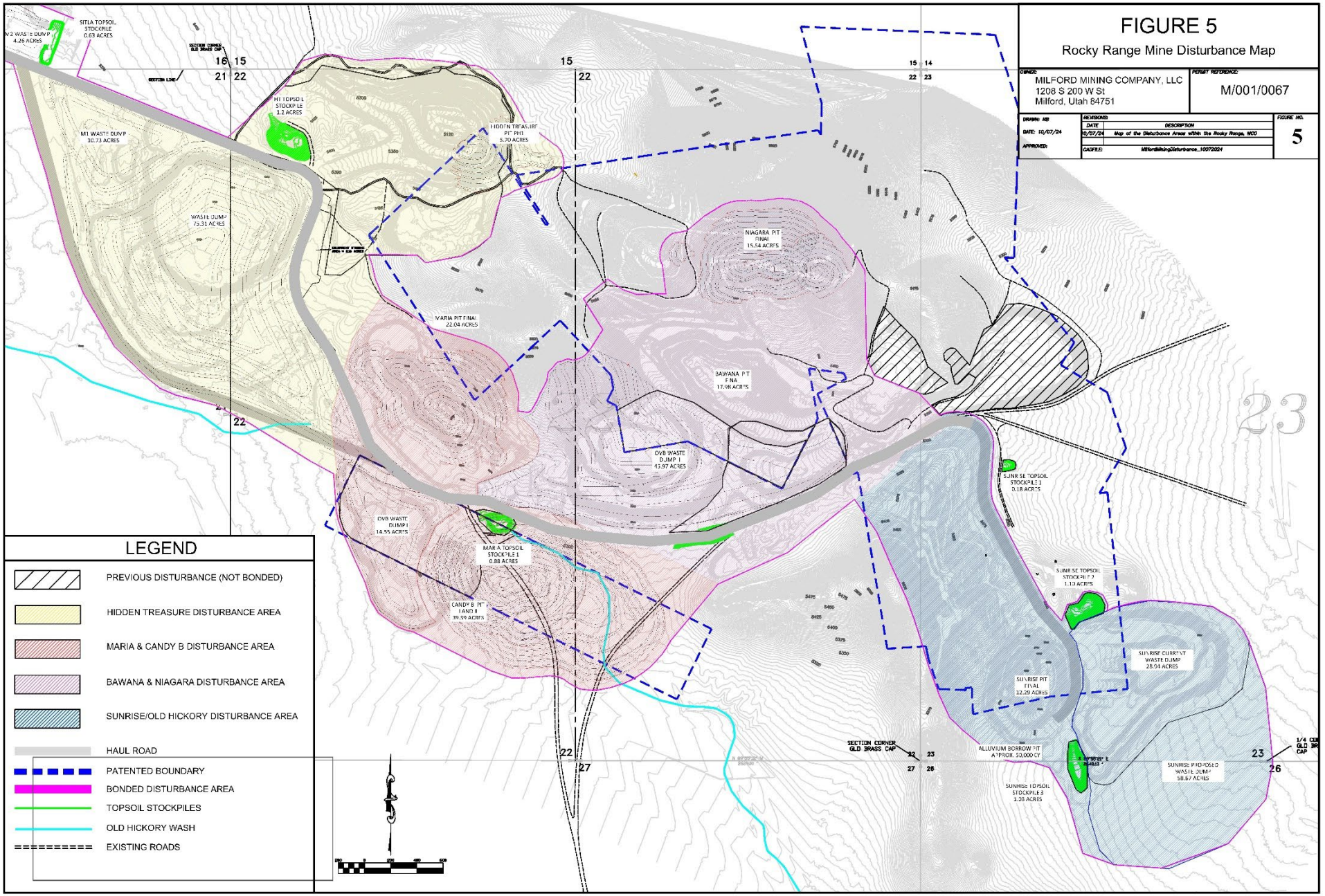


FIGURE 5
Rocky Range Mine Disturbance Map
OWNER:
MILFORD MINING COMPANY, LLC
1208 S 200 W St
Milford, Utah 84751
PERMIT REFERENCE:
M/001/0067
DRAWN: MB
DATE: 10/07/24
APPROVED:
REVISIONS
DATE
DESCRIPTION
10/07/24
Map of the Disturbance Areas within the Rocky Range, MCO
CADFILE:
MilfordMiningDisturbance_10072024
FIGURE NO.
5
SITLA TOPSOIL STOCKPILE 0.63 ACRES
M2 WASTE DUMP 4.26 ACRES
M1 TOPSOIL STOCKPILE 3.2 ACRES
HIDDEN TREASURE PIT PIT 5.70 ACRES
M1 WASTE DUMP 30.73 ACRES
WASTE DUMP 73.31 ACRES
NIAGARA PIT FINAL 15.54 ACRES
MARIA PIT FINAL 22.04 ACRES
BAWANA PIT FINA 17.98 ACRES
OVB WASTE DUMP I 42.87 ACRES
OVB WASTE DUMP I 14.55 ACRES
SUNR SE TOPSOIL STOCKPILE 1 0.18 ACRES
MARIA TOPSOIL STOCKPILE 1 0.88 ACRES
SUNRISE TOPSOIL STOCKPILE 2 1.10 ACRES
CANDY B PIT LAND II 39.59 ACRES
SUNRISE CURRENT WASTE DUMP 28.94 ACRES
SUNRISE PIT FINAL 12.29 ACRES
SECTION CORNER OLD BRASS CAP
ALLUVIUM BORROW PIT APPROX. 50,000 CY
SUNRISE PROPOSED WASTE DUMP 58.67 ACRES
SUNRISE TOPSOIL STOCKPILE 3 3.33 ACRES
1/4 CEN OLD BR CAP
LEGEND
PREVIOUS DISTURBANCE (NOT BONDED)
HIDDEN TREASURE DISTURBANCE AREA
MARIA & CANDY B DISTURBANCE AREA
BAWANA & NIAGARA DISTURBANCE AREA
SUNRISE/OLD HICKORY DISTURBANCE AREA
HAUL ROAD
PATENTED BOUNDARY
BONDED DISTURBANCE AREA
TOPSOIL STOCKPILES
OLD HICKORY WASH
EXISTING ROADS

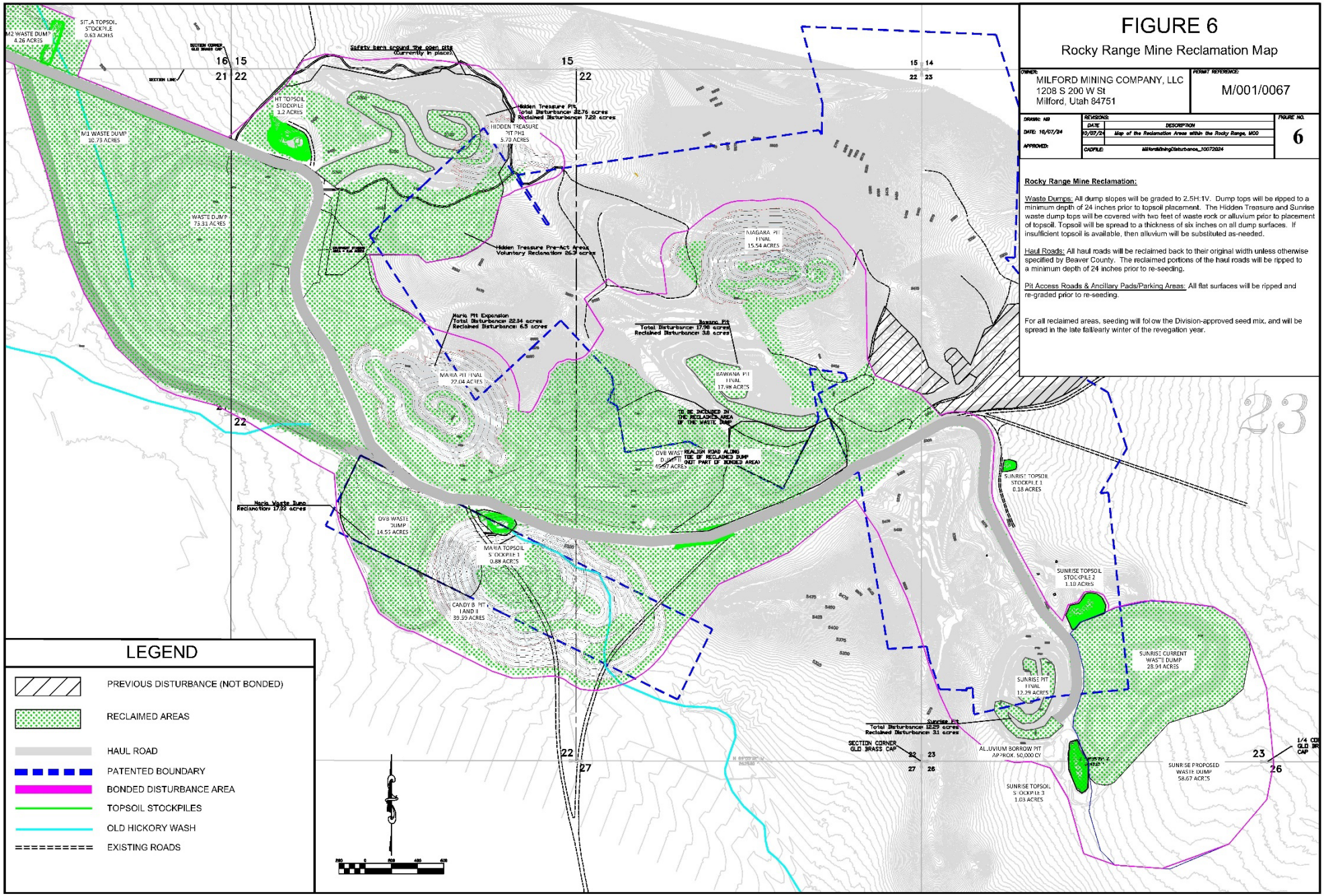
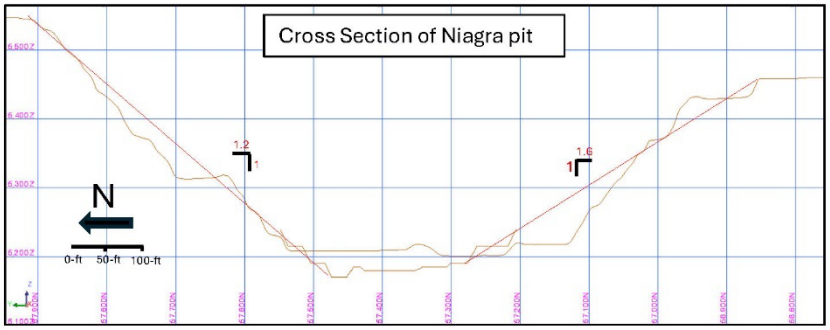


FIGURE 6
Rocky Range Mine Reclamation Map
OWNER:
MILFORD MINING COMPANY, LLC
1208 S 200 W St
Milford, Utah 84751
PERMIT REFERENCE:
M/001/0067
DRAWN: NB
DATE: 10/07/24
APPROVED:
REVISIONS:
DATE
DESCRIPTION
10/07/24
Map of the Reclamation Areas within the Rocky Range, MCO
CADFILE:
MilfordMiningDisturbance_10072024
FIGURE NO.
6
Rocky Range Mine Reclamation:
Waste Dumps: All dump slopes will be graded to 2.5H:1V. Dump tops will be ripped to a minimum depth of 24 inches prior to topsoil placement. The Hidden Treasure and Sunrise waste dump tops will be covered with two feet of waste rock or alluvium prior to placement of topsoil. Topsoil will be spread to a thickness of six inches on all dump surfaces. If insufficient topsoil is available, then alluvium will be substituted as-needed.
Haul Roads: All haul roads will be reclaimed back to their original width unless otherwise specified by Beaver County. The reclaimed portions of the haul roads will be ripped to a minimum depth of 24 inches prior to re-seeding.
Pit Access Roads & Ancillary Pads/Parking Areas: All flat surfaces will be ripped and re-graded prior to re-seeding.
For all reclaimed areas, seeding will follow the Division-approved seed mix, and will be spread in the late fall/early winter of the revegation year.
LEGEND
PREVIOUS DISTURBANCE (NOT BONDED)
RECLAIMED AREAS
HAUL ROAD
PATENTED BOUNDARY
BONDED DISTURBANCE AREA
TOPSOIL STOCKPILES
OLD HICKORY WASH
EXISTING ROADS
SITE A TOPSOIL STOCKPILE 0.63 ACRES
M2 WASTE DUMP 4.26 ACRES
M1 WASTE DUMP 10.75 ACRES
HT TOPSOIL STOCKPILE 1.2 ACRES
WASTE DUMP 73.31 ACRES
Safety berm around the open pits (Currently in place)
Hidden Treasure Pit
Total Disturbance 22.76 acres
Reclaimed Disturbance 7.22 acres
HIDDEN TREASURE PIT PH1 5.70 ACRES
Hidden Treasure Pre-Act Area
Voluntary Reclamation 26.3 acres
NIAGARA PIT FINAL 15.54 ACRES
Maria Pit Expansion
Total Disturbance 22.84 acres
Reclaimed Disturbance 6.5 acres
Bawana Pit
Total Disturbance 17.98 acres
Reclaimed Disturbance 3.6 acres
MARIA PIT FINAL 22.04 ACRES
BAWANA PIT FINAL 17.98 ACRES
TO BE INCLUDED IN THE RECLAIMED AREA OF THE WASTE DUMP
OVB WASTE DUMP 45.67 ACRES
REALIGN ROAD ALONG TOE OF RECLAIMED DUMP (NOT PART OF BONDED AREA)
Maria Waste Dump Reclamation 17.33 acres
OVB WASTE DUMP 14.55 ACRES
MARIA TOPSOIL STOCKPILE 1 0.88 ACRES
CANDY B PIT 1 AND 2 39.39 ACRES
SUNRISE TOPSOIL STOCKPILE 1 0.18 ACRES
SUNRISE TOPSOIL STOCKPILE 2 1.10 ACRES
SUNRISE CURRENT WASTE DUMP 28.94 ACRES
SUNRISE PIT FINAL 12.29 ACRES
Sunrise Pit
Total Disturbance 12.29 acres
Reclaimed Disturbance 31 acres
ALUVIUM BORROW PIT APPROX. 50,000 CY
SUNRISE TOPSOIL STOCKPILE 3 1.03 ACRES
SUNRISE PROPOSED WASTE DUMP 58.67 ACRES
SECTION CORNER OLD BRASS CAP
1/4 COR OLD BRASS CAP
16 15 21 22
15 22
15 14 22 23
22 27
23 26
23



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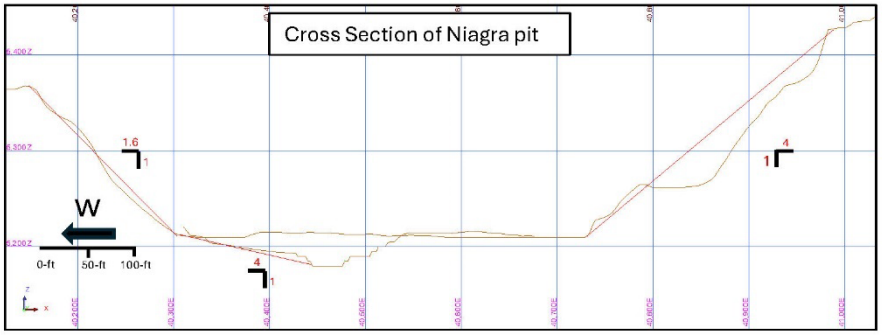

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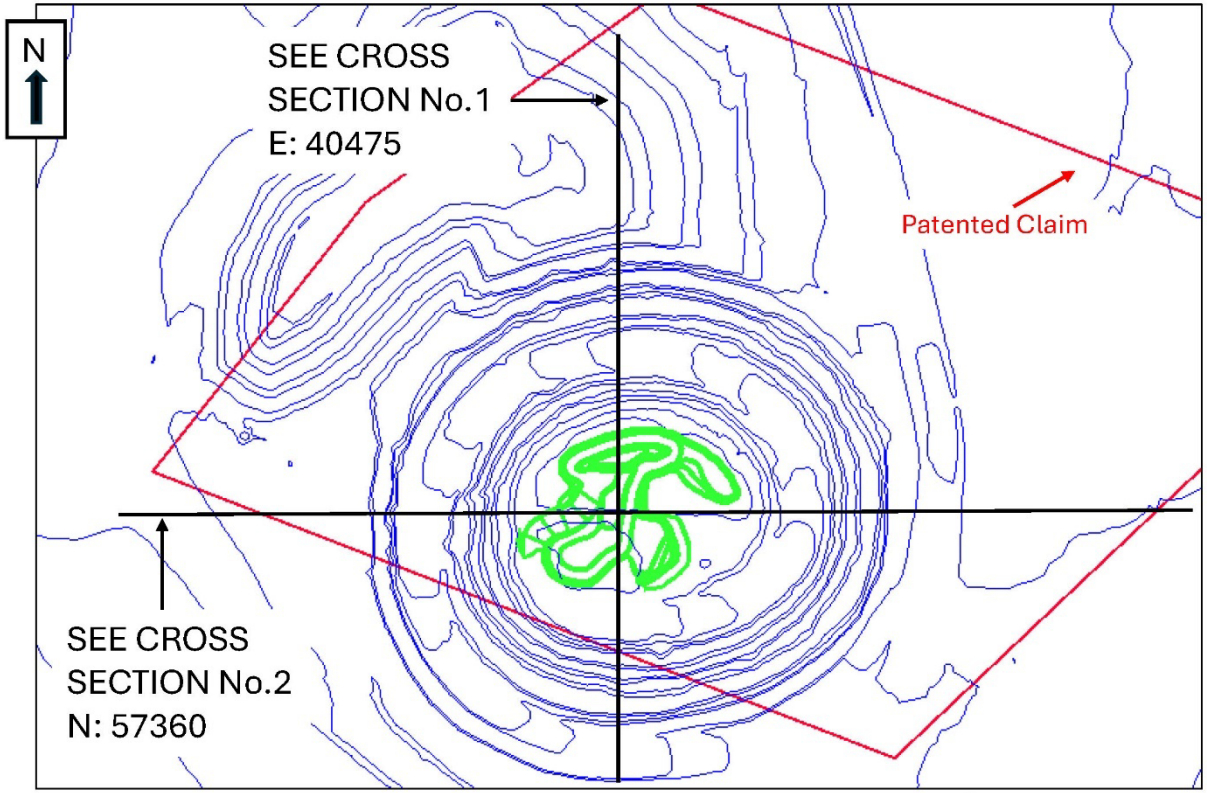

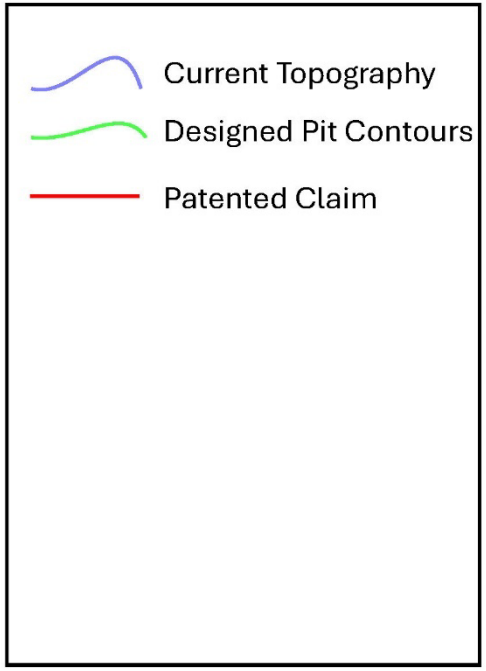

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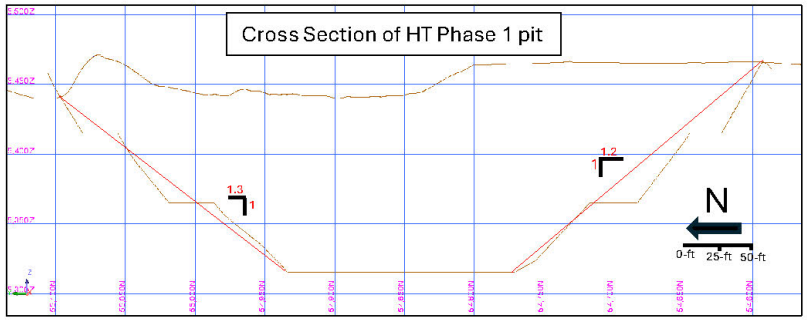
FIGURE 10 – COPPER RANCH PIT DESIGN WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTION 17

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:

DATE	DESCRIPTION
10-1-24	Copper Ranch Pit Design and Profiles



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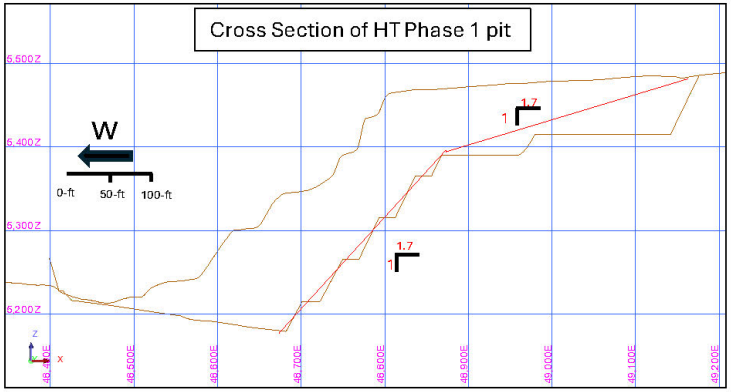

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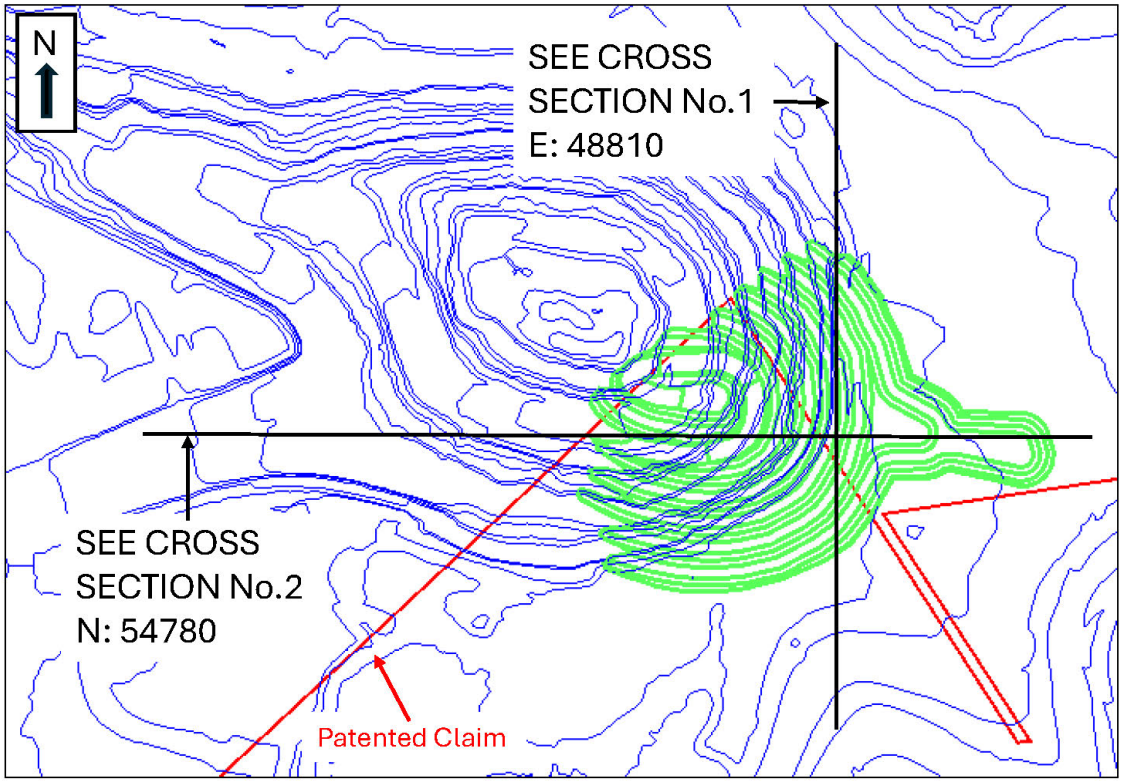

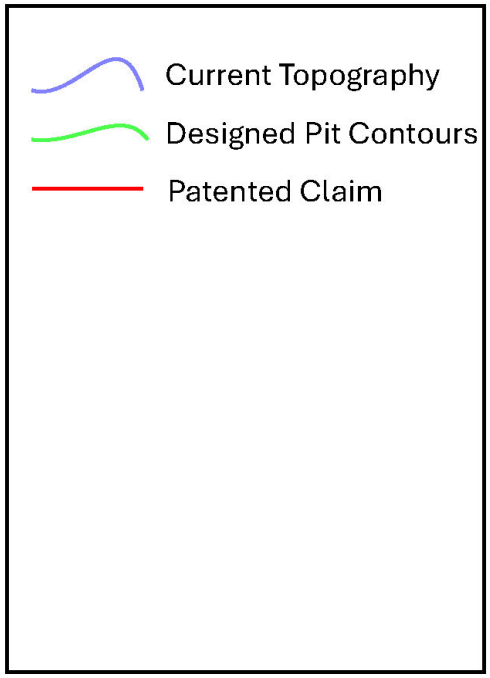

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FIGURE 11 – HIDDEN TREASURE PHASE 1 PIT DESIGN WITH CROSS SECTIONS

Milord Mining Company

Utah

WITHIN SECTION 22

MILFORD MINING COMPANY
UTAH

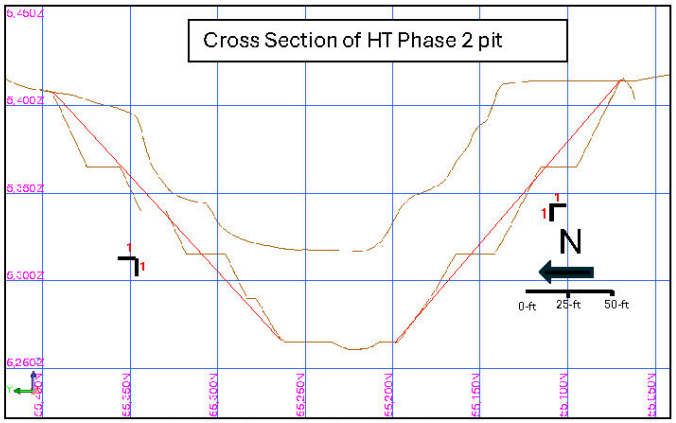
DRAWN: Kyle Schuerg

DATE: Oct. 1, 2024

APPROVED:

REVISION:

DATE	DESCRIPTION
10-1-24	HT Ph1 Pit Design and Profiles



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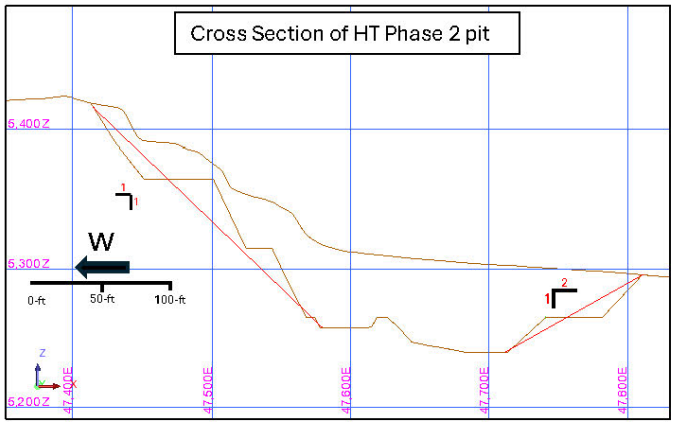

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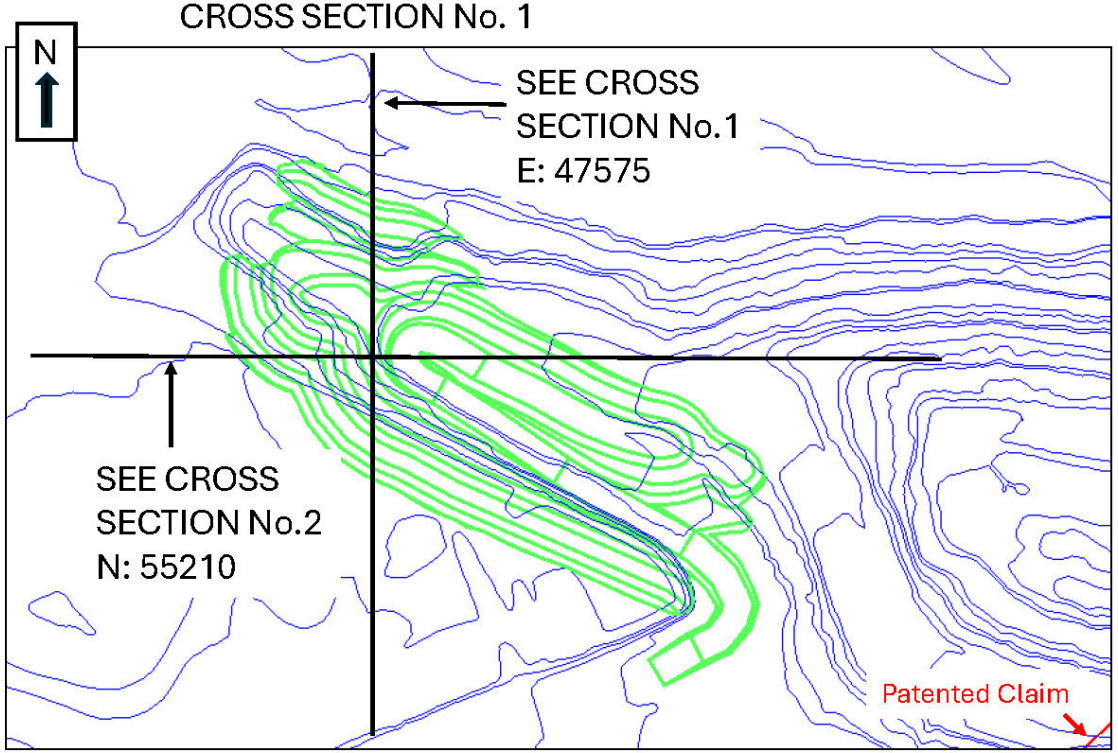

Current Topography

Designed Pit Contours

Patented Claim

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FIGURE 12 – HIDDEN TREASURE PHASE 2 PIT DESIGN WITH CROSS SECTIONS

Milord Mining Company

Utah

WITHIN SECTIONS 15 & 22

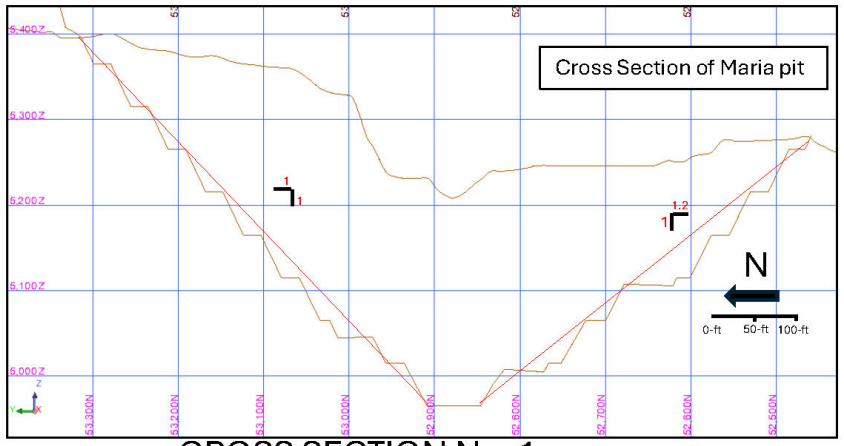
MILFORD MINING COMPANY UTAH

DRAWN: Kyle Schuerg

DATE: Oct. 1, 2024

APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	HT Ph2 Pit Design and Profiles



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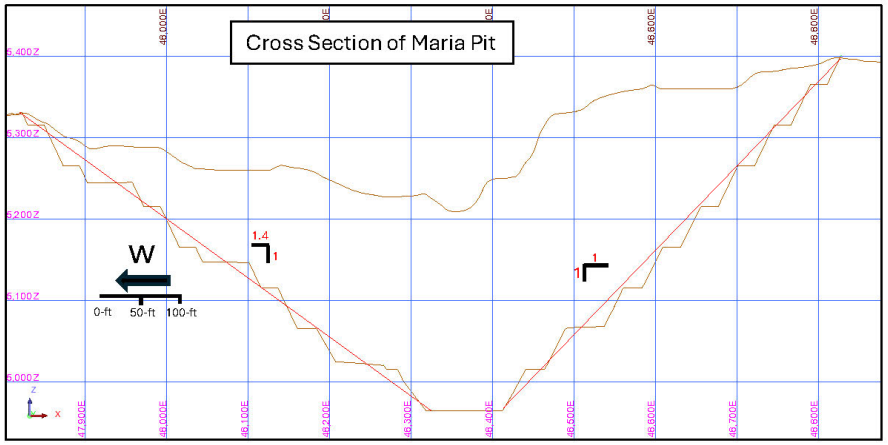

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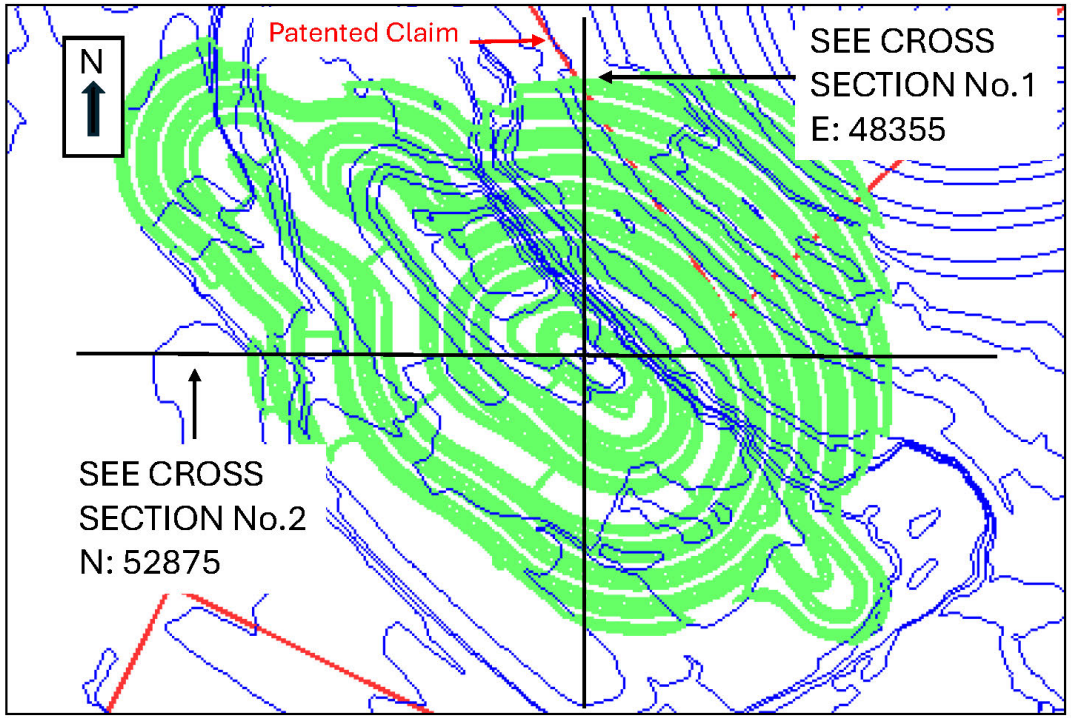

Current Topography

Designed Pit Contours

Patented Claim

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FIGURE 13 – MARIA PIT DESIGN WITH CROSS SECTIONS

Milord Mining Company

Utah

WITHIN SECTIONS 22

MILFORD MINING COMPANY
UTAH

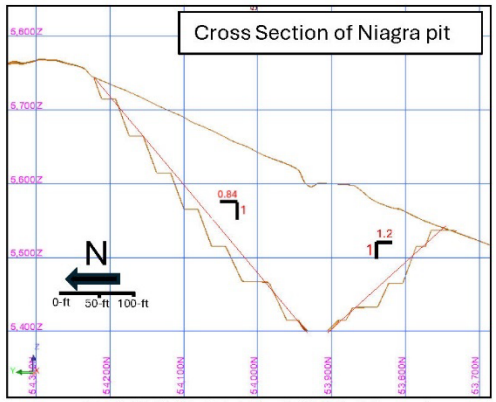
DRAWN: Kyle Schuerg

DATE: Oct. 1, 2024

APPROVED:

REVISION:

DATE	DESCRIPTION
10-1-24	Maria Pit Design and Profiles



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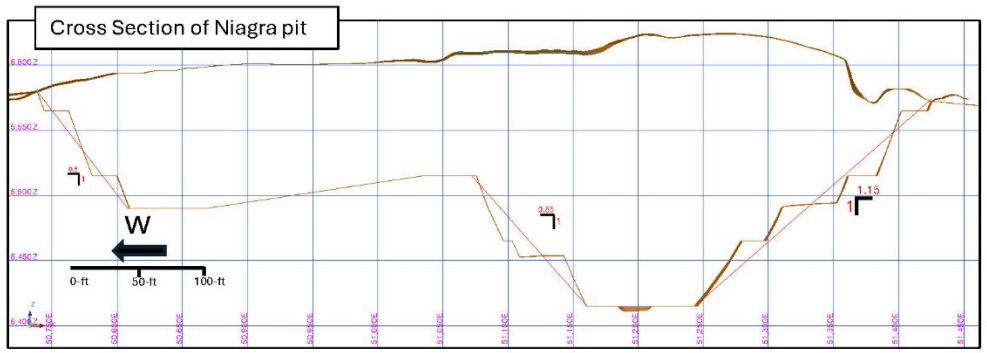

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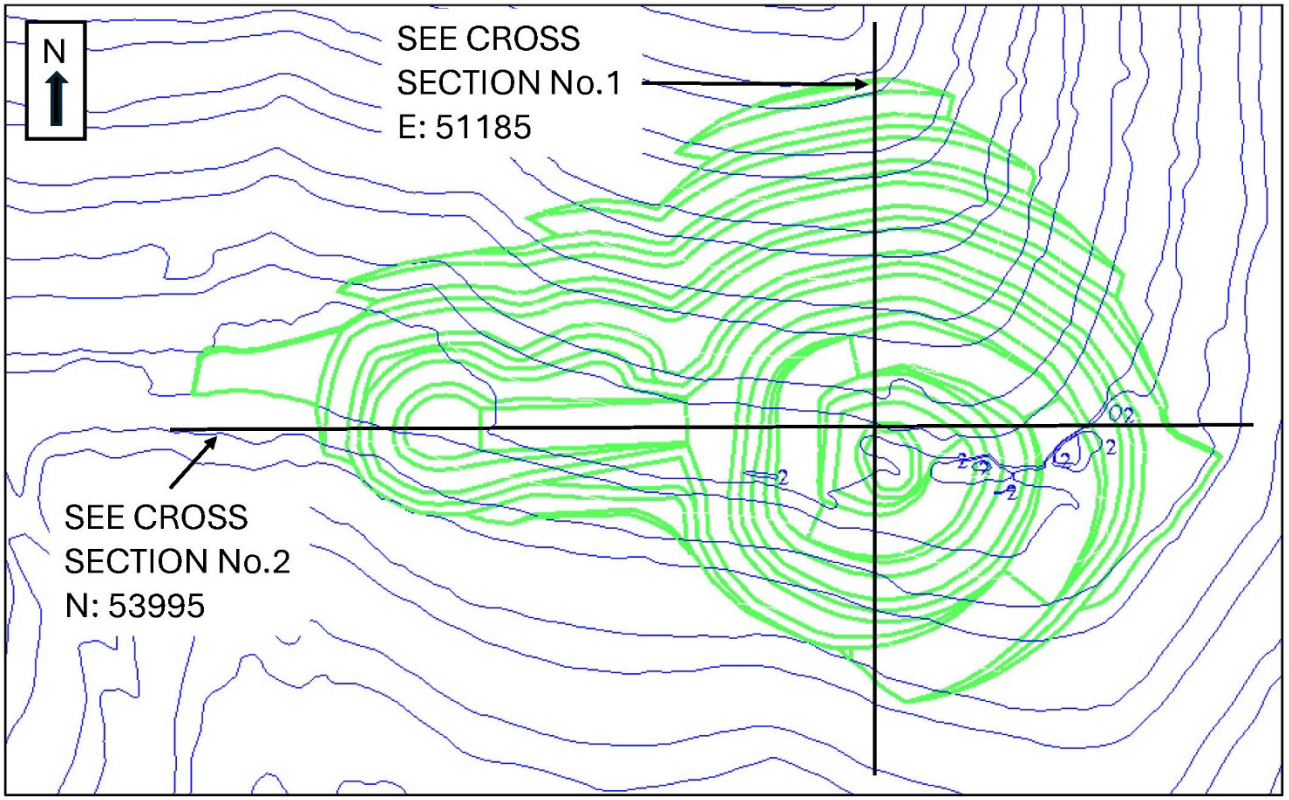

Current Topography

Designed Pit Contours

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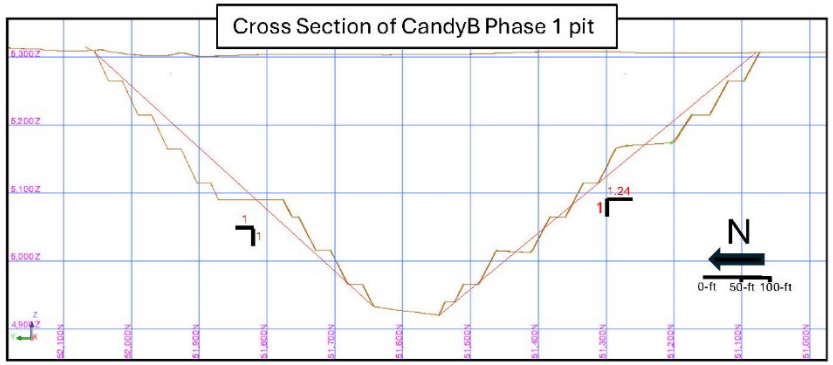
FIGURE 14 – NIAGRA PHASE 1 PIT DESIGN WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTIONS 22

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	Niagra Ph1 Pit Design and Profiles



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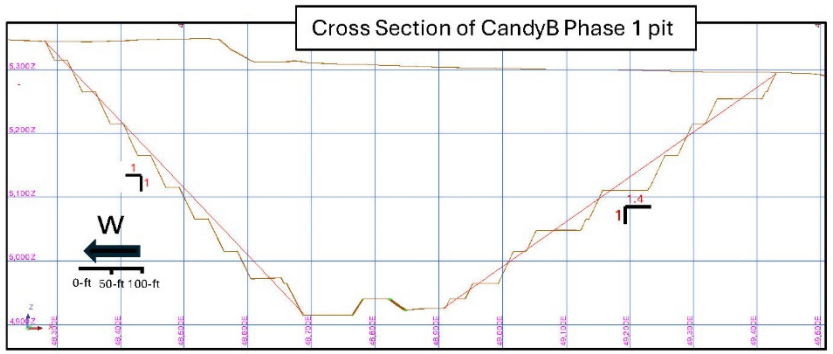

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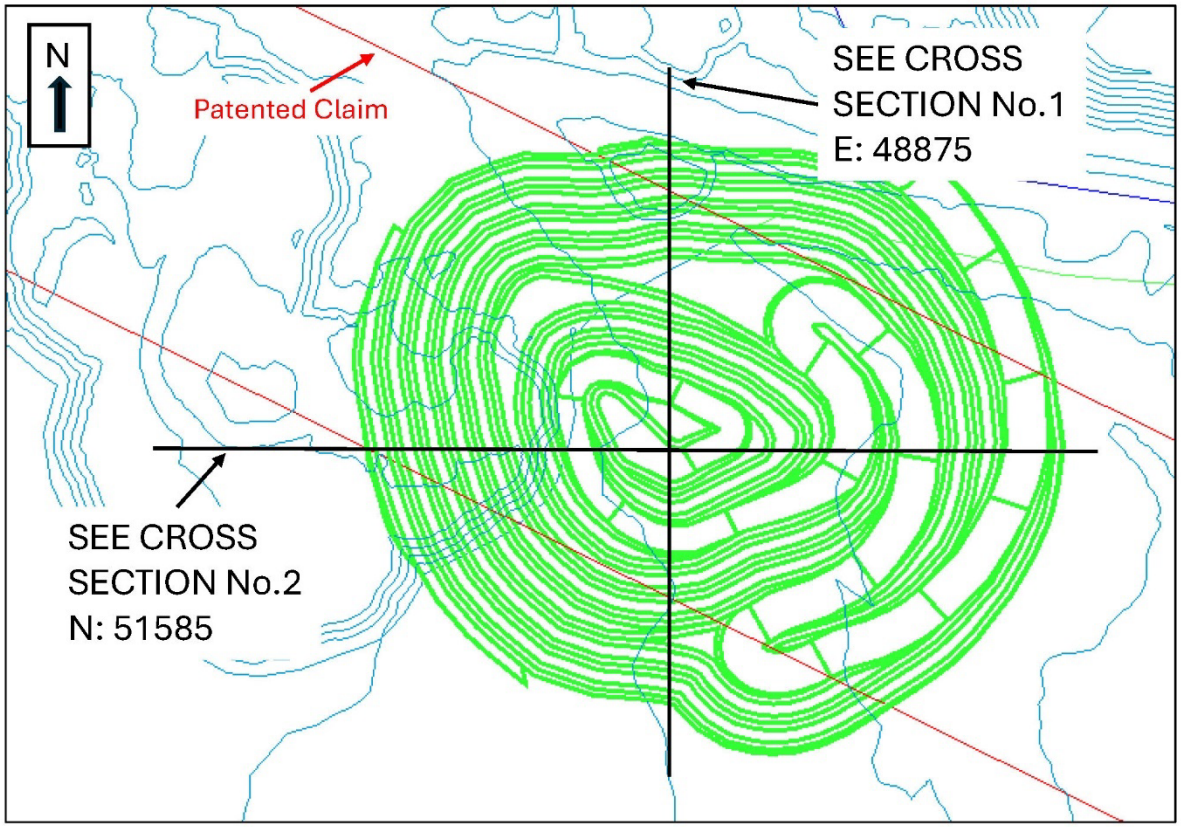

Current Topography

Designed Pit Contours

Patented Claim

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FIGURE 15 – CANDYB PHASE 1 PIT DESIGN WITH CROSS SECTIONS

Milord Mining Company

Utah

WITHIN SECTION 22

MILFORD MINING COMPANY
UTAH

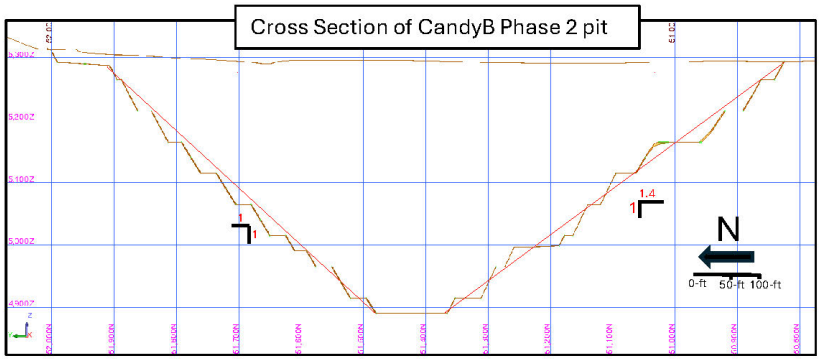
DRAWN: Kyle Schuerg

DATE: Oct. 1, 2024

APPROVED:

REVISION:

DATE	DESCRIPTION
10-1-24	CandyB Ph1 Pit Design and Profiles



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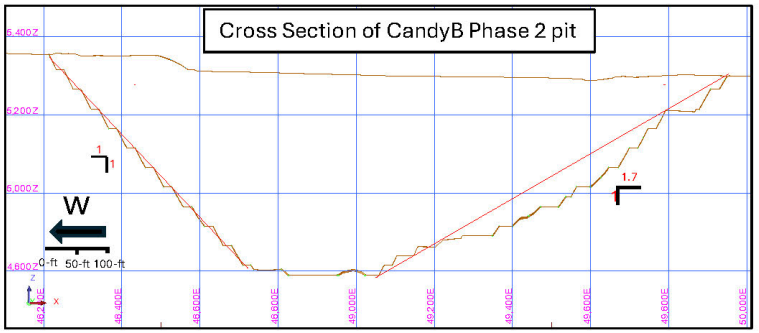

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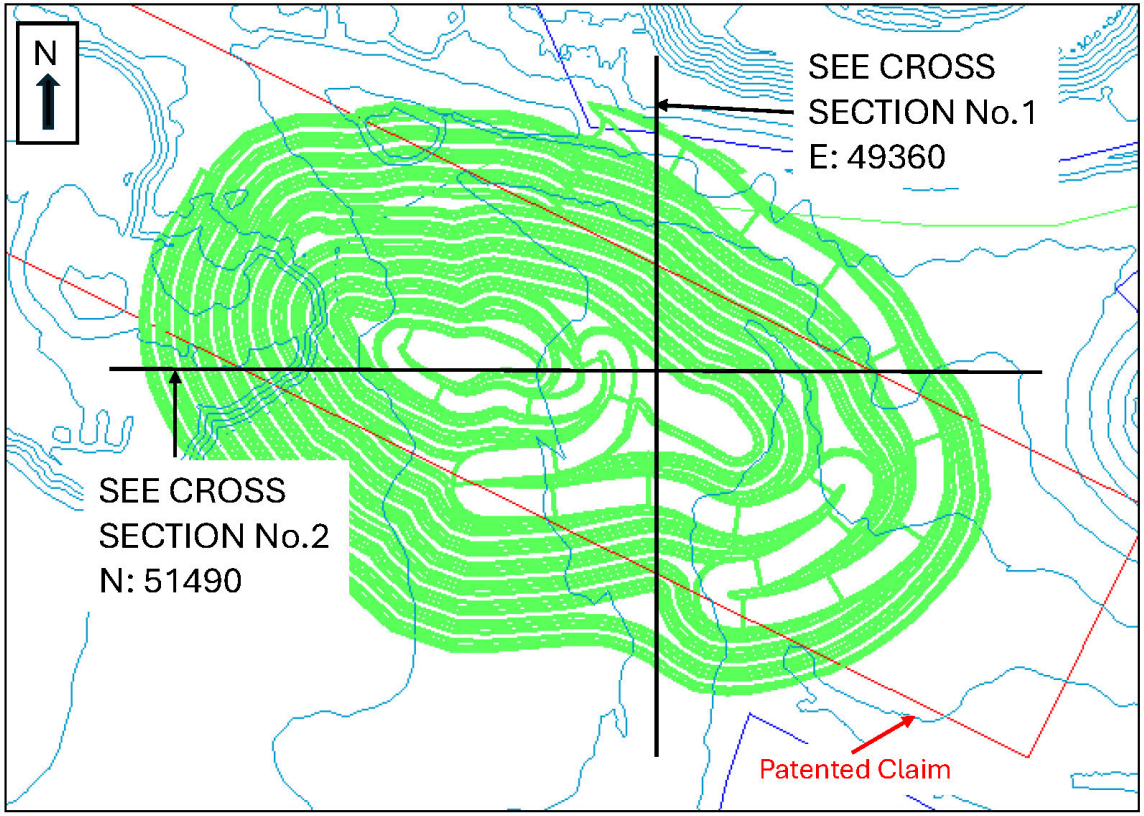

Current Topography

Designed Pit Contours

Patented Claim

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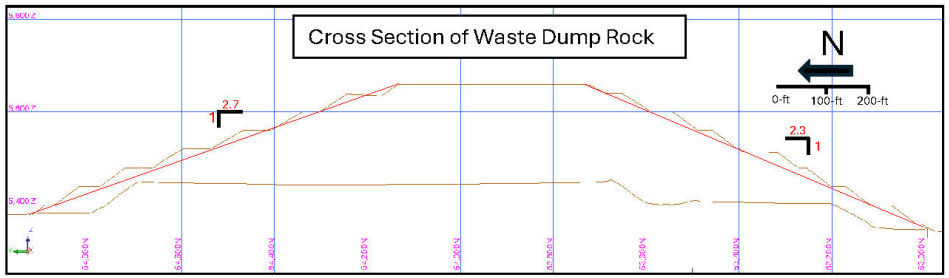
FIGURE 16 – CANDYB PHASE 2 PIT DESIGN WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTION 22

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	CandyB Ph2 Pit Design and Profiles



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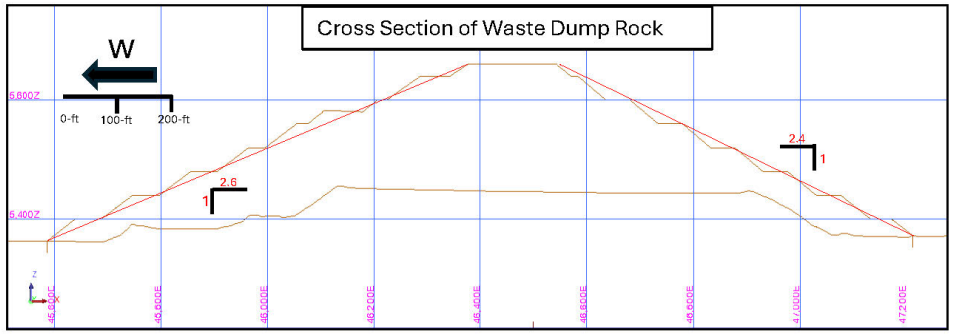

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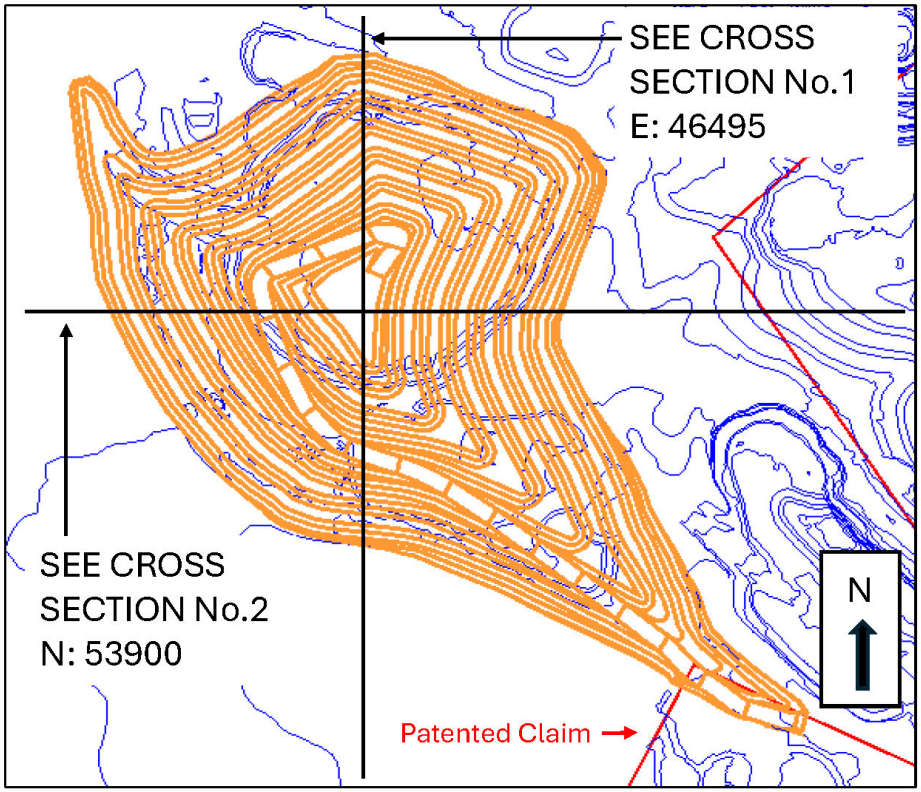

Current Topography

Designed Dump Contours

Patented Claim

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FIGURE 17 – WASTE DUMP ROCK WITH CROSS SECTIONS

Milord Mining Company

Utah

WITHIN SECTIONS 21 & 22

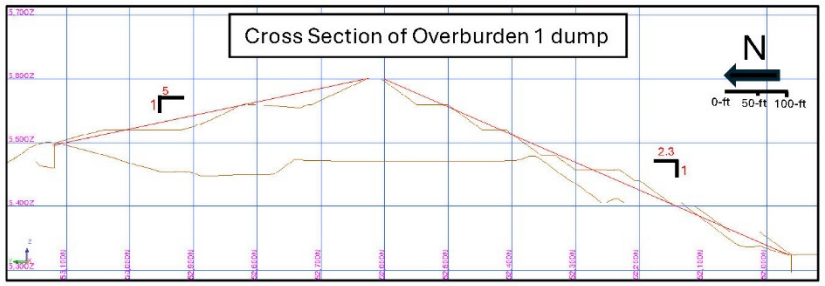
MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg

DATE: Oct. 1, 2024

APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	WASTE DUMP ROCK



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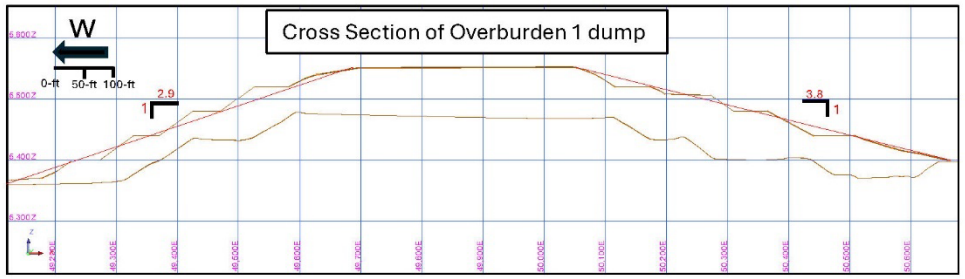

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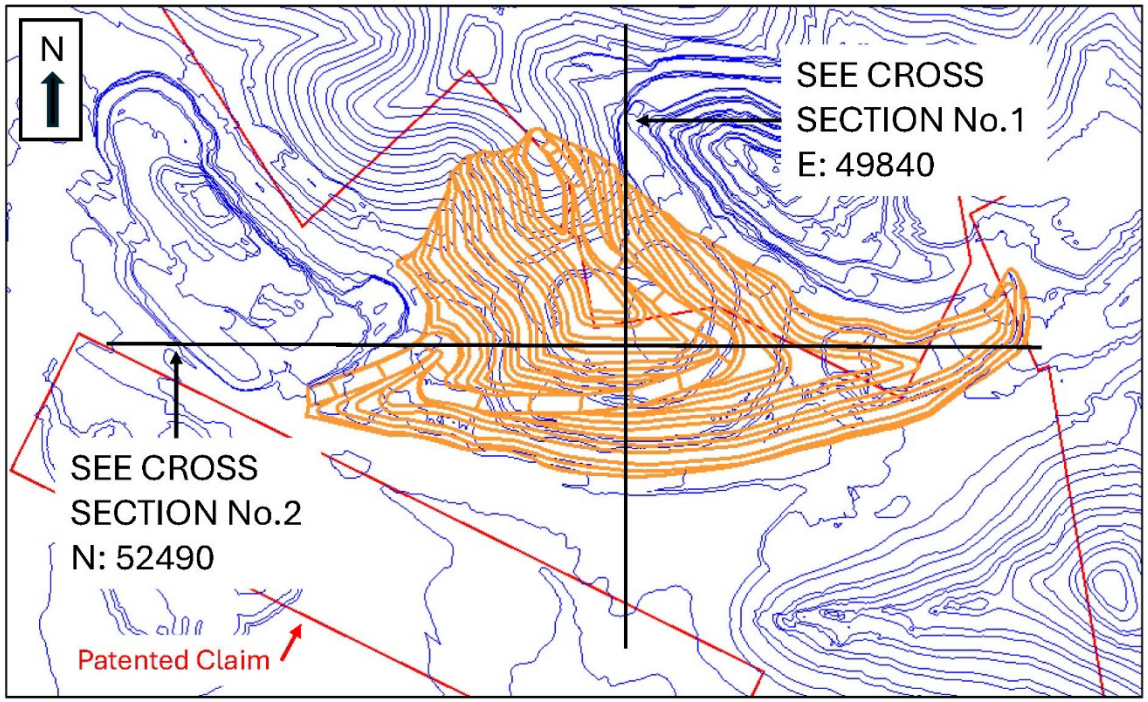

Current Topography

Designed Dump Contours

Patented Claim

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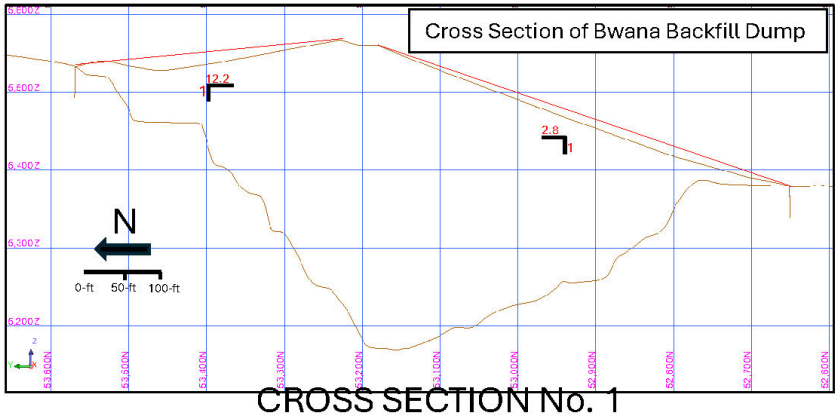
FIGURE 18 – OVERBURDEN DUMP 1 WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTION 22

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	OVERBURDEN DUMP 1



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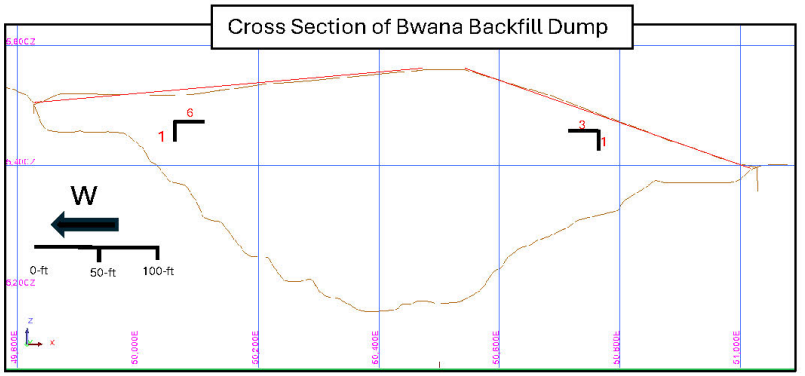

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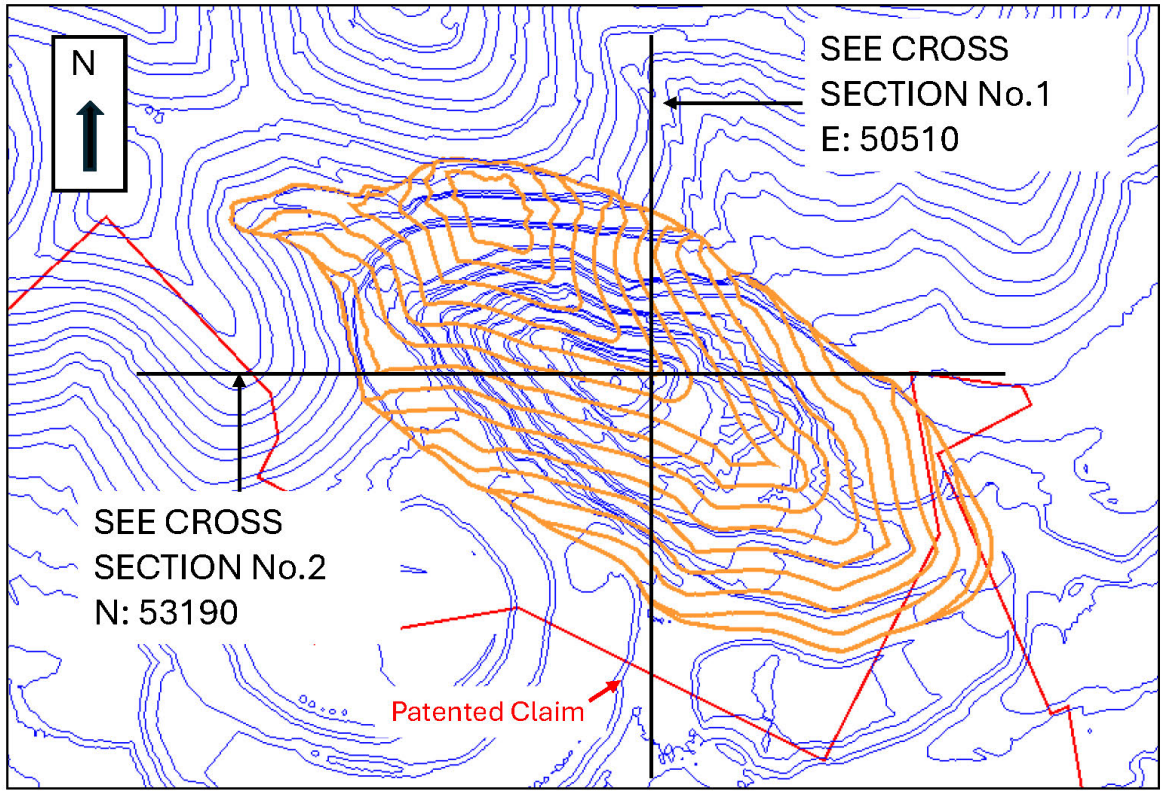

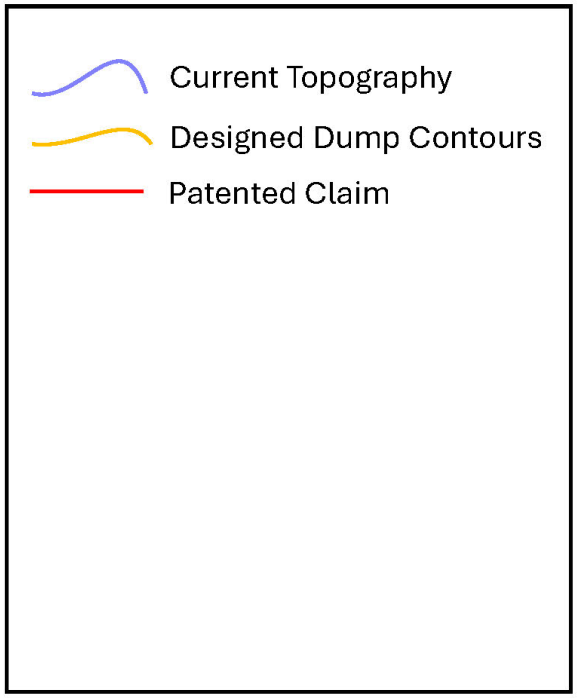

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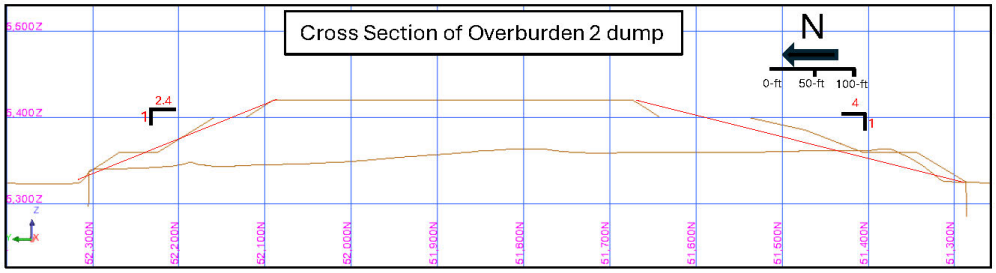
FIGURE 19 – BWANA BACKFILL DUMP WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTION 22

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	BWANA BACKFILL DUMP



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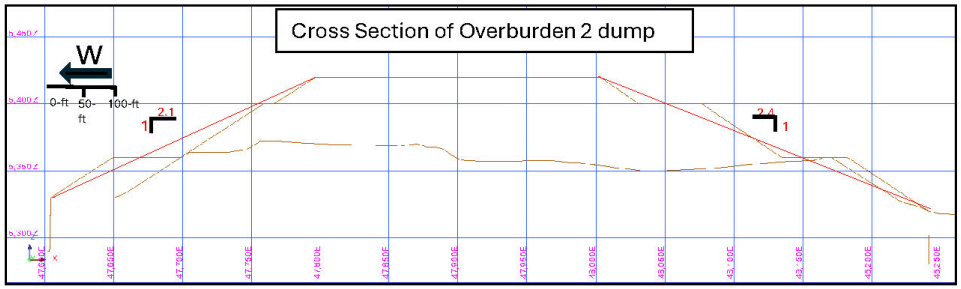

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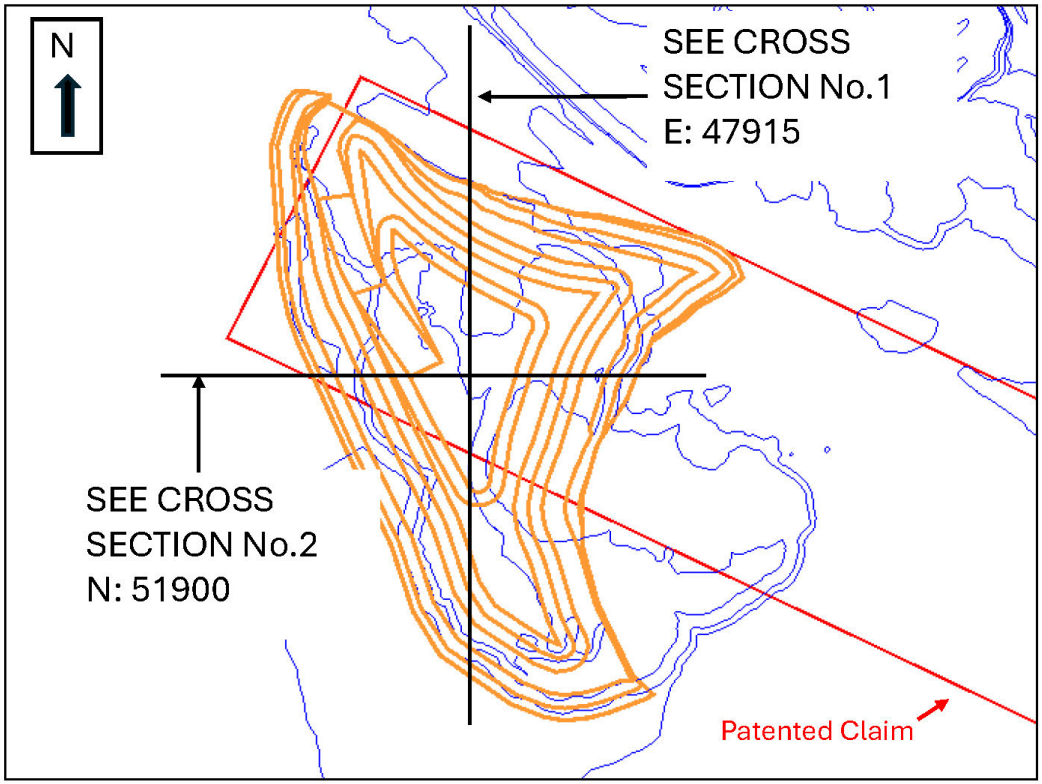

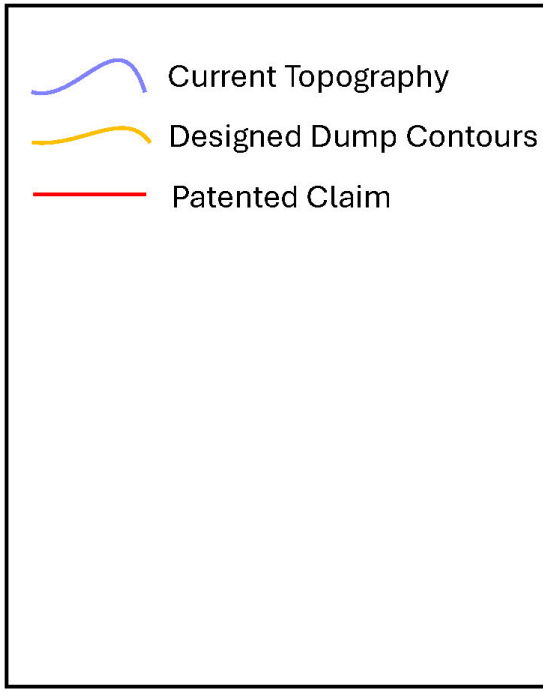

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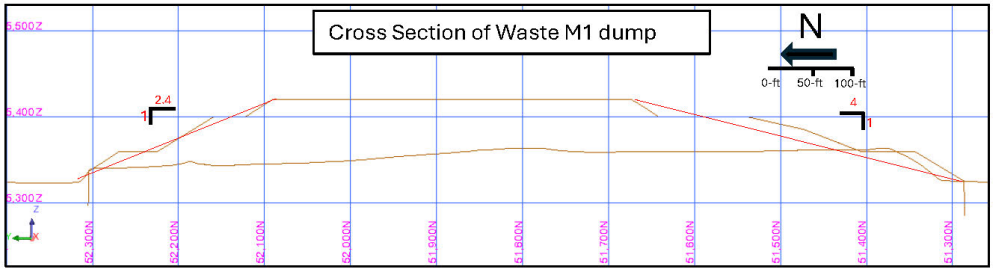
FIGURE 20 – OVERBURDEN DUMP 1 WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTION 21

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	OVERBURDEN DUMP 2



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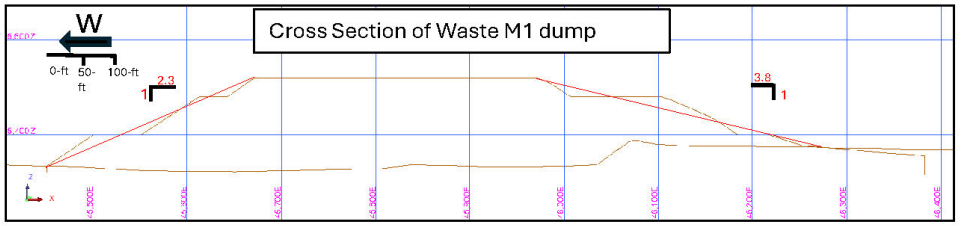
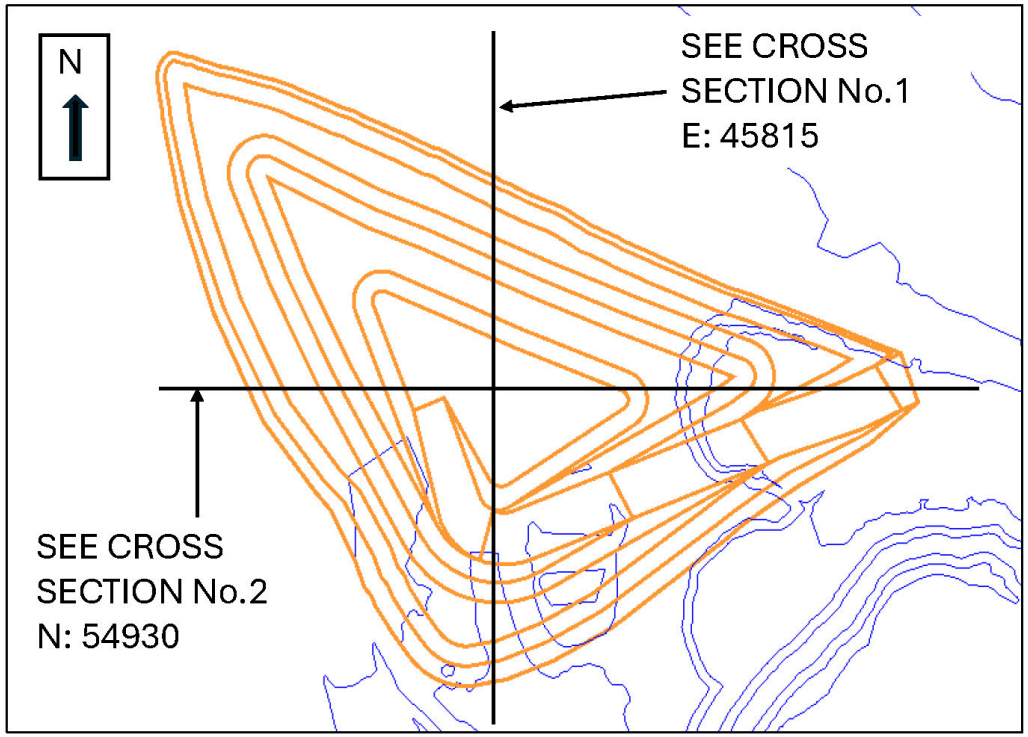


CROSS SECTION No. 2



Current Topography

Designed Dump Contours

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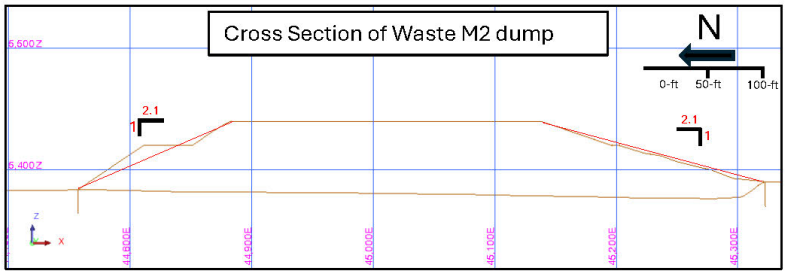
FIGURE 21 – WASTE DUMP M1 WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTION 22

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:

DATE	DESCRIPTION
10-1-24	WASTE DUMP M1



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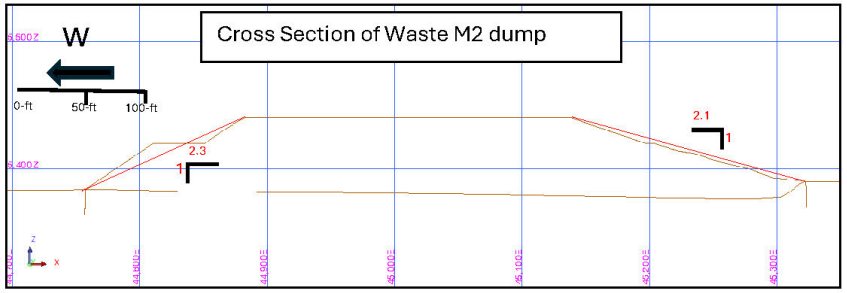

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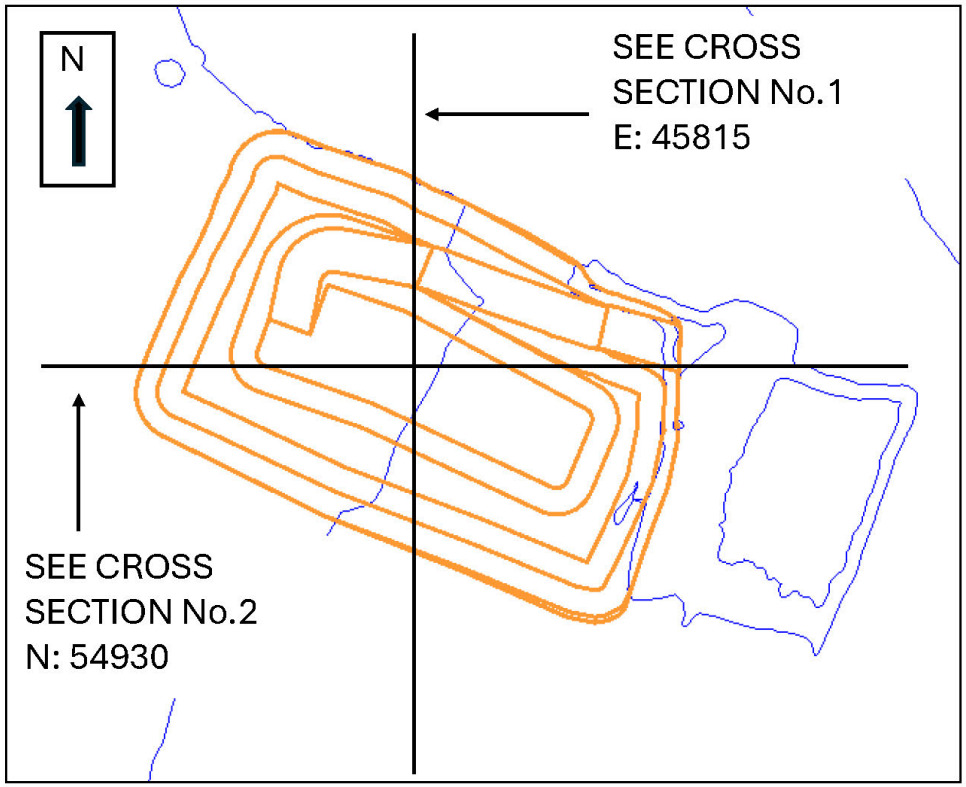

Current Topography

Designed Dump Contours

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FIGURE 22 – WASTE DUMP M2 WITH CROSS SECTIONS
Milord Mining Company
Utah
WITHIN SECTION 16

MILFORD MINING COMPANY
UTAH

DRAWN: Kyle Schuerg
DATE: Oct. 1, 2024
APPROVED:

REVISION:	
DATE	DESCRIPTION
10-1-24	WASTE DUMP M2

APPENDIX E

Geology

GEOLOGY, ORE DEPOSITS AND MINERALOGY OF THE ROCKY RANGE, NEAR MILFORD BEAVER COUNTY, UTAH

J. A. Whelan

UTAH GEOLOGICAL AND MINERAL SURVEY
a division of
Utah Department of Natural Resources and Energy

SPECIAL STUDIES 57 NOVEMBER 1982

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DEPARTMENT OF NATURAL RESOURCES AND ENERGY
Temple A. Reynolds, Executive Director

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GEOLOGY, ORE DEPOSITS AND MINERALOGY OF THE ROCKY RANGE NEAR MILFORD, BEAVER COUNTY, UTAH

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INTRODUCTION

The Rocky Range is a small, isolated mountain range northwest of Milford in Beaver County, Utah. The range was organized into a mining district in 1872 (Huntley, *in* Butler, 1913, p. 117) and has been a small but significant producer of copper and tungsten ores during periods of high metal prices.

The most complete discussion of the range to date is that of Butler (1913, p. 57, 87, 117, 193-94), who gives the geology of the range, the early history of the district and a description of the Old Hickory mine.

An unpublished report by Joseph Ralph (1915) describes the Montreal mine. Hobbs (1954) describes the tungsten mining at the Old Hickory and Copper Ranch mines. Erickson and Marranzino (1960), and Connor and Miesch (1963) analyze the results of geochemical prospecting in the range. Welsh (1973b) and Whelan (1973) give brief descriptions of the range.

As part of the continuing program to study areas of mineralization in the state, the late Professor Bronson Stringham (Department of Mineralogy, University of Utah) mapped the range during the summer of 1967. At the time of Dr. Stringham's untimely death in 1968, his map was almost completed. This writer completed and field checked the map and did supporting laboratory work during 1973-74.

News notes in the *Salt Lake Mining Review*, *Beaver County News*, and *Milford Times* were used to trace the activity of individual prospects in the range.

GEOGRAPHY

The Rocky Range is a relatively small, isolated range 3 miles west and 4 miles north of Milford, Beaver County, Utah. The main body of the range lies within sections 10, 11, 14, 15, 22, 23, 26 and 27, T. 27 S., R. 11 W., Salt Lake Base and Meridian; but low-lying flows and intrusions in sections 9, 16, and 17, which lie between the Rocky Range and Beaver Lake Range, are included in this report (Figure 1, see page 9).

The highest elevation in the range is 6,003 feet, or about 1,000 feet above the surrounding Escalante Desert. There are no streams or other surface waters in the range. The southwest portion of the range drains to the intermittent Beaver River via Hickory Wash, and the northern portions of the range drain to the Beaver River through various small channels.

Labor and mining supplies are available through Milford, a railroad and ranching town with a population of 1,293 (April 1, 1980), which lies at the intersection of State Highways 257 and 21. The Union Pacific railroad passes through Milford.

GEOLOGY

Sedimentary Rocks

Geologic Periods Represented – The consolidated sedimentary rocks exposed in the Rocky Range include quartzites, marbles, dolomitic marbles and metamorphosed shales of possible Cambrian age and of Permian and Triassic age. The total thickness of the Permian-Triassic sediments exposed in the Star Range to the south is 5,176 feet (Baetcke, 1969). However, the thickness exposed in the Rocky Range is considerably less because the section is incomplete at both the top and bottom and because gypsum and possibly other units are missing as a result of thermal metamorphism and faulting.

Undifferentiated Paleozoic Rocks – In two areas of the Rocky Range, the sedimentary rocks could not be assigned a stratigraphic position with any certainty because intense thermal metamorphism has resulted in bleaching, recrystallization, and complete destruction of fossils. One area is in the NE ¼ section 22, and the other is around the Copper Ranch mine (SE¼ section 17) (Figure 1).

The sediments in the NE ¼ of section 22 are chiefly marbles and dolomitic marbles. The most common rock type is a white fine-grained marble, which weathers to gray with some tan caliche on the surface. Some mottled white marble has oval blue dolomitic spots, about a half-inch across. Some of the marbles become ribbed as a result of weathering, these ribs exhibit slump structures. Tan and blue dolomite also occur in this outcrop area. Float was found of a tan-weathering breccia with sandy matrix and angular dolomite and calcite fragments, as large as one inch across. Welsh (1973a) tentatively assigns the rocks in this area to the Cambrian System.

Unidentified limestones in the second area are the host rock for the skarns of the Copper Ranch ore deposit. Hobbs (1945, p. 100) states:

> "Here as at the other mines [Old Hickory?], pure massive limestone grades into shaly and sandy limestone, and certain beds of the impure limestone have been

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metamorphosed to form garnet-diopside-magnetite rock; but the rocks here, unlike those at the other mines, contain remnants of biotite, which was once abundant in some layers but has since been altered in large part to chlorite and talc or some closely related mineral. Mica-rich layers are particularly abundant in the upper part of the deposit, and the scheelite is frequently associated with the mica."

By inference, one might place this unit in the Permian-Toroweap Formation. However, the biotite-rich layers could indicate that the rock is possibly of Cambrian age, therefore it was mapped as undifferentiated Paleozoics (Pzun) (Figure 1).

Talisman Quartzite – The Talisman Quartzite was named by Butler (1913, p. 36) from outcrops located to the east of the Talisman mine in the Star Range (later called the Cedar-Talisman). Baetcke (1969, p. 45, 47-49) measured and described 1,212 feet of Talisman Quartzite in the Star Range, only 3 miles south of the Rocky Range.

Baetcke (1969) separated the Talisman Quartzite into a lower and an upper unit. The lower unit consists of thin-bedded, fine-grained, "lithographic" limestone and inter-bedded quartzose sandstone, which is thin-bedded to thick-bedded, yellowish-brown, fine-grained to coarse-grained, and friable. Limestone is more abundant in the lower portion of the lower unit, while the upper portion consists almost entirely of sandstone. The lower unit is relatively non-resistant and generally forms a slope. The upper unit consists mainly of gray to redish-brown, fine-grained, cross-bedded orthoquartzite, but the upper unit also contains minor beds of yellowish-brown, friable, quartzose sandstone. The upper unit is resistant and is a ridge former.

Only the upper unit of the Talisman Quartzite is found in the Rocky Range. In the Star Range, the Talisman Quartzite is underlain by the Pennsylvanian-Permian Callville-Pakoon undifferentiated formations.

Butler (1913, p. 36) assigned a Pennsylvanian (?) age to the Talisman Quartzite. Brill (1963, p. 323) and Baetcke assign it to the early Permian.

The lower part of the Talisman Quartzite is considered to be correlative with the Queantoweap Sandstone of northwestern Arizona and the Cedar Mesa Sandstone of central Utah.

In both the Star and Rocky ranges, the Talisman Quartzite is overlain, possibly disconformably, by the Permian Toroweap Formation. The contact is drawn at the top of the orthoquartzites of the Talisman Quartzite and at the base of the lowermost strata of inter-bedded yellowish-brown sandstones and light-gray limestone beds of the Toroweap Formation.

Toroweap Formation – Baetcke (1969, p. 51, 53-56) measured a total thickness of 524 feet of Toroweap Formation in the Star Range, and separated it into two generalized lithologic units: A lower limestone and an upper gypsum.

The lower unit consists almost entirely of limestone. The lower-most strata are generally arenaceous and contain thin sandstone interbeds. The middle strata, constituting the principal lithologic type of the lower unit, are fine-grained to coarse-grained, bioclastic, case hardened, light-gray to dark-gray limestone. The middle strata also contain nodules and lenses of blue chert. The upper strata of the lower unit are fine-grained, "lithographic," thin-bedded limestone containing thin sandstone interbeds. The lower unit is thin-bedded to medium-bedded.

In the Star Range, the upper unit consists of inter-bedded limestone, dolomite, sandstone, siltstone, and gypsum. In the Rocky Range, however, the gypsum beds have been dissolved. The Toroweap Formation is middle Permian (Baetcke, 1969, p. 53).

The conformable contact between the Toroweap Formation and the overlying Kaibab-Plympton undifferentiated is drawn at the base of the lower-most light-gray, fine-grained crinoidal limestone of the Kaibab-Plympton undifferentiated.

Kaibab-Plympton Undifferentiated – Baetcke (1969, p. 58 and 61-63) measured and described a total thickness of 660 feet of Kaibab-Plympton undifferentiated in the Star Range. The lower portion of the section is predominantly light-gray, bioclastic, fine-grained to coarse-grained, medium-bedded limestone. The middle portion of the section consists of inter-bedded limestone and dolomite with a few thin sandstone interbeds. The lower strata of this unit are cherty and coarse grained; the middle strata are less cherty and are bioclastic. The middle portion is medium-bedded. The upper portion of the section is cherty, bioclastic limestone with quartzite near the base, and in the Star Range, bedded gypsum near the top. The cherty strata are thin-bedded to medium-bedded. In the Rocky Range, the gypsum has been dissolved and the Kaibab-Plympton undifferentiated is bleached and marbleized. The disconformable contact between the Kaibab-Plympton undifferentiated and the overlying "Moenkopi Formation" is at the top of a discontinuous, cherty, limestone conglomerate and at the base of overlying reddish-brown to green shales and siltstones. The contact is considered to be the boundary between strata of Permian and Triassic ages.

"Moenkopi Formation" – Baetcke (1969, p. 68-73) provisionally assigned the name "Moenkopi Formation" to the strata of the lower part of the Triassic section of the Star Range, even though these strata constitute an exceedingly anomalous "Moenkopi". The type Moenkopi is essentially a continental facies, con-

sisting of inter-bedded red and brown sandstone, siltstone, and shale. The "Moenkopi" strata of the Star and Rocky Ranges are inter-bedded limestone, sandstone, siltstone, and shale that apparently are the products of sedimentation in marine and tidal flat environments. Baetcke retained the name Moenkopi only because the name is in general usage in adjacent areas.

The thickness of the "Moenkopi" is estimated to be approximately 2,780 feet in the Star Range (Baetcke, 1969, p. 70). Only the lowermost units of Moenkopi are exposed in the Rocky Range.

Extrusive Igneous Rocks

Extrusive rocks crop out over about 1½ square miles of the area mapped and make up the NE portion of the range, in sections 14 and 15. There are also two isolated outliers to the NE in section 11. Two flows, both of intermediate composition, are exposed. Previous workers agree that the vent from which these flows issued was in the SW portion of the volcanic outcrop area in sections 14, 15, and 23.

Additional outliers of volcanic rocks of intermediate composition occur west of the main range in sections 9, 16 and 17. These outliers are probably from the Beaver Lake Range. The classification of Grout (1932, p. 50) is used for extrusive rocks.

Copper Ranch Knoll Dacite Porphyry – This volcanic unit makes up most of Copper Ranch Knoll or Porcupine Hill in the E. ½ section 17 and the volcanic portions of the low knolls of the S. ½ section 9 and the N. ½ section 16, R. 11 W., T. 27 S. (Figure 1). The source of the volcanics was probably the Beaver Lake Range to the west; the flows dip about 30° to the east.

The upper portion of these flows on Copper Ranch Hill, is a dense greenish-black rock with 5 percent phenocrysts, mostly of plagioclase. The phenocrysts occur up to 1mm, but average 0.5 mm in size. Minerals in the groundmass average 0.1mm in size.

Anhedral quartz constitutes about 40 percent of the rock, chiefly in the groundmass. Plagioclase constitutes about 35 percent of the rock, as subhedral phenocrysts and in the groundmass. Plagioclase phenocrysts are somewhat altered to calcite.

Biotite, two-thirds altered to chlorite, makes up approximately 20 percent of the rock. It is evenly distributed and exhibits a crude flow alignment.

Orthoclase makes up less than 5 percent of this rock. Hornblende, mostly altered to chlorite, is also present. Magnetite, somewhat concentrated about chlorite, makes up to several percent of the rock.

The lower flows are a light green; phenocrysts are slightly more numerous and slightly larger, averaging 0.75mm. These flows weather tan.

The phenocrysts are mostly plagioclase, three-fourths altered to calcite; about 5 percent anhedral less than 5 percent, euhedral quartz and several percent biotite, about 40 percent of which is altered to chlorite.

The groundmass is fine, 0.01 to 0.1mm. It consists of quartz and chlorite with small quantities of plagioclase, orthoclase, and anhedral magnetite.

The flows to the north, in sections 9 and 16, are somewhat darker green. Phenocrysts, mostly plagioclase, are somewhat larger, averaging about 1.5mm, and make up about 30 percent of the rock. Phenocrysts weather tan. Microscopic examination indicates the plagioclase to be about three-fourths altered to calcite.

The groundmass is very fine, with minerals averaging about 0.01mm in size. About half of the groundmass is glass, with very fine chlorite throughout and about 15 percent fine quartz and plagioclase. The plagioclase of the groundmass, like the phenocrysts, is altered to calcite. The groundmass contains about 5 percent disseminated magnetite and a trace of sphene.

Trachyte Porphyry – This rock makes up the volcanic plug in the SW¼ section 14, T. 27 S., R. 11 W., Salt Lake Base and Meridian. It is a dense, fine-grained gray rock which weathers brown. It contains about 31 percent phenocrysts, mostly clear potassium-feldspar (23 percent), quartz (3 percent); and biotite (5 percent). Biotite phenocrysts give the rock a peppered appearance. Potassium-feldspar phenocrysts are subhedral, range in size from about 0.8 to 2.0mm (average about 1mm). Quartz phenocrysts are anhedral and corroded. They range in size from 0.3 to 1.8mm and average 0.9mm. Biotite is euhedral but almost completely altered to chlorite and limonite. Biotite laths are 0.5 to 2.5mm long, and average about 1mm in length.

The groundmass is composed chiefly of anhedral potassium-feldspar about 0.05mm in size (47 percent), glass (15 percent), and biotite (2 percent). Biotite in the groundmass averages about 0.1mm. The rock contains about 5 percent accessory pyrite, generally anhedral, but occasionally euhedral.

Older Volcanics (Trachyte) – This trachyte unit is a light green, fine grained rock with about 35 percent phenocrysts of potassium-feldspar, plagioclase, quartz, and chlorite, altered from biotite and hornblende. It weathers into more rounded outcrops than the younger volcanics.

Microscopic examination indicates the groundmass is about 60 percent glass with 2 to 3 percent each of plagioclase, altered to calcite, and potassium-feldspar, both in crystallites of about 0.01mm. In the groundmass the quantity of plagioclase exceeds slightly the quantity of potassium-feldspar.

The potassium-feldspar phenocrysts which make up about 20 percent of the rock are anhedral to subhedral, and are lightly sericitized. They average 0.5mm in size but occur up to 2mm.

Plagioclase phenocrysts are euhedral to subhedral, about the same size as those of potassium-feldspar, and make up less than 5 percent of the rock. They are generally almost completely altered to calcite.

Quartz phenocrysts which make up only a few percent of the rock, are anhedral and average 0.3mm in size. Hornblende is generally euhedral and averages 0.25mm in size. It is generally almost completely altered to chlorite.

Chlorite after biotite makes up about 2 percent of the rock. It is euhedral and occasionally cuts potassium-feldspar and quartz phenocrysts.

Hematite, probably after magnetite, in grains 0.025 to 0.1mm, makes up about 1 percent of the rock. Sphene is also present as an accessory mineral. The similarity between the composition of this rock and the volcanic plug (Figure 1) indicates that the plug may be the source of these flows.

Rocky Range Andesite/Quartz Latite Porphyry – This younger volcanic rock has a dark-brown to green groundmass containing anhedral to euhedral chalky white plagioclase phenocrysts, 0.5 to 3mm in length. The groundmass also contains angular to rounded fragments up to 100mm, of a fine-grained older volcanic rock, which contains a few plagioclase phenocrysts up to 1mm. Local green coloration is due to local propylitic alteration, possibly deuteric in origin.

Phenocrysts make up 30 to 50 percent of the rock and consist of plagioclase (10 to 15 percent), ferromagnesian minerals (3 to 12 percent), quartz (3 to 10 percent), and potassium-feldspar (0 to 6 percent). Plagioclase phenocrysts dominate the lightcolored phenocrysts in the hand specimen, the ferromagnesian minerals are camouflaged by brown weathering or green deuteric alteration.

Plagioclase phenocrysts range from 1mm to 4mm and average slightly over 1mm in length. Many contain small inclusions of anhedral quartz, and are altered with flecks of sericite. Some have cores of calcite, probably indicating original normal zoning. Most plagioclase phenocrysts were too altered to determine An content, but a determination on Carlsbad-Albite twinning gave an An content of 40.

The ferromagnesian minerals are chiefly hornblende, with some biotite, and vary from unaltered to almost completely altered to chlorite and limonite. Ferromagnesian phenocrysts are slightly smaller than plagioclase phenocrysts, ranging from 1mm to 1.5mm, and many contain small euhedral inclusions of potassium-feldspar.

Quartz phenocrysts are anhedral and average 0.6mm. Potassium-feldspar occurs chiefly as inclusions in the ferromagnesian minerals, or occasionally as separate phenocrysts.

The groundmass is glassy with up to 5 percent fine plagioclase feldspar and some quartz or potassium-feldspar (?). It is frequently highly sericitized or devitrified to microlites. Some specimens could be classified as andesite, but others are quartz latite.

Intrusive Igneous Rocks

Intrusive rocks occupy more than 1 square mile in the mapped area. They occur as stocks and dikes, although some of the smaller bodies which appear to be stocks may actually be sills.

Schmoker (1975) postulates that in the Milford area the larger outcrops of intrusives are cupolas on a batholith that underlies the area from west of the Frisco Mountains to Milford, and extends about 12 miles both north and south of Milford. The various intrusions that crop out in this area have different compositions and ages, which indicates that the batholith, if it is a continuous mass, is complex. The classification and nomenclature used in this report to describe the intrusive rocks is that of Grout (1932, p. 50).

Granite – The largest single intrusive mass in the range forms bold peaks. It is composed of granite and occupies much of section 10 and the W. ½ of section 15, R. 11 W., T. 27 S. The granite is a coarse-grained, granitoid rock with anhedral pink orthoclase, white plagioclase, greenish black euhedral to anhedral hornblende, and glassy quartz apparent in the hand specimen. It weathers to a tan color.

Hornblende is the dominant ferromagnesian mineral, but biotite may be present, especially in the SE¼ of section 15 where the granite has assimilated volcanic rocks. In this same location a muscovite granite facies is found.

The ferromagnesian mineral, in one sample from the north end of the mass, is chlorite with pyroxene cores. Scattered epidote occurs in the granite, and outcrop in sections 3 and 16 contains 5 to 10 percent epidote.

Quartz, anhedral, unaltered, but generally shattered may form about 35 percent of the rock. Grains range in size from 0.5mm to 2.0mm with a mean size of about 1mm.

Orthoclase forms about 30 percent of the rock. Most grains are subhedral and may be shattered. Some exhibit Carlsbad twinning. Orthoclase grains may contain small inclusions of quartz and plagioclase. Most

orthoclase is slightly sericitized. Crystals range in size from 1.0 to 2.5mm, and average about 1mm.

Plagioclase forms about 25 percent of the rock. The grains are subhedral; some crystals are bent; average composition is An 30-35. Plagioclase lathes range in size from 1mm to 3mm, averaging about 2mm. Most is lightly sericitized, but close to the volcanic contact it may be altered to calcite.

Hornblende forms about 5 percent of the rock. Subhedral lathes range in size from 0.4 to 1.0mm and average about 0.8mm long. About two-thirds of the hornblende is altered to chlorite, probably penninite, but alteration of individual grains varies from none to complete.

Biotite may compose up to 2 percent of the rock. It is finer-grained than the hornblende and more of it is completely altered to chlorite.

Magnetite and sphene make up about 3 percent of the rock. Magnetite occurs as isolated anhedral grains, about 0.1mm in size, and may be associated with chlorite or as streaks in chlorite. Sphene may also be associated with chlorite. It occurs in subhedral grains averaging about 0.2mm by 0.5mm.

Throughout most of the mass the rock is fairly uniform in texture. The outcrop in sections 9 and 16, however, is porphyritic with 1mm to 5mm phenocrysts of plagioclase, potassium-feldspar, quartz, and hornblende in a groundmass of quartz, orthoclase, and plagioclase averaging 0.1mm in size.

Monzonite – This rock outcrops in the NW¼ section 9, R. 11 W., T. 27 S., is a medium-grained, uniform, granitoid rock with prominent feldspars and ferromagnesian minerals. Minor quartz is visible under the hand lens. Light limonitic staining develops on weathered surfaces.

Under the microscope the rock has a hypidiomorphic granular texture. Orthoclase makes up about 40 percent of the rock and occurs as anhedral grains 1mm to 3mm in size exhibiting slight sericitic alteration.

Plagioclase also makes up about 40 percent of the rock. It occurs in euhedral to subhedral crystals, about 0.8mm long. It is lightly sericitized.

Quartz, which makes up about 5 percent of the rock, is anhedral, unaltered, and occurs in grains 0.2mm to 0.5mm in size. Biotite and biotite altered to chlorite make up about 10 percent of the rock. The biotite is about three-fourths altered to chlorite. It is euhedral to subhedral and occurs in laths varying from 0.3mm to 1.0mm in length. Average length is about 0.6mm. Magnetite grains may replace biotite (?).

Pseudomorphs of chlorite after hornblende make up about 5 percent of the rock. Magnetite and sphene occur as accessory minerals; magnetite averages about 0.02mm in size. The euhedral sphene is somewhat larger.

Quartz Monzonite – This rock unit crops out in section 22, NE¼ section 27, and NW¼ section 26, R. 11 W., T. 27 S. Outcrops occur as low to moderately high hills. The skarn type ore-bodies of the Rocky Range occur at contacts of the quartz monzonite with sediments.

The rock is coarse-grained and granitoid. Pink orthoclase, subhedral white plagioclase, subhedral greenish-black hornblende, and grey glassy quartz are apparent in the hand specimen. It weathers to a light tan.

The orthoclase forms about 35 percent of the rock and is anhedral. It varies from slightly altered to almost completely altered to kaolin. It ranges in size from 0.5 to 3mm. Some orthoclase shows poorly developed graphic intergrowths.

Quartz, which forms about 30 percent of this rock, is anhedral, unaltered, embayed, and generally shattered. It ranges in size from 0.5mm to 2mm.

Subhedral plagioclase grains range in size from 0.5mm to 3mm. Plagioclase is slightly altered to calcite.

Hornblende is subhedral and it ranges in size from 0.5 to 2.0mm and averages about 1.0mm. Hornblende is generally three-fourths to completely altered to chlorite.

Epidote is generally present in amounts of about 3 percent of the rock and may make up to 10 percent of the rock. Epidote forms as reaction rims on hornblende.

Sphene normally forms about 3 percent of the rock but may be present in amounts up to 7 percent. It is subhedral and ranges in size from 0.1 to 1.0mm, and averages about 0.5mm.

Magnetite is anhedral grains, about 0.1mm in size, makes up about 1 percent of the rock. Apatite occurs as an accessory mineral. Biotite occurs as an accessory mineral except near ore bodies where it may be the dominant ferromagnesian mineral.

Lemmon, Silberman and Kistler (1973, p. 23-26) give K/Ar ages of 27 m.y. for hornblende from the quartz monzonite north of the Maria and 20.8 m.y. for biotite from the same rock. Their ages for granodiorite of the Frisco stock at the Cactus adit in the Frisco Range is 28 m.y. and granodiorite of the OK stock in the Rocky Range as 28 m.y. Thus the Rocky Range quartz monzonite might be slightly younger than the granodiorites of the area. These authors attribute the younger age possibly to Miocene volcanism. They note, however, that the porphyritic quartz monzonite of the Copper King shaft, in the Star Range to the south, gives a K/Ar age of 20.9 m.y. and that this younger intrusion could have affected the Rocky Range quartz monzonite. The writer favors the latter theory.

In the Beaver Lake Range the quartz monzonite intrudes both the granodiorite and the volcanics (Barosh, 1960, p. 34). It is felt the same relationships are valid for the Rocky Range.

Ferroaugite granodiorite – This unit crops out as a low hill in a small area on the very east end of the range. It has a distinctive brown-black mottled appearance on weathered outcrop. In the hand specimen plagioclase and pyroxenes are most apparent. Some of the pyroxenes are black. Biotite has weathered to a limonitic brown color. Close examination reveals quartz and a tannish potassium-feldspar.

Plagioclase, which occurs as subhedral grains 0.5 to 2.0mm in size forms about 30 percent of the rock. It exhibits some calcitic alteration, bent twinning and mottled extinction.

Quartz, which makes up about 20 percent of the rock, occurs as anhedral grains, as fracture fillings, and as graphic intergrowths with orthoclase.

Orthoclase comprises about 15 percent of the rock and occurs as anhedral grains, about one-fourth altered to kaolinite. It appears strained and cracked. Some orthoclase shows excellent graphic intergrowths in quartz. Orthoclase varies in size from 0.1 to 1mm.

Subhedral ferroaugite makes up slightly less than 20 percent of this rock. Much of the ferroaugite has reaction rims of biotite around it.

Epidote forms up to 15 percent of this rock. It is generally associated with biotite. Biotite, under 10 percent of the rock, forms as reaction rims on ferroaugite and as isolated euhedral crystals. It ranges in size from 0.2 to 1mm. Biotite is about one-third altered to chlorite and goethite.

Anhedral magnetite makes up about three percent of this rock. It is generally in contact with epidote, chlorite, or biotite and occurs in grains up to several tenths of a millimeter across.

Granodiorite – Low outcrops of granodiorite occur in the SE¼ section 8, the SW¼ section 9, and the NE¼ section 16, R. 11 W., T. 29 S. The outcrop, predominately in section 8, is isolated.

The intrusive found underground at the Copper Ranch mine, although described as quartz monzonite by Hobbs (1944, pp. 99-101) is the granodiorite of this paper. The rock is medium to coarse-grained, with plagioclase, hornblende, quartz and orthoclase apparent in the hand specimens. On the weathered surface the feldspars have a tan to cream-colored cast with the quartz appearing glassy and the hornblende showing as greenish-black laths. On a sawed surface the plagioclase is white and the orthoclase has a pinkish hue. The rock consists of about 40 percent plagioclase, about 30 percent quartz, 10 percent each of hornblende and orthoclase and 5 percent magnetite, 4 percent apatite, and one percent sphene.

The plagioclase is possibly of two generations, as some is euhedral and zoned, with centers of An_{70-75}, and about one-tenth altered to calcite. Anhedral plagioclase, not zoned, with less alteration to calcite, also occurs. Plagioclase ranges in size from 0.5 to 4.5mm. The euhedral plagioclase tends to be larger than the anhedral plagioclase.

Quartz is anhedral and unaltered and ranges in size from 0.5 to 2mm. The hornblende is euhedral and about one-fourth altered to chlorite, probably penninite. Based on one relic crystal form, some grains composed wholly of chlorite may represent a trace amount of completely altered biotite in the rock. Hornblende contains inclusions of quartz, plagioclase, and magnetite and grains range in size from 0.5mm to 5mm. The ferromagnesian minerals in the outcrops of this unit in section 16 are completely altered to chlorite and epidote.

Anhedral accessory magnetite, 0.5mm in size forms approximately 5 percent of the rock. It is frequently associated with chlorite.

Subhedral sphene averaging about 0.5mm by 0.25 mm in length and width but ranging from 1.0 to 0.1mm respectively makes up about 1 percent of the rock. It is closely associated with chlorite. Accessory apatite makes up several percent of the rock.

In the Beaver Lake Range, 2 miles to the northwest of the Rocky Range, the granodiorite and the volcanics are intruded by the quartz monzonite.

Montreal Mine Granodiorite – This unit was the most difficult unit to classify, either petrographically or genetically. It outcrops in the NE¼ section 22 and the NW¼ section 23, nearly surrounding a small roof pendant of Permian Kaibab Formation. The magnetite stopes of the Montreal mine occur on the contact of this unit with the Kaibab Formation.

The outcrop forms a low hill. The unit has been altered propylitically, with epidote prominent on joints and fracture fillings. It weathers dark brown. In general appearance it resembles the volcanic rocks outcropping to the north. Both Stringham and this writer initially mapped these as the same unit, and classified these rocks as an intrusion, those to the north as a volcanic neck. On fresh surfaces, however, this rock has (1) a granitoid texture, and (2) has a much lower color index than the volcanics to the north.

The dominant mineral is subhedral plagioclase, which makes up about 40 percent of the rock. It is pitted and cracked and exhibits some alteration to calcite. Plagioclase crystals are 0.4 to 1.0mm long by 0.25 to 0.5mm wide.

Orthoclase makes up about one-fourth of the rock. Crystals are 0.4mm to 1.0mm long, and 0.3mm wide. The orthoclase exhibits both sericitic and kaolinitic alteration.

Ferromagnesian minerals make up about 15 percent of the rock. Generally hornblende is dominant, and occurs in subhedral to anhedral laths, 0.3 to 1.2mm long by 0.15mm to 0.8mm wide. Hornblende is half to completely altered to chlorite, chiefly penninite.

Biotite is present, both as separate crystals and as reaction rims on hornblende. It is three-fourths altered to chlorite. The quantity of biotite increases near the Montreal magnetite ore body.

Quartz is anhedral and unaltered. It constitutes about 10 percent of the rock. The quartz varies in size from 0.15mm to 1.0mm. Quartz content increases towards the Montreal magnetite ore body, where it occurs as veinlets.

Sphene, subhedral but ragged, makes up 1 to 5 percent of the rock, in crystals 0.1 to 0.25mm wide and 0.1 to 1mm long. Sphene is generally associated with chlorite.

Opaque minerals make up 2 to 10 percent of this rock, in 0.1mm grains. Most of the opaque mineral grains are anhedral magnetite, but both anhedral grains and cubic grains of pyrite occur. Magnetite content of this rock unit increases towards the Montreal magnetite ore body.

Aplite Dikes – Aplite dikes are prominent in the Maria pit. They are fresh appearing, pink, sugary textured rocks.

Under the microscope the rock consists of quartz and orthoclase in about equal amounts, both with anhedral in grains 0.4mm to 0.7mm long and 0.2mm to 0.6 across. The rock contains traces of sphene, magnetite, and biotite, the latter about 30 percent altered to chlorite, probably penninite.

Biotite Latite Dikes – Biotite Latite dikes occur in the southernmost stock, NE¼, section 27, NW¼ section 26, and the ferroaugite, granodiorite, SW¼ section 23, R. 11 W., T. 27 S.

These dikes have the sugary texture of aplites. Quartz and pink-white feldspars are apparent in the hand specimen, with up to 10 percent biotite and hornblende. Twice as much biotite is present as hornblende, and both are about three-fourths altered to chlorite.

Orthoclase is anhedral and shows some kaolinitic (?) alteration. It makes up 40 to 45 percent of the rock and occurs in grains 0.5mm to 1.5mm.

Anhedral, unaltered quartz makes up 25 to 30 percent of the rock. Quartz varies in size from 0.25 to 0.5mm.

Subhedral plagioclase, in crystals about 0.5mm long, constitutes 20 to 25 percent of the rock.

Hornblende occurs as subhedral crystals, frequently with biotite reaction rims. Biotite and hornblende average 1.0mm in size.

Anhedral magnetite, up to 0.1mm, forms up to three percent of this rock in places. Much of it is associated with the ferromagnesian minerals.

Granite Dikes – A granite dike, intruding quartz monzonite and the Talisman and Toroweap formations, crop out in the NW¼, section 22, R. 112, T. 27 S. The dike is about 1,000 feet long and up to 125 feet wide. The rock is medium-grained with granitoid texture, a light pink in color with orthoclase, plagioclase, quartz, and anhedral to euhedral hornblende apparent in the hand specimen. It weathers to a tan color.

Orthoclase is the most common mineral and makes up about 50 percent of the rock. It occurs in anhedral crystals, and exhibits kaolinitic (?) alteration. Grains range in size from 0.5mm to 2mm.

Plagioclase and quartz occur in about equal amounts, approximately 20 percent each. Plagioclase is subhedral, and exhibits almost no alteration. Its anorthite content is about 40 percent. Plagioclase grain size ranges in size from 1mm to 3mm.

Quartz is anhedral, embayed, unaltered, and ranges in size from 0.5mm to 1.0mm. Hornblende and biotite range in size from 0.5 to 1mm. Hornblende is euhedral to anhedral and constitutes about two percent of the rock. Biotite both replaces hornblende and occurs as separate euhedral laths with shredded ends. Biotite makes up about 5 percent of the rock and is about half altered to chlorite, in part penninite.

Magnetite and sphene each make up about one percent of the rock. Sphene is subhedral in crystals about 0.1mm. Magnetite is anhedral and averages 0.05 mm.

Alkali Feldspar Leuco-granite – Copper Ranch Knoll, also known as Porcupine Hill (Barosh, 1960, p. 48), E½ section 17, T. 27 S., R. 11 W., contains several dikes of alkali-feldspar leuco-granite, and of porphyritic alkali feldspar leuco-granite. The dikes are about 40 feet wide and up to 400 feet long. Contacts of the dikes with the lavas are sharp with no apparent contact metamorphism of the lavas.

The alkali-feldspar leuco-granite has a fine-grained granitoid texture. In outcrop the rock appears fresh, is white or pinkish-white, and consists almost entirely of quartz and orthoclase with less than one percent biotite and only a trace of hornblende.

Microscopic examination indicates orthoclase is slightly more abundant than quartz. All of the quartz and most of the orthoclase occurs as anhedral grains

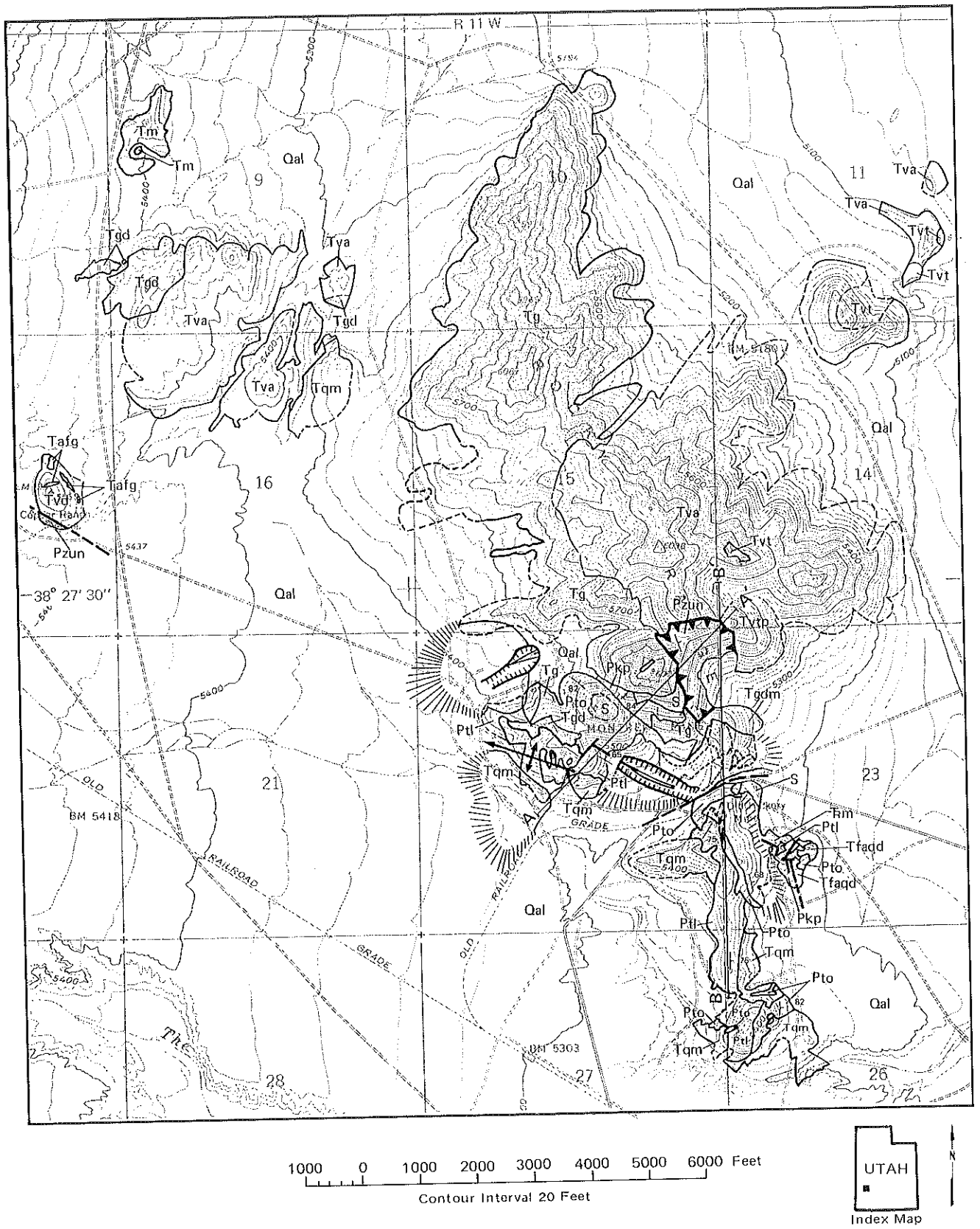


FIGURE 1. Geology of the Rocky Range, Beaver County, Utah

averaging 0.75mm in size. Occassional crystals of orthoclase are subhedral. Quartz shows only slight fracturing. Orthoclase is incipiently sericitized. Slightly less than half of the orthoclase and quartz occurs as myrmekitic intergrowths of quartz in orthoclase.

Biotite laths are euhedral and average about 0.1mm by 0.5mm. About 90 percent of the biotite is altered to chlorite and fine dusty magnetite.

Plagioclase is subhedral and forms up to a maximum of five percent of the rock. Plagioclase is partially altered to calcite. Calcite has also been introduced into the rock.

Magnetite is rare, anhedral and averages 0.15mm in size. Accessory zircon was found.

The porphyritic alkali-feldspar leuco-granite also occurs as dikes in Copper Ranch Knoll, is similar in composition, except it contains slightly more plagioclase.

The rock is white in weathered hand specimen, but pinkish white when sawed. It contains pinkish anhedral feldspar phenocrysts up to 40mm across that average about 12mm. These are set in a fine-grained granitoid groundmass.

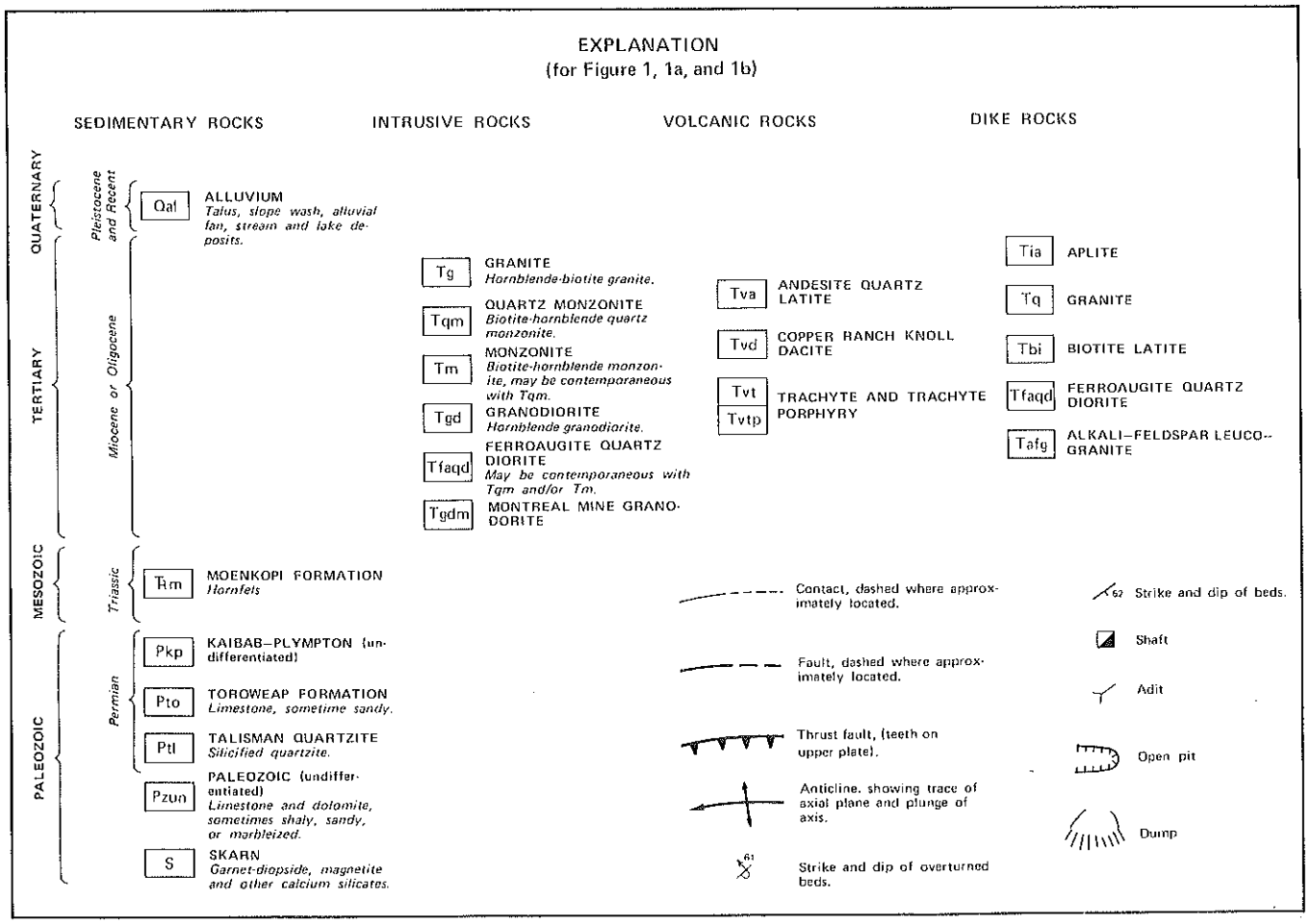
The rock consists of about 40 percent quartz. Three-fourths of this is in the groundmass as anhedral grains about 1mm in size. The remainder occurs as myrmekitic intergrowths in orthoclase phenocrysts.

Similar percentages apply to orthoclase. The orthoclase of the groundmass is anhedral in grains about 1mm in size.

Plagioclase constitutes about 10 percent of the rock and is about one-eighth altered to calcite. Plagioclase is subhedral with grains about 1mm.

Hornblende, now three-fourths altered to chlorite, chiefly penninite, constitutes about 5 percent of the rock. Hornblende is subhedral and averages 0.5mm in size.

Magnetite, apatite, and sphene form several percent of the rock. Magnetite is rare, and occurs as anhedral grains, averaging under 0.1mm. Apatite and sphene are euhedral to subhedral and average under 0.05mm in size.



Geology by J. A. Whelan and B. Stringham

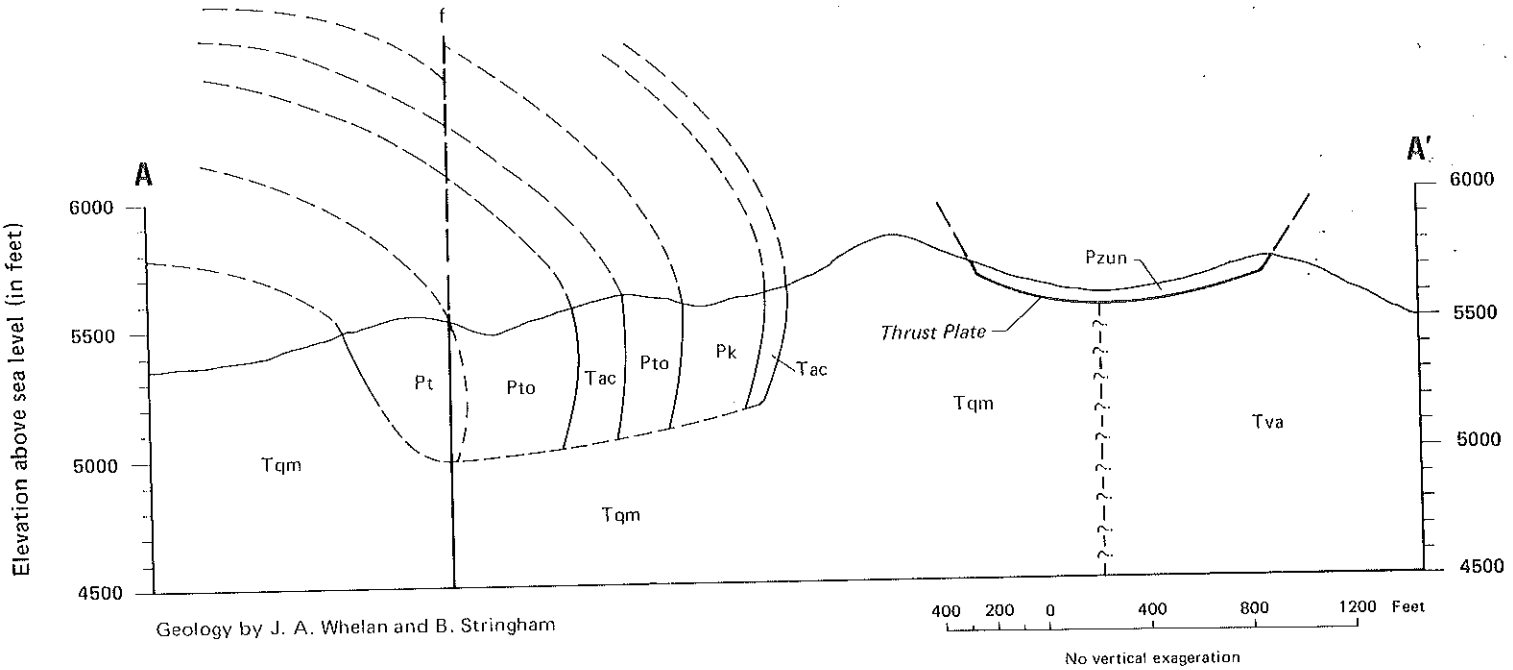


FIGURE 1a. Cross-section A-A'

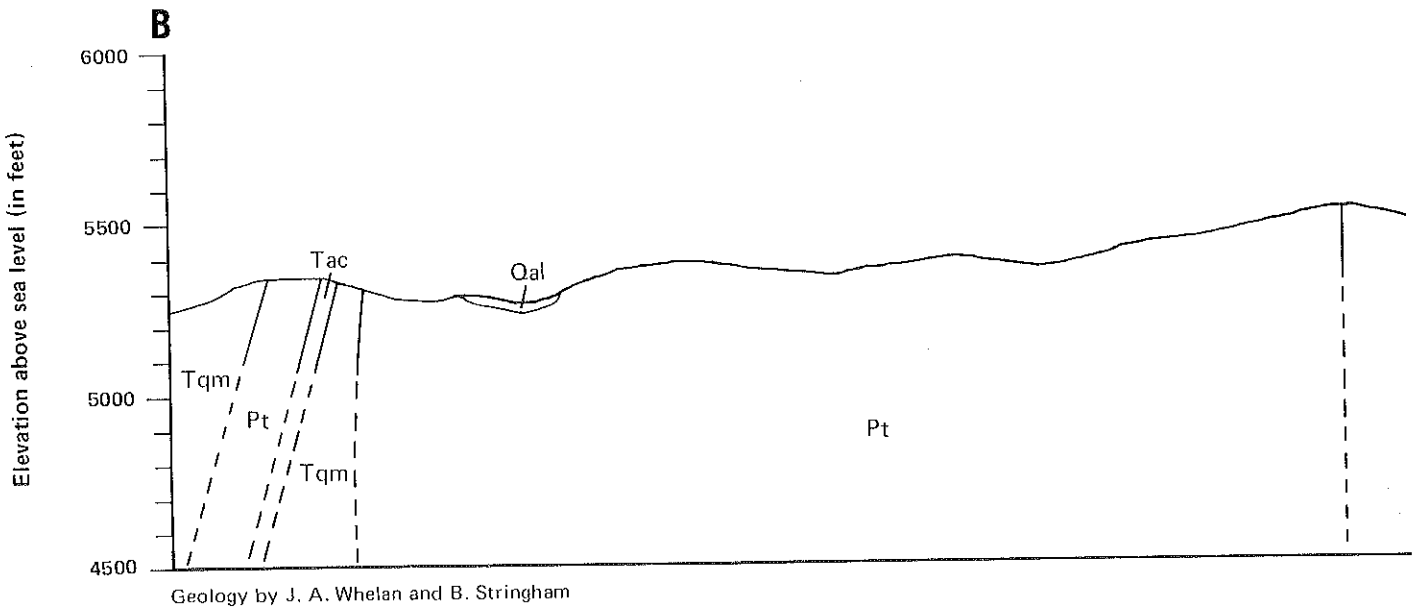


FIGURE 1b. Cross-section B-B'

Ferroaugite Quartz Diorite Dikes -- Two dark colored dikes of this rock occur in the southern spur of the range NW¼, section 26, T. 27 S., R. 11 W. One dike intrudes the quartz monzonite, the other Talisman quartzite.

The rock is dense, medium-grained, with ferromagnesian minerals prominent in the hand specimen and plagioclase is less so. Microscopic examination indicates that plagioclase is the dominant mineral, constituting about 45 percent of the rock. The plagioclase is anhedral to subhedral and averages 1.5mm in size. Piagioclase crystals contain hedenbergite, quartz, and orthoclase inclusions. All of the minerals of this rock unit, including plagioclase, are fractured, with iron staining along fractures. Plagioclase averages An_{40}.

Orthoclase forms slightly less than 10 percent of this rock unit. It is relatively fresh, often exhibits overgrowths, and may contain ferroaugite inclusions. It averages 1.5mm in size. Quartz forms 5 to 10 percent of this rock.

Ferroaugite, which makes up to about 20 percent of the rock, is anhedral to subhedral, and averages about 1mm in size. It may contain subhedral inclusions of plagioclase and orthoclase. Magnetite is associated with ferroaugite. Some hypersthene occurs in the rocks.

Epidote makes up about 10 percent of this rock unit, magnetite about five percent, and apatite one percent. Quartz grains are small, averaging 0.15mm, and occur as isolated grains and as veinlets. Rutile needles are found in the quartz.

Biotite makes up about 5 percent of the rock. Unlike that in the other rocks in the area it exhibits only slight alteration to chlorite. The relationship, if any, between the ferroaugite, quartz diorite and the ferroaugite granodiorite is not known.

Dacite Porphyry Dikes – Fine-grained, green porphyry dikes occur in the quartz monzonite and undifferentiated Paleozoic sediments in the NE¼ section 22, and in the Permian Kaibab Formation, NE¼ section 22 and NW¼ section 23, T. 27 S., R. 11 W.

The phenocrysts, which make up about 15 percent of the rock, are small, 0.3 to 0.8mm long and 0.15 mm to 0.40mm wide, and consist of about two-thirds subhedral hornblende and one-third subhedral to euhedral muscovite. The groundmass is fine-grained, about 0.01mm, and consists of quartz, plagioclase, and hornblende in equal amounts.

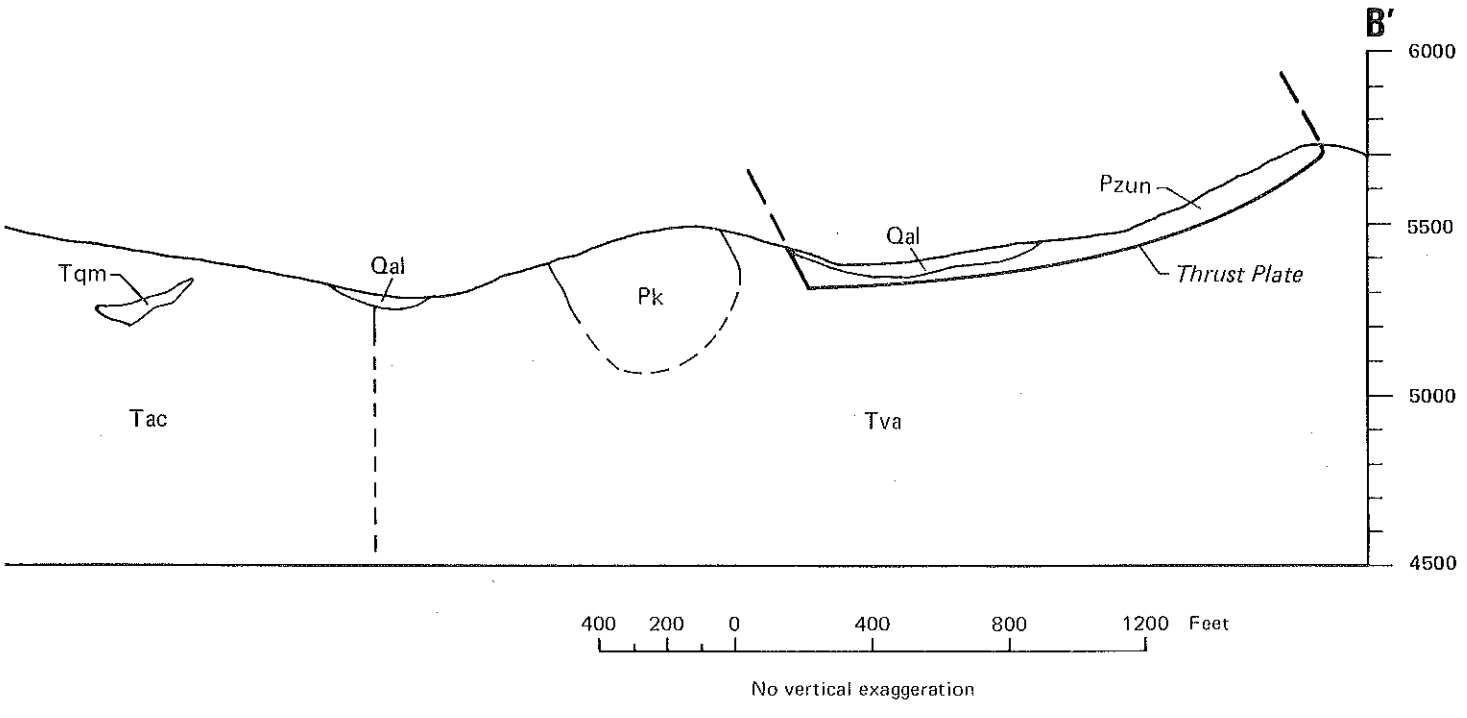
Structure

Structural features of the Rocky Range include folds, block faulting, a tear fault and thrust faulting. Cross sections are given as Figures 1a and 1b.

Folds – The northwest-trending block of sediments in section 22 (Figure 1) is a northwest-plunging, asymmetric anticline that is cut by northwest-trending faults. The northeast limb of the anticline is overturned.

The north-south trending block of sediments along the north-south boundary between sections 22, 23, 26, and 27 is a monocline dipping to the east. The beds are also overturned on the eastern edge of this structure.

The general similarity between both the structure and stratigraphy of the northeastern limb of the anticline and the monoclinal fold, together with the similarity between the Old Hickory and Bawana ore bodies



(see section on mines, p. 15) allows one to postulate that the two structures were once one, and have since been separated.

Butler (1913, p. 194) suggested that the sediments of the Rocky Range were roof pendants on the intrusions. The present author, and many of the people that have worked in the area, concur with Butler. If the folded sediments are roof pendants, they might have been broken apart while at the top of the magma chamber.

Normal Faults – The most prominent normal faults are the northwest-trending faults parallel to the axis of the anticline in the NE¼ of section 22. The displacement on these faults is unknown but believed to be small. Their straight traces across topography indicate nearly vertical fault planes, but because the beds are also nearly vertical, the faults may be bedding-plane faults. The northwest-trending faults were probably important in the emplacement of the Bawana and Maria ore bodies (see section on mines, p. 15) The best exposed of these faults is on the Talisman Toroweap Formation contact. This fault is offset by later, northeast trending faults which appear to have net displacements of 150 to 300 feet.

In north-trending sediments of the SW¼ of section 23, a northwest fault, essentially parallel to those described above, is cut by a north-trending fault essentially parallel to the strike of the block of sediments. This fault, in turn, is cut by two small east-west trending faults. It was not possible to determine displacements but they are believed to be small.

Grampian Thrust – Welsh (1973a) interprets the undifferentiated lower Paleozoic limestones and dolomites as Cambrian(?) rocks which have been thrust over the Permo-Triassic sequences. He considers the thrust fault in the north end of the Rocky Range to be a part of the same thrust exposed south of Grampian Hill in the Frisco Range and that exposed on the north end of the Mineral Range.

Left Lateral Tear Fault – The valley separating the south-trending southern spurs of the range from the main northerly portion is an east-northeast striking tear fault with 500 feet of apparent left lateral displacement.

Relationship to Regional Structure – Most of the mountain ranges in this portion of the Basin and Range province consist of generally north-south trending synclines and anticlines. From west to east these structures are as follows: Wah Wah Mountains, synclinal; San Francisco Mountains, anticlinal-synclinal; Star and Beaver Lake ranges, anticlinal; Mineral Range, synclinal-anticlinal. The folded rocks vary in age from Cambrian through Jurassic. Topography is generally subdued. The Grampian thrust has placed older rocks over younger in the Wah Wah, San Francisco and Beaver Lake mountains, as well as the Mineral Range. This thrusting is thought to have occurred in Late Jurassic or Early Cretaceous.

However, the Rocky Range and the easternmost spur of the Star Range, in the Milford Flat quadrangle, do not fit this pattern. The sedimentary rocks of the Star Range, spur strike northeast, those of the Rocky Range strike north-south in the southern part of the range and north-west to the north. Both structural units consist of Permian through Jurassic rocks only. Both are complexly intruded and thermally metamorphosed. Both have more rugged, less mature topography than the surrounding ranges. The writer believes that these small structural units represent roof pendants on intrusives.

GEOLOGIC HISTORY

Probable Precambrian basement rocks outcrop in the Mineral Range, but none are found in the Rocky Range. Lower Cambrian Rocks and Middle Cambrian Prospect Mountain Quartzite and Pioche Shale are not found in the Rocky Range. Since they do crop out in the Wah Wah and Frisco ranges to the west and the Mineral Mountains to the east, they were undoubtedly present in the Rocky Range area at one time.

The lowest stratigraphic unit found in the range is an undifferentiated limestone and dolomite of probable Middle Cambrian age. The only other Paleozoic rocks found in the Rocky Range are the Permian rocks which consist of the Talisman Quartzite, the Toroweap Limestone, and the Kaibab Limestone, the Paleozoic rocks of the surrounding area almost entirely consist of marine limestone, dolomite, siltstone, and sandstone that were deposited at the margin of the Cordilleran miogeosyncline to the west and the adjacent shelf to the east. This sequence of strata records, by changes in rock character, a shifting pattern of shelf and basin environments of sedimentation.

Mesozoic sedimentation is represented by a complex assemblage of marine limestone, sandstone, shale, and non-marine sandstone and conglomerate of Triassic and Jurassic age that were deposited in a mixture of epineritic and continental environments, including shallow sea floors, tidal flats, flood plains, and stream beds.

As noted under structure, during early Cretaceous time large scale thrusting occurred from west to east. A portion of this thrust plate is present in the Rocky Range, where it has placed the older Paleozoic rocks over the late Paleozoic and Mesozoic sedimentary rocks of the range. Portions of the thrust plate are also found in the Wah Wah Mountains, the Frisco, Mineral and Pavant ranges, and possibly the Star Range (Baer, 1962).

The sediments were then folded into a series of synclines and anticlines. The anticlinal structure of the Rocky Range is much more severe than this regional folding with steep dips and overturned flanks. Perhaps the more gentle regional folding was the precursor of the more rugged structure of the Rocky Range, which may have been caused by Tertiary intrusions.

In places in the vicinity a Cretaceous (?) or Tertiary (?) conglomerate has been deposited unconformably over the folded structures described above.

After deposition of the conglomerate, faulting transverse to the range took place, associated with, or followed closely by volcanism and intrusion.

The relationships between the various intrusions and the extrusive rocks in the Rocky Range is not known. However, it is thought that most of the volcanics are older than the granodiorite which in turn is older than the quartz monzonite.

Cenozoic volcanism in the area is complex. Both local and regional lavas occur. Lemmon, Silberman and Kistler (1973, p. 25) give K-Ar ages for volcanic rocks between 34.1 and 20.8 m.y. Rhyolites in the Mineral Range, to the west, give ages from 0.8 to 8.0 m.y. (Lipman and others, 1978, pp. 133-47). The Black Rock basalts to the north-northeast are 970,000 years old (Condie and Borsky, 1972, p. 337).

Lemmon, Silberman and Kistler (1973, p. 25) give ages for intrusive rocks in the area of 20.8 to 28.4 m.y. Ages for the granite (now known to be a complex intrusion with quartz monzonites and granodiorites at depth) of the Mineral Mountains range from 9.0 m.y. (Armstrong, 1970, pp. 203-32) to 15.0 m.y. (Park, 1968, p. 73).

The sediments in the Rocky Range are thought to be roof pendants on the intrusion. Their uplift and metamorphism by the intrusion results in the more rugged topography than is found in adjacent Basin and Range Mountains. The rotation of part of the structure from its original north trending Basin and Range attitude is probably also due to the intrusion. The spur of the Star Range in Milford Flat and possibly the northern tip of the Star Range are also roof pendants related to the same intrusive events.

Basin and Range faulting probably started in Mid-Tertiary time and continues to the present. The uplift of the ranges accompanying the faulting resulted in erosion which deposited Tertiary and Quaternary terriginous sediments in the valleys. At times the valleys contained playa lakes, as indicated by Tertiary limestones northwest of the Mineral Moutains and near South Crystal Peak (Whelan and Bowdler, 1979, p. 81-85).

Rhyolitic volcanism continued into late Tertiary and associated basaltic volcanism continued to Quaternary times. During Pleistocene time, Milford Valley was occupied by Lake Bonneville. Shore line features abound on both sides of the valley. The Rocky Range is higher than these features (5,200 feet) except near its very northern end.

MINING HISTORY AND PRODUCTION

Early History

The history of the Rocky district through 1912 is given by Huntley (Butler, 1913, p. 117) as follows:

> Rocky district is about 1½ by 3 miles in extent and includes a small isolated range north of the Star district and east of the San Francisco. It was organized in 1872 and had, at the period under review, about 25 locations, although six times that number have probably been made. The country rock is granite, quartzite, and limestone. The principal work has been done upon the following claims:
>
> *Big Mountain tunnel.* On the side of a mountain there is an east and west vein 10 feet wide in granite. from a 100-foot shaft about 31 tons of assorted ore were shipped to Salt Lake City, which, it is said, averaged 30 percent copper, 25 ounces silver, and $12 gold.
>
> *June iron mine.* This mine had shipped 1,500 or more tons of flux to Frisco in the previous years.
>
> *Rocky iron mine.* This claim was owned by the Frisco Mining & Smelting Company and is said to have shipped 2,000 tons of flux since its discovery. It is worked through great open cuts upon the surface.
>
> *Copper mine.* This is an immense vein of copper ore with croppings 100 feet wide. The ore is a carbonate stain in the joints of a siliceous rock and taken together is of very low grade; but 30 percent copper ore, assaying $12 silver and $10 gold, can be sorted from it. Some has been shipped. There is to all appearances a 50-foot vein of copper. Shafts 75 and 55 feet deep have been sunk.
>
> During the prevailing high price of copper in 1906 and 1907 considerable iron-copper ore was shipped from Old Hickory mine to the Salt Lake smelters. With the fall in price of copper it was no longer possible to operate the mine at a profit, and there has been little activity in the district until 1912, when shipment was resumed.
>
> In 1903 the Majestic Mining & Smelting Company completed a smelting plant south of Milford for the treatment of ores from the Star, Beaver Lake, and Rocky districts. The amount of ore developed was not sufficient to keep the plant running, and after operating a few days it was shut down and has been idle since.

Production

The Rocky Range has been a small but significant producer of copper, silver and tungsten. Some production figures are combined with those of the Beaver Lake District. Available data are shown on Table 1.

From 1912 through 1923, production was from the Old Hickory, Montreal and Copper Ranch mines. Direct shipping oxide copper ore was produced from the

Table 1. Metal production for the Rocky Range

District and Year	Short tons	Gold oz	Silver oz	Copper lb	Lead lb	Zinc lb	Tungsten short ton unit	Direct shipping iron ore long tons
Beaver Lake & Rocky, 1870-1902[1]	–	225	13,250	931,000	80,000	–	–	–
Beaver Lake & Rocky, 1902-10[1]	20,799	193	20,920	1,052,483	–	–	–	–
1902-17[1]a	108,766	415.69	86,831	4,160,281	35,671	–	–	–
Beaver Lake & Rocky, 1871-1957[2]	–	–	–	–	–	–	1,655	–
Rocky District, 1906-70[3]	753,623	3,259	759,813	32,810,494	3,700[6]	500[6]	–	–
Rocky District, 1960[5]	–	1	198	900	2,400[1,6]	500[6]	–	–
Rocky District, 1961[5]	No Production							
Rocky District, 1962	–	23	5,880	109,300	–	–	–	–
Rocky District, 1963[3,5]								
Rocky District, 1963[3,5]	–	124	62,040	1,796,100	–	–	–	100
Rocky District, 1964[5]	–	738	176,698	6,176,800	300[6]	–	–	–
Rocky District, 1965[5]	–	474	115,400	3,712,900	–	–	–	–
Rocky District, 1966[5]	–	665	163,986	5,690,500	–	–	–	–
Rocky District, 1967[5]	–	439	123,700	4,647,900	–	–	–	–
Rocky District, 1968[5]	–	–	–	3,571,400	4,000[6]	600[6]	–	–

[1] Butler, 1913, p. 118.
[1]a Butler, 1920, p. 505.
[2] Mardirorsian, C. A., 1966.
[3] USBM Compilation.
[4] Iron produced in 1964, but figure concealed.
[5] Stowe, 1975.
[6] The writer cannot verify any lead or zinc production from the Rocky Range.

Old Hickory, Copper Ranch, and the Niagara Falls Tunnel area of the Montreal mine. Fluxing iron ore, which was low in copper, was produced from the lower, easterly ore body of the Montreal mine. Mining in this ore body was both by open pit and underground. The Old Hickory mine had glory hole and underground operations. The Copper Ranch was an underground operation. There was no activity in the district in 1924-25, 1927-28, and 1930-39.

Production of direct shipping oxide copper ores was resumed from the Old Hickory and Montreal mines in 1940 and, with the exceptions of 1948, 1950, and 1952, continued at one or both mines through 1957. The Old Hickory mine was worked for tungsten from 1941 through 1943, and again in 1955-56.

About 1960, the Bawana ore body was discovered by the Cerro Verde Mining Company. Arrangements were made that year with the Majestic Oil and Mining Company and the Bogdanich Development Company to start stripping the property and to renovate a 350 ton/day flotation mill on the property. The Bawana commenced production in 1962. From 1964 until 1968, the Bawana was worked by the American Mining Company. In 1968, the American Mining Company merged with the West Toledo Mining Company and operations were shifted to the OK mine in the Beaver Lake Mountains. Treatment was by acid leach and cementation.

In 1969, there was no mining activity in the Milford area. In 1970, Shield's Development Company resumed operations in the OK mine and continued until Essex International, Incorporated took over operations in November of 1971. Essex continued to mine the OK, but immediately began the first development of the Maria mine, an open pit, in the Rocky Range. They ceased operations in the OK in the fall of 1973 and commenced stripping the Hidden Treasure ore body. After some mining from the Hidden Treasure, Essex International ceased operations in the fall of 1974. There has been no activity in the range since.

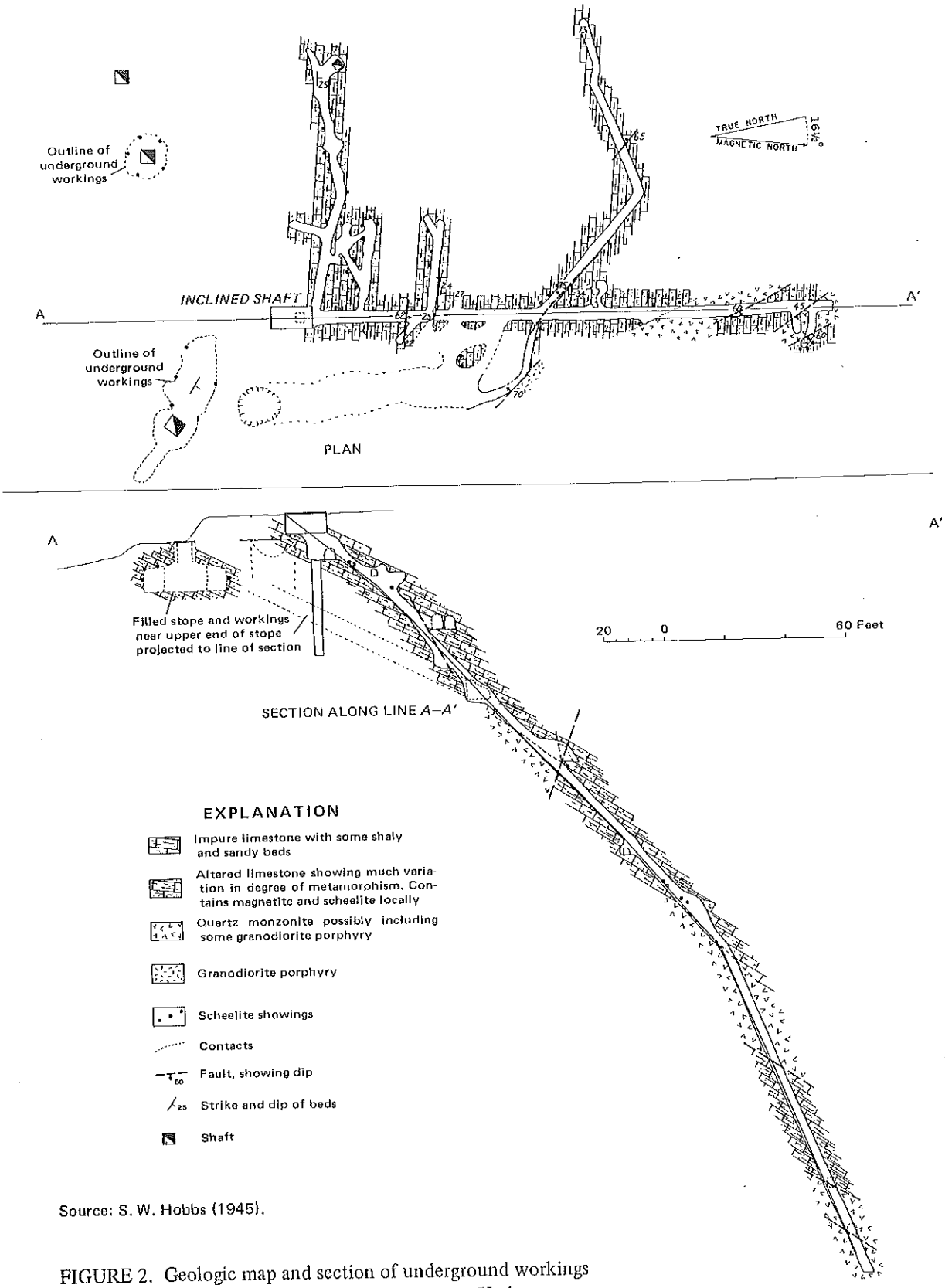
MINES

Copper Ranch – The Copper Ranch mine is in the SE ¼ of section 17, T. 27 S., R. 11 W. (Figure 1); and consists of two patented claims, the Marguerite No. 15 and Jewel mine, both survey No. 5476. The first reference to the Copper Ranch is in the *Salt Lake Mining Review* of April 29, 1899 (v. 1, p. 14), which notes that the Copper Ranch was formerly known as the Marguerite.

The Copper Ranch produced at least intermittently through the end of World War I, although it was reported temporarily closed in 1913 (*Salt Lake Mining Review,* v. 14, February 15, 1913 p. 29). It has apparently been inactive since 1918. Although Hobbs (1945, p. 99) reported that scheelite was discovered on the property in 1941 the writer can find no records of production since 1918. Essex International did block out some ore by drilling in 1973-74. The best geologic description of the mine is that given by Hobbs (1944 p. 99-101), which is given below in its entirety:

> The Copper Ranch mine, 2½ miles northwest of the Old Hickory mine, is connected by dirt roads with the Old Hickory mine and with State Highway No. 26 (pl. 32). The mine openings are on the south side of a low rounded knoll of bedrock which projects from the alluvial plain. The workings consist of an inclined shaft 315 feet deep, 425 feet of drifts branching from the shaft, a stope which is now filled, and three small shafts immediately south of the main shaft. Plate 38* shows a plan and longitudinal section of the mine. The mine was originally worked for copper, and a small amount of commercial copper ore was taken from the upper workings. Scheelite was not discovered in the mine until 1941.
>
> **Geology** The Copper Ranch mine, like the Old Hickory and Cupric mines, is in a contact-metamorphic deposit formed where limestones have been invaded by quartz monzonite and granodiorite porphyry Here, as at the other mines, pure massive limestone grades into shaly and sandy limestone, and certain beds of the impure limestone have been metamorphosed to form garnet-diopside-magnetite rock, but the rocks here, unlike those at the other mines, contain remnants of biotite, which was once abundant in some layers but has since been altered in large part to chlorite and talc or some closely related mineral. Mica-rich layers are particularly abundant in the upper part of the deposit, and the scheelite is frequently associated with the mica.
>
> The granodiorite porphyry is abundantly exposed on the surface of the hill, and the quartz monzonite is the predominant igneous rock underground. The relations between the two types of igneous rock at this deposit were not observed at any place in the mine.
>
> The principal structural features of the deposit are the results of igneous intrusion and a small amount of faulting. The limestone series strikes N. 75° W. and dips 25° to 35° NE., its attitude being fairly constant throughout the mine. The igneous rocks are intruded into the limestones as sills and as dikes. The main sill is in the upper part of the mine, and the main dikes cut the limestones in the lower part of the shaft, with a strike of N. 20° to 25° W., and a dip of 60° to 70° NE.
>
> A series of steeply dipping faults, which strike northwest and dip both to the northeast and to the southwest, cut both the limestones and igneous rocks. Some of the faults follow the contacts of the igneous bodies, but others cut across these contacts and offset them. The extent of this offsetting could not be accurately determined, but it is probably not very great.
>
> **Ore Deposit** The mineralization in the mine is controlled both by the bedding in the limestone and by

*Figure 2 of this report



Source: S. W. Hobbs (1945).

FIGURE 2. Geologic map and section of underground workings of the Copper Ranch mine, Beaver County, Utah

the contact of the igneous rock with the limestone. In the upper part of the mine the distribution of the drifts and stopes illustrates the dependence on bedding The material mined from these workings was all secondary copper carbonate ore, but scheelite has been found to be widely scattered through the adjacent ground, mostly in one or two rather well defined beds two to three feet in thickness. The debris, also, which fills the large stopes east of and below the upper section of the shaft might possibly contain enough scheelite to be considered a low-grade ore. In the lower workings the scheelite is more closely associated with the contacts of quartz monzonite than with particular beds of limestone. It occurs only in small pockets, which probably contain altogether only a small quantity of the mineral.

Here as elsewhere in the district, the scheelite fluoresces with a marked yellowish color. This is especially true in the upper part of the workings, where the mineral is soft and in large part powdery. All these characteristics suggest a high molybdenum content.

Reserves Assays of material from the pits in front of the main shaft are reported to show one to two percent of WO_3 but this material was probably handpicked. The distribution of the material in the mine, together with its relatively high molybdenum content, would probably reduce the average grade of any considerable amount of the ore to 0.25 or 0 5 percent WO_3. A conservative estimate would give about 2,200 tons of measured ore of this grade. On the basis of the exposures immediately south of the main shaft, there is probably two to three times this amount of indicated ore. Any plan to work such ore, however, must take into account a high and quite variable molybdenum content which not only reduces the amount of WO_3 in the ore but also makes necessary the separation of these two components in preparing the final product.

The Old Hickory Mine – A good description of the Old Hickory Mine is that given by Hobbs (1945, p. 94-99):

> The Old Hickory mine is on a southern spur of the Rocky Range, about five miles northwest of Milford (pl. 32). This spur consists of a group of low hills, the highest of which rises only 300 feet above the alluvial plain, and the mine lies just south of a low saddle which nearly separates these hills from the main body of the range. The mine is reached by good roads from the town and consequently has easy access to both main highways and railroads.
>
> The Old Hickory mine, though long known to contain a body of copper-magnetite ore, was never extensively worked except in 1906-07, when the high price of copper made it commercially profitable to mine the ore for copper. In 1917-18, when the mine was again worked, it was only because the magnetite in the ore was needed as a flux at the smelters.
>
> The old mine consisted of a shaft 300 feet deep, a tunnel, called the second level, which cuts the ore body about 100 feet below the shaft collar, and four other levels, the first or 80-foot level about 20 feet above the tunnel, and the third, fourth, and fifth levels below the tunnel at depths of 150, 200, and 300 feet respectively. Most of the ore above the 80-foot level has been stoped out to the surface, leaving a deep, long glory hole The original timbering was burned out of the mine and completely destroyed, but the shaft and the workings immediately adjacent to it were retimbered and placed in good working order by C. H. Segerstrom in 1941 in preparation for mining the newly discovered tungsten ore. The mine was worked by Mr. Segerstrom for tungsten from the fall of 1941 to December 1943, when the operation was closed and the mine was turned back to E. J. Schoo the former owner.
>
> Geology The Old Hickory mine lies in a belt of Triassic rocks at a place where they are rather complexly intruded by stocks and dikes of quartz monzonite. Plate 1[1] shows the topography and geology in the vicinity of the mine. The Triassic rocks, which belong to the Harrington Formation, are composed of thin-bedded shales with beds of limestone and lenses of quartzite. The contact metamorphic rocks around the intrusive bodies include one zone that is composed largely of magnetite, it is in this zone that the best scheelite ore has been found. In the vicinity of the Old Hickory, the rocks strike nearly north-south, directly toward the main masses of intrusive quartz monzonite and granodiorite porphyry, which lie about 1,100 feet north of the shaft. Surface exposures close to the mine workings are poor, but small scattered outcrops of quartz monzonite and abundant exposures of it in the mine indicate that the scheelite occurs close to igneous contacts.
>
> *Sedimentary rocks.* At the mine the lithologic sequence from west to east in the Harrington Formation is as follows: a massive layer of quartzite[2], variable in thickness, on the west side is followed by the ore body, which is in a completely replaced limestone layer[3], probably more susceptible to alteration because of original impurities and porosity, and now composed chiefly of magnetite accompanied by some silicate, sulfide, and scheelite. To the east of the ore body the rocks are thoroughly metamorphosed, but it is inferred from their present composition that they originally consisted of impure shaly limestones and calcareous shales with lenses of quartzite and pure limestone. A few dikes of granodiorite porphyry are intruded parallel to the bedding.
>
> This series of altered sedimentary rocks displayed near the mine and shaft may be traced southward for at least 1,500 feet along the strike, despite considerable variations in the intensity of the metamorphism, which depends on the varying relation of the sedimentary to the igneous rocks. The zone containing magnetite and scheelite extends for only about 500 feet south of the shaft. Beyond the shaft, there is garnet rock with only sparse and scattered showings of scheelite.
>
> *Igneous rocks.* The igneous rocks in and near the Old Hickory mine are quartz monzonite and granodiorite porphyry. The quartz monzonite seems to be more abundant and to be more closely related to the ore deposit than the prophyry, and, in both its coarse and fine-grained phases, it forms dikes, sills, and small irregular intrusive masses in the limestone. The general charact-

[1] Figure 3 of this report

[2] Talisman Quartzite

[3] Toroweap and Kaibab Plympton Undifferentiated formations

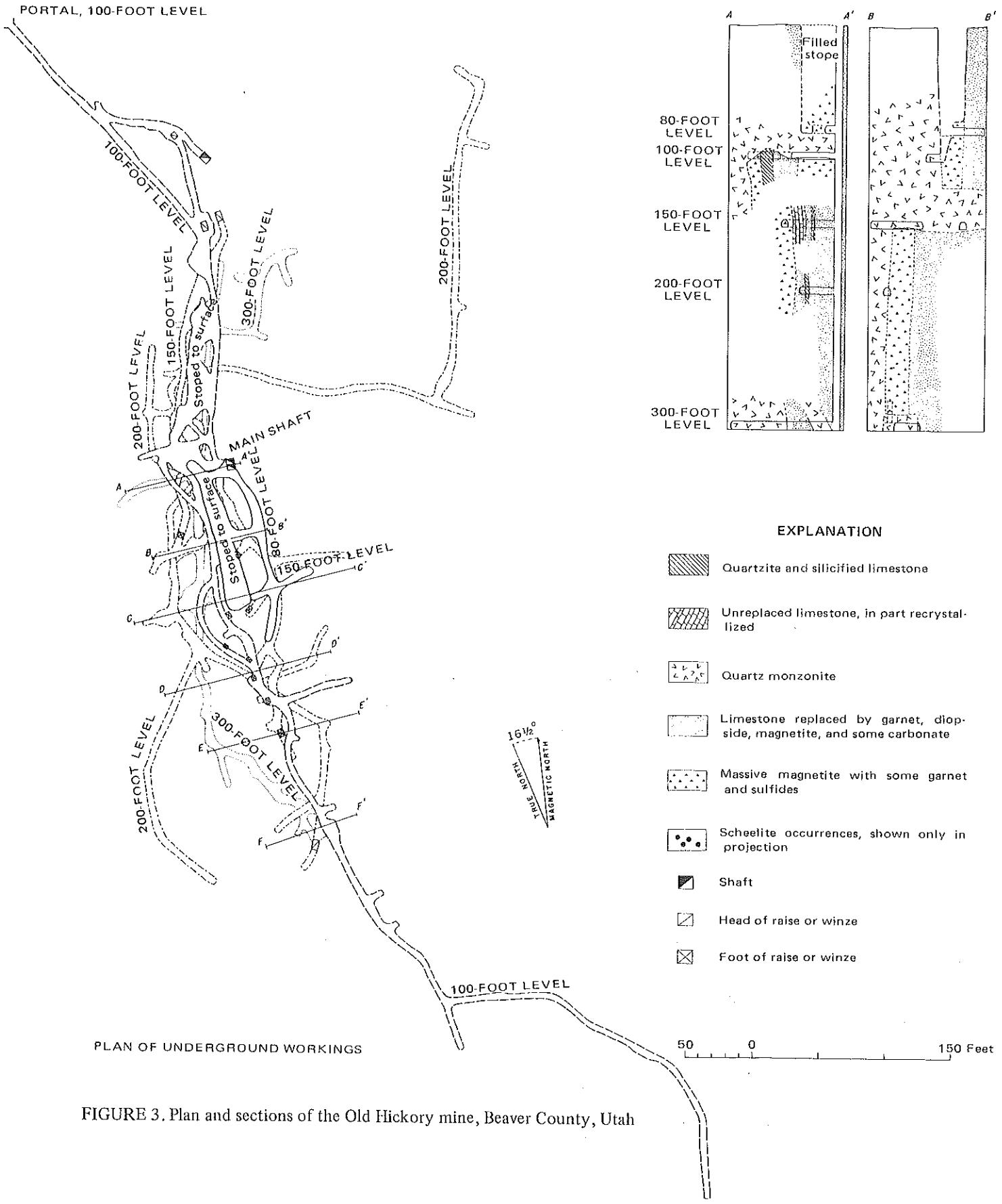
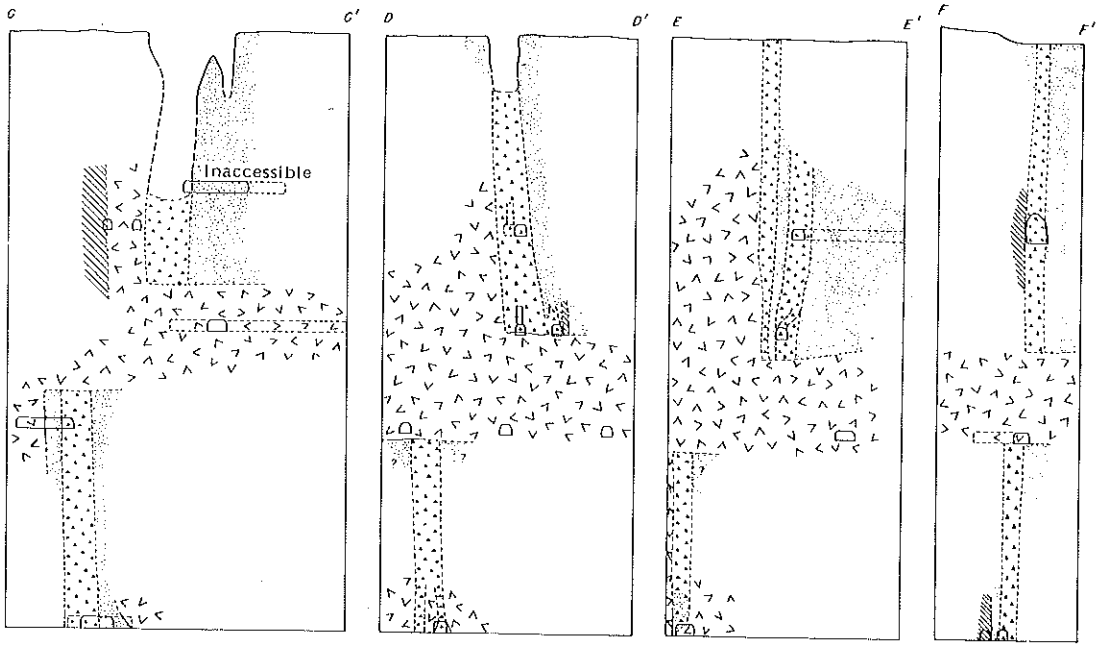
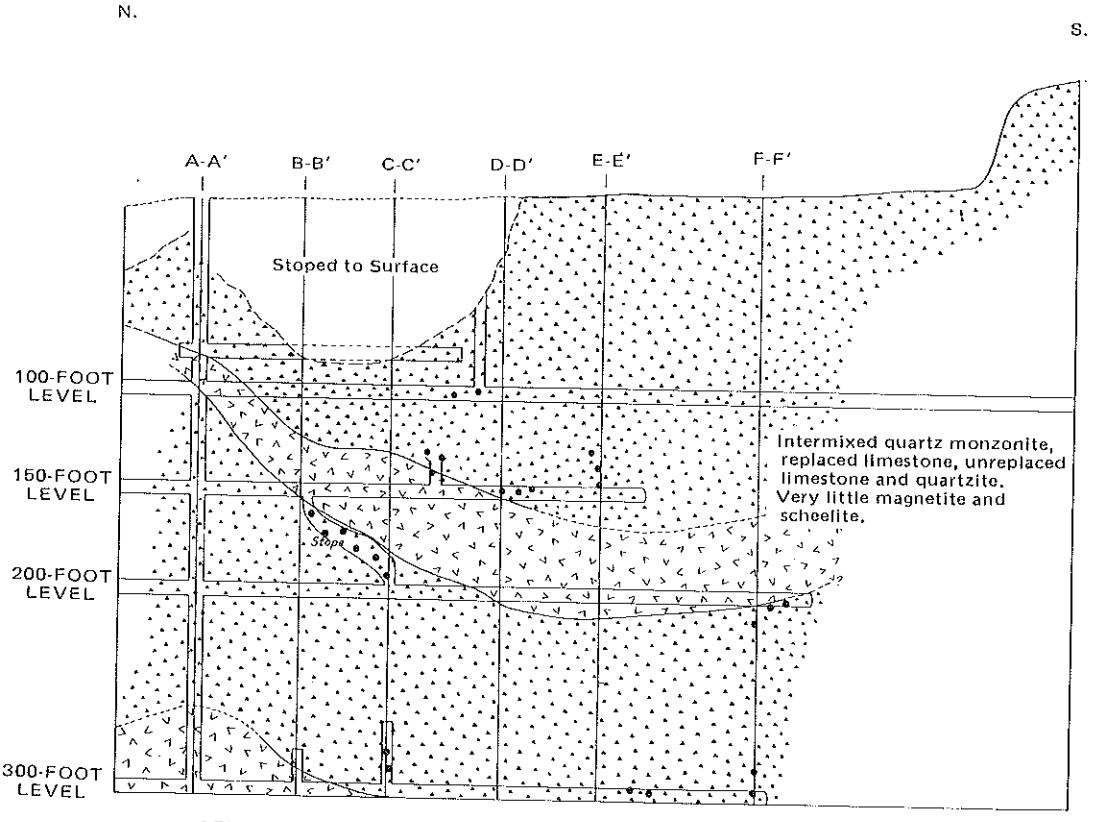


FIGURE 3. Plan and sections of the Old Hickory mine, Beaver County, Utah



STRUCTURE SECTIONS



GENERALIZED LONGITUDINAL PROJECTION OF MAGNETITE ORE BODIES

Source: S. W. Hobbs (1945).

er of the igneous rock indicates that the sedimentary rocks at the Old Hickory probably constitute a large roof pendant in the quartz monzonite.

Structure. The sedimentary strata in general stand nearly vertical and strike nearly north, with little variation in dip or strike. The principal structure complications are due to the irregular intrusion of the igenous rocks, which follow the bedding planes of the sedimentary rocks for the most part but frequently cut across them as rather gently dipping dikes or as irregular masses.

One dike, striking nearly east and dipping gently to the south separates the sedimentary rocks including the ore body, into two segments The upper segment is displaced relative to the lower about 50 or 60 feet to the east as is shown in the structure sections (pl. 1)[1]. The measure of the displacement is based entirely upon the offset produced in the magnetite zone and the vertical igneous contact west of the ore body. This offset may have been caused by a fault along which the dike was later intruded, or by movement along the dike either before or after it solidified. Possibly the offset is not due to faulting at all but marks a jog in a zone of alteration formed along an irregular igneous contact, at the place where the horizontal dike was by chance injected. Faulting, however, seems the most probable cause of the offset for in one place the quartzite, the one member of the series that can be identified both above and below the dike, is apparently displaced. Other faults are of minor importance in the immediate vicinity of the mine, where post-mineral movement, although it has produced gouge along some of the contacts of the ore body, has nowhere significantly offset the contacts

Ore deposit *Mineralogy.* The scheelite of the Old Hickory mine occurs in a contact-metamorphic deposit produced by the intrustion of quartz monzonite into calcareous sediments. The ore appears to be localized principally in one or more beds of limestone that are especially susceptible to replacement. The main deposit is in an elongate tabular body, 15 to 25 feet wide, consisting chiefly of magnetite and silicates, the most abundant of which are garnet and diopside. Gradual changes of composition may be observed not only in crossing the strike but also along it, and in many places the deposit is made up of thin layers evidently differing in composition. The proportion of magnetite to silicates varies widely from about 90 percent magnetite and ten percent silicates to 90 percent silicates and ten percent magnetite. Minor constituents of the deposit are the sulfides pyrite, chalcopyrite, and bornite, some secondary copper minerals, and scheelite. The scheelite is generally most abundant in rock that contains abundant magnetite, and such rock occurs mainly at or very close to igneous contacts. Most of the magnetite is localized in the 15- to 25-foot tabular zone adjoining the quartzite and monzonite on the west but scattered grains of magnetite and scheelite are found in garnet-diopside rock 100 feet or more from the contact. Still farther from the main contact certain favorable layers are completely altered to garnet-diopside-magnetite rock containing little or no scheelite, but most of the rest of the sedimentary series is only recrystallized or slightly altered.

[1] Figure 3 of this report

The primary copper sulfides are so sparsely scattered that the rock containing them can have no value as an ore of copper, but a small amount of copper has been obtained from some rock near the surface where copper carbonate is concentrated in the numerous fractures.

The scheelite in the magnetite-garnet rock occurs in two forms. A few two to three-inch veins of nearly solid scheelite in large, translucent, greenish-gray crystals have been found at the base of the open cut 50 feet south of the main shaft, but these veins are traceable for only 10 to 15 feet. Most of the scheelite occurs in small grains, or more commonly in clusters of small grains, one half to one-inch long in the magnetite. Each cluster appears superficially to be a single large crystal, but close examination reveals its composite character. All gradations are found between rock in which these clusters are widely scattered and zones 10 to 15 feet long in which the clusters are crowded together.

All of the scheelite in the Old Hickory mine, like that in the Cupric property, has a yellowish-white or yellowish fluorescence color, indicating that it contains a good deal of calcium molybdate. The color varies considerably from place to place, and assays of the mineral are said to show that some of it contains only a few percent and some of it 20 or 30 percent of calcium molybdate. None of the mineral in the Old Hickory mine has a blue-white fluorescence color.

The minerals in the deposit are probably almost contemporaneous. In some places magnetite and sulfides cut earlier garnet and diopside, and veins of scheelite cutting magnetite show that some of it is later than magnetite, although some is earlier or of the same age The whole sequence, however, is related to the same period of igneous activity

At the Old Hickory mine, as at the Cupric mine, the important factors in localization of the scheelite and primary sulfides are country rock of favorable composition and the immediate proximity of the igneous intrusive contact. Fracturing played a minor part, although it prepared the ground for the deposition of oxidized copper ore near the surface.

Ore shoots and limits of ore. Scheelite is not only associated with magnetite, as already noted, but is concentrated in rather definite ore shoots within the rock rich in magnetite. One of these ore shoots which extends from the 200-foot to the 150-foot level, lies beneath the low-dipping quartz monzonite dike already mentioned (p. 96), and extends along the junction of the dike with the vertical contact of the monzonite body on the east. The contacts between the ore shoot and the igneous rocks are sharp. It is possible that the ore minerals were derived directly from the adjacent igneous rock, but it is more likely that the inverted trough formed by the intrusive contacts directed solutions from below and thus concentrated them in definite shoots.

Other prominent shoots have been found in the mine, but much of the scheelite is irregularly distributed through the magnetite rock. Small quantities of scheelite have been noted in zones east of the main contact deposit, but igneous rock has always been found nearby when it was looked for.

Both the abundance of igneous rock in the mine and its distribution strongly suggest that the sedimentary rocks in which the ore occurs form a large roof pendant

in the igneous rock. This view is further substantiated by the fact that the abundance of igneous rock in general increases with depth. It seems likely, indeed, that the sedimentary rocks and consequently the ore deposit will be completely cut out at no great distance below the present 300-foot level of the mine.

Five hundred feet south of the shaft the strike of the sedimentary rocks swings slightly to the east and a thick band of quartzite comes in on the surface between the limestone and the igneous rock. This is probably the reason for the scarcity of magnetite in surface exposures to the south. Underground the 100-foot level extends along the strike of some magnetite lenses associated with dike rocks, to a point 750 feet south of the shaft, but scheelite is here very sparse or entirely lacking.

Production and reserves Although a little of the garnet-diopside rock south of the open cut contains scheelite, all the ore that had been mined by early 1944 was in rock that contained at least 50 percent of magnetite, so the amount of indicated ore available depends primarily upon the amount of magnetite-rich rock in the mine. Not all of this rock, however, is scheelite ore, and it is therefore necessary, in calculating reserves, to take account of the distribution of scheelite within the magnetite rock.

The localization of the scheelite ore is controlled mainly by two factors, whose relative importance varies from place to place. The more important factor is proximity to a contact. The other is control of the movements of the ore-bearing solutions by impervious igneous rock. The low-angle dike already noted, for example, apparently has acted in at least one place to concentrate solutions on its lower side. In general, however, the magnetite above the low-angle dike is more uniformly impregnated with scheelite than that below, where the scheelite is more spotty.

The structure sections and the longitudinal projection of the ore body in plate 37[1] give a picture of the extent and distribution of the ore that is helpful in calculating reserves. The zone rich in magnetite extends for several hundred feet north of the shaft, but very little scheelite has been found in the old mine workings that explore this part of the zone and it is not included in the estimates of reserves

The structure sections in plate 37[1] illustrate the decrease in thickness of the magnetite zone toward the south and show that it seems to be ore-bearing for only a short distance in that direction. On the surface, very little scheelite-bearing magnetite was found beyond a point about 100 feet south of the open cut and on the 100-foot level the ore disappears almost directly beneath this point The scheelite ore tends also to pinch out in depth, and below the 300-foot level there is probably very little ore. This is partly because the magnetite body narrows downward, partly because the scheelite content of the magnetite rock diminishes downward.

Most of the pockets of higher-grade ore were mined out by December 1943, and mining was discontinued. Between the fall of 1941 and December 1943 the mine supplied 18,000 tons of rock from which 6,800 tons of ore containing 0.6 percent WO_3 was sorted. The average grade of the rock removed from the mine thus is 0.226 percent WO_3.

Most of the possible scheelite ore in the mine is contained in a block of magnetite-rich contact rock roughly 300 feet deep, 450 feet long, and 6 to 30 feet wide. From its volume about 75,000 cubic yards, there must be subtracted the volume of included igneous rock and that of the empty stopes, estimated at 51,000 cubic yards. The net volume of magnetite-rich rock would be 24,000 cubic yards which at 7,210 pounds per cubic yard would weigh approximately 86,500 tons. To this may be added 20,000 tons of ore calculated from surface exposures beyond the limits of the underground workings, making a total of 106,500 tons of magnetite-rich rock in the deposit. It is known from direct observation that a large part of this material is barren. The erratic distribution of the scheelite in the magnetite may be regarded, by a liberal construction, as making all unexplored parts of the magnetite body potential sources of ore, but there is no reason to suppose that they will be any richer on the average than the parts that have been mined.

By December 1943, all of the better ore shoots had been mined out and any ore left in the ground was either of lower grade or in as yet undiscovered ore shoots. At the beginning of operations in 1941 ore reserves at the Old Hickory mine were estimated by the writer to be about 15,000 tons of measured and indicated ore containing approximately 0.5 percent WO_3, and 43,000 tons of inferred ore containing 0.25 percent WO_3. Actual production has amounted to 18,000 tons which averaged slightly under 0.25 percent WO_3. This production has essentially removed all of the ore formerly classed as measured and indicated.

Mining activity in 1943 opened more of the mine for examination, permitted a more accurate appraisal of ore reserves, and showed the distribution of sheelite-bearing rock to be quite restricted. Thus, it does not seem probable that there are any large potential reserves of ore in high-grade pockets or of large tonnages of low-grade material.

It is estimated that about 400 tons of ore containing from 0.75 to 1.00 percent of WO_3 could be sorted from scheelite-bearing material left in the mine. This amount of ore is classed as indicated as much of it is partly exposed by underground workings. It is possible that some undiscovered pockets of ore, minable under conditions existing in 1944, are present, but there is no basis on which to estimate the tonnage. About 5,000 tons of rock containing approximately 0.1 to 0.2 percent WO_3 may be inferred. This is not ore, but could possibly be a source of small production under emergency conditions.

Magnetite Stopes, Montreal Mine – The magnetite stopes of the Montreal mine are located in the SW¼, NW¼, section 23, T. 27 S., R. 11 W., Salt Lake Base and Meridian (Figure 1). It consists of an open pit and two levels of underground workings (Figures 4 - 4c).

The ore is a tactite where Permian Kaibab limestone has been contact metamorphosed by the Montreal mine granodiorite. The skarn is characterized by much simpler mineralogy than those associated with the quartz monzonite; the minerals being chiefly magnetite, chlor-

[1] Figure 3 of this report

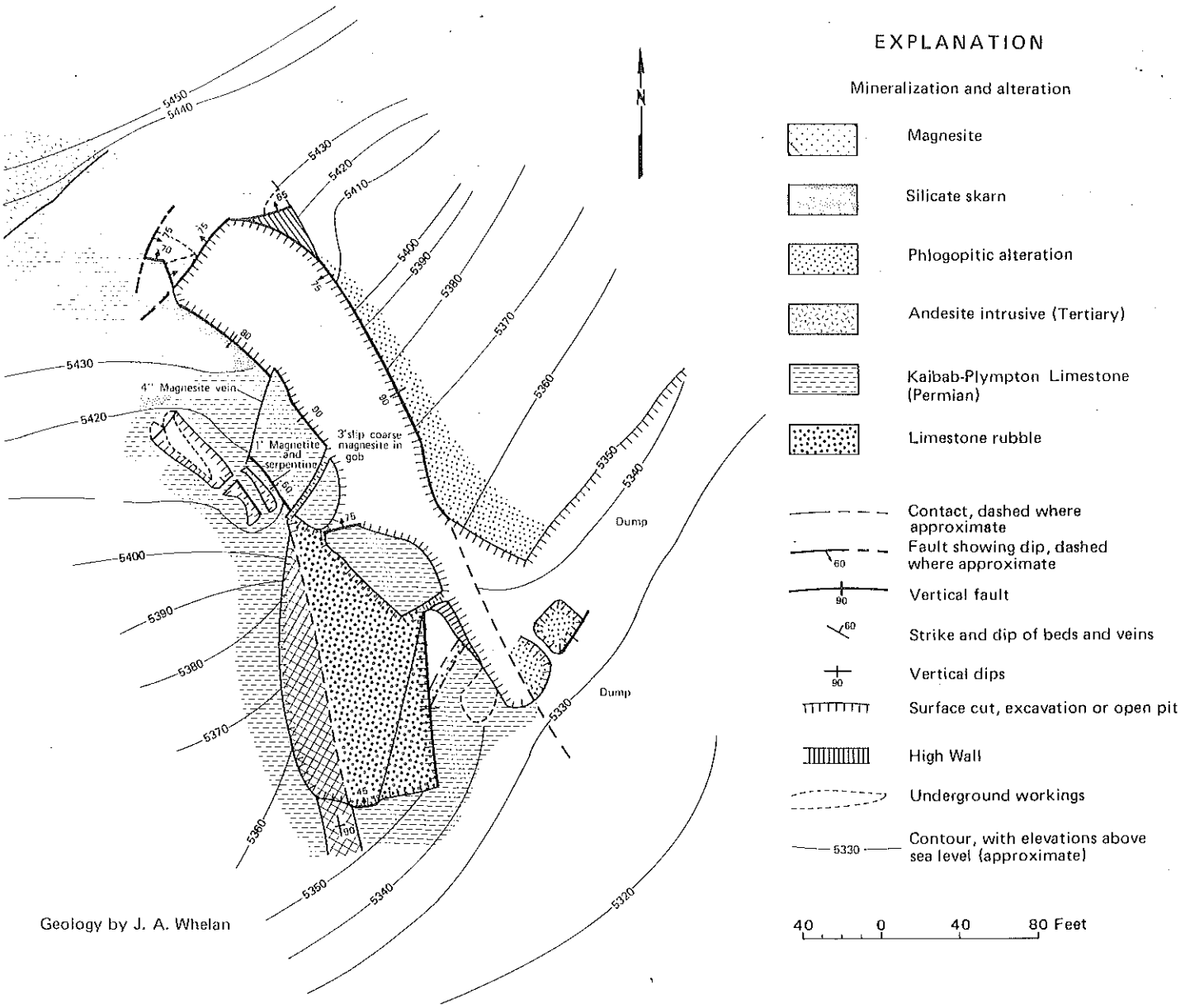


FIGURE 4. Surface workings of the Magnetite Stope, Montreal mine, Beaver County, Utah

ite, phlogopite and some serpentine on the lower level. Copper minerals are essentially absent.

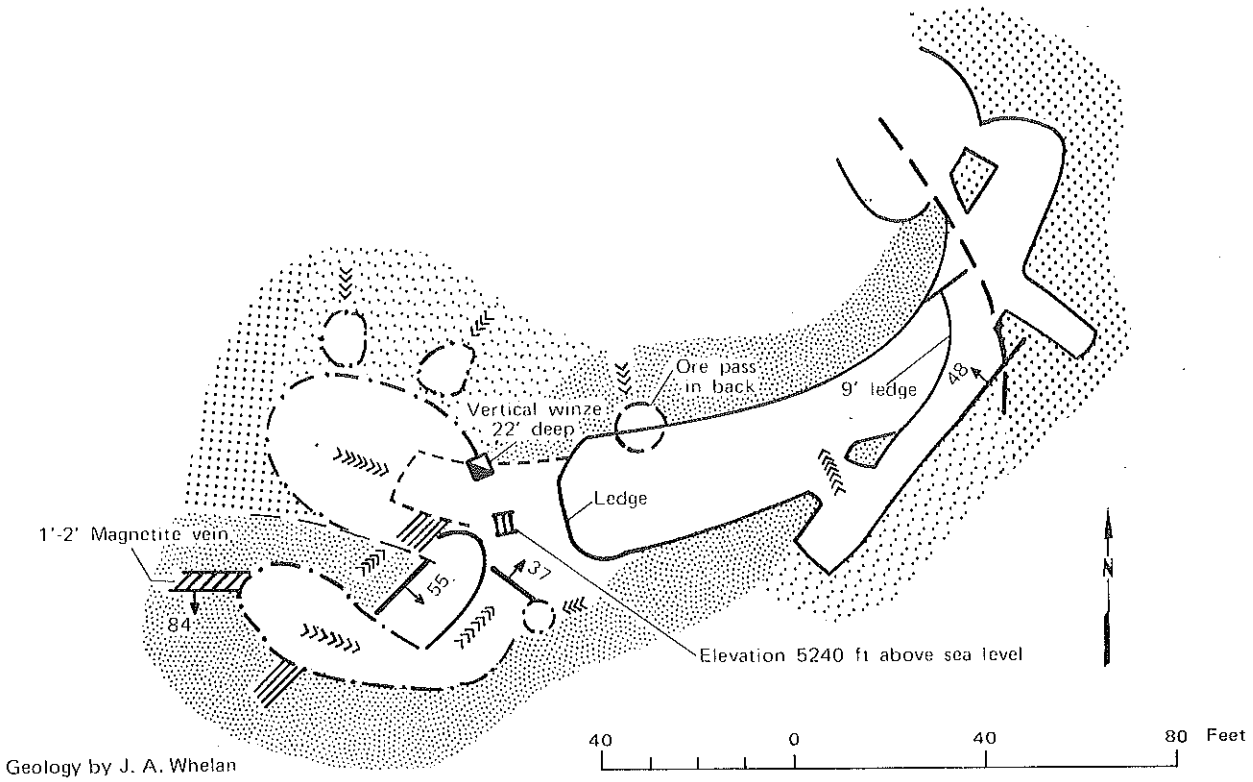
The limestone is marbleized. It is cut by veinlets of silicified magnesite. The granodiorite is propylitically altered, containing much epidote on joint surfaces, with hornblende and biotite partially altered to chlorite.

The ore body shows a rude zoning. The tabular magnetite is enclosed in a zone of magnetite-chlorite. The contact of the ore body with the intrusive is characterized by rather clean, fine, golden phlogopite. This contact is a fault, however, and the phlogopite may be the result of later hydrothermal activity along the fault.

The magnetite was shipped as a smelter flux. Production from the pit and underground workings was small, probably not exceeding ten to twenty thousand tons.

Niagra Falls Claims – The exact date work started on the Niagra Falls claims is not known. However, the adit, Figures 5a - b, was driven prior to 1913 (Ralph, 1915, p. 2 and 4).

The ore body was a pipe of contact metamorphic minerals formed in Kaibab Limestone at the contact with quartz monzonite. It was localized by the intersection of northwest trending faults and east to east-



EXPLANATION

Magnetite with phlogopitic alteration

Magnetite with chlorite

Massive magnetite

Contact, dashed where approximately located

37 Fault showing dip, dashed where approximately located

Workings on level

Workings above lower level

Workings below level

Head of winze

84 Vein, showing dip

Grizzly

Fault zone

Inclined workings (chevrons point downward)

FIGURE 4a. First underground level of the Magnetite Stope, Montreal mine, Beaver County, Utah

southeast trending faults, probably of small displacement. The east trending faults parallel the jointing in the quartz monzonite. The ore body plunges about 70° N, 60° W. The ore was a skarn composed of magnetite and diopside but with significant quantities of garnet, actinolite, serpentine, phlogopite, chlorite and magnesite. The limestone is in places turned into a solid grossularite garnet rock and is everywhere recrystallized to marble. Ralph (1915, p. 6) gave the following assay of the ore:

copper	2.13 percent
iron	36.04 percent
insoluble increment	13.70 percent
silver	0.71 oz/t

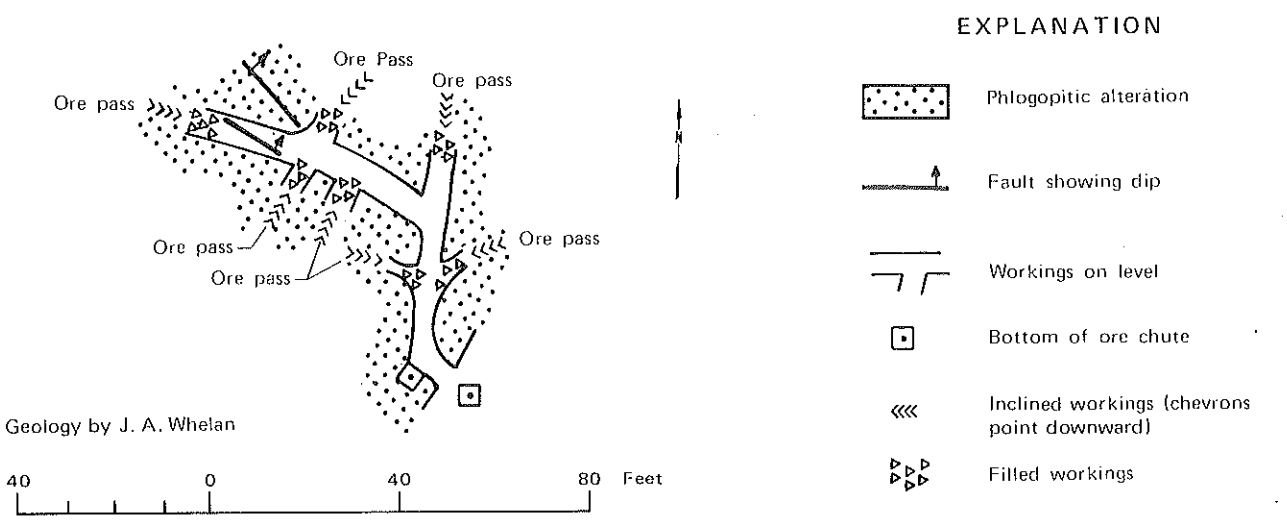


FIGURE 4b. Underground sub-level of the Magnetite Stope, Montreal mine, Beaver County, Utah

During mapping for this project grab samples were taken as follows:

Location	Percent copper
Magnetite rich stopes, adit level	1.74
Raise by ore chute, adit level	0.99
Diopside rich ore, adit level	0.90
East stope, adit level	1.40
Ore pile, surface prospect above Niagra Falls Stopes	3.70
Ore pile, outcrop Niagra Falls Stopes	0.90

The workings (Figure 5b) consist of northwest trending adit through quartz monzonite, about 550 feet to the quartz monzonite-limestone (now garnet rock) contact. A drift here, about 80 feet to the east, along the contact, proved to be barren. Drifting continued into the garnet rock, to the northwest for about 300 feet, again in barren rock. Drifting was also continued westward for about 350 feet, now pack walled off at 300 feet. Two cross cuts to the south from this drift intersect the ore body. It is interesting to note Ralph's comments (1915, p. 4 and 5) on the work:

> "The body of limestone in about the center of the property which became 'included' in the monzonite at least on three sides, and which is roughly of horse shoe shape, constitutes the nucleus for an important contact deposit of cupriferous magnetite, the most prominent outcrop of which is at the 'toe'. This outcrop was apparently the chief point of interest to the original locators of the property, and in an effort to develop this ore body at depth an adit was run into the hill side 550 feet, and where the 'face' was vertically beneath the outcrop in question. No mineral being encountered at this point two 'forks' were run - the included angle being approximately 100° - one to the extent of 350 feet and the other 250 feet making a total of nearly 1,200 feet of prospecting No sign of ore being encountered further effort was abandoned.
>
> A study of this set of conditions in 1913 suggested to the writer that failure to encounter the contact at depth was by reason of nonappreciation of the 'dip' of the limestone, and at a point about 150 feet beyond where the left 'fork' diverged from the main cross cut a swinging back at right angles was suggested, and which resulted, after only 30 feet of work, in encountering the north 'wing' of the contact. This development showed that the main adit had plunged directly under the overchanging 'nose' of the tilted limestone; that the right hand fork had veered hopelessly farther into the monzonite while the left fork had practically been skirting the contact through the whole of its distance."

There is considerable stoping on the adit level, and above and below it. A two compartment shaft goes to a lower level or levels, but they were not explored or mapped. The main ore body is stoped from the adit level to the surface. The writer estimates about 20,000 tons of two percent copper ore has been mined from this property.

The Bawana Mine – The Bawana mine was discovered as a gravity anomaly in the late 1950s. It is a skarn type copper deposit in the Toroweap Formation. The ore body was about 400 feet long and about 80 feet wide. It has been mined to a depth of about 200 feet. Its strike was about N 60° W and its dip 65° NE. A section across the middle of the ore body is shown in Figure 6.

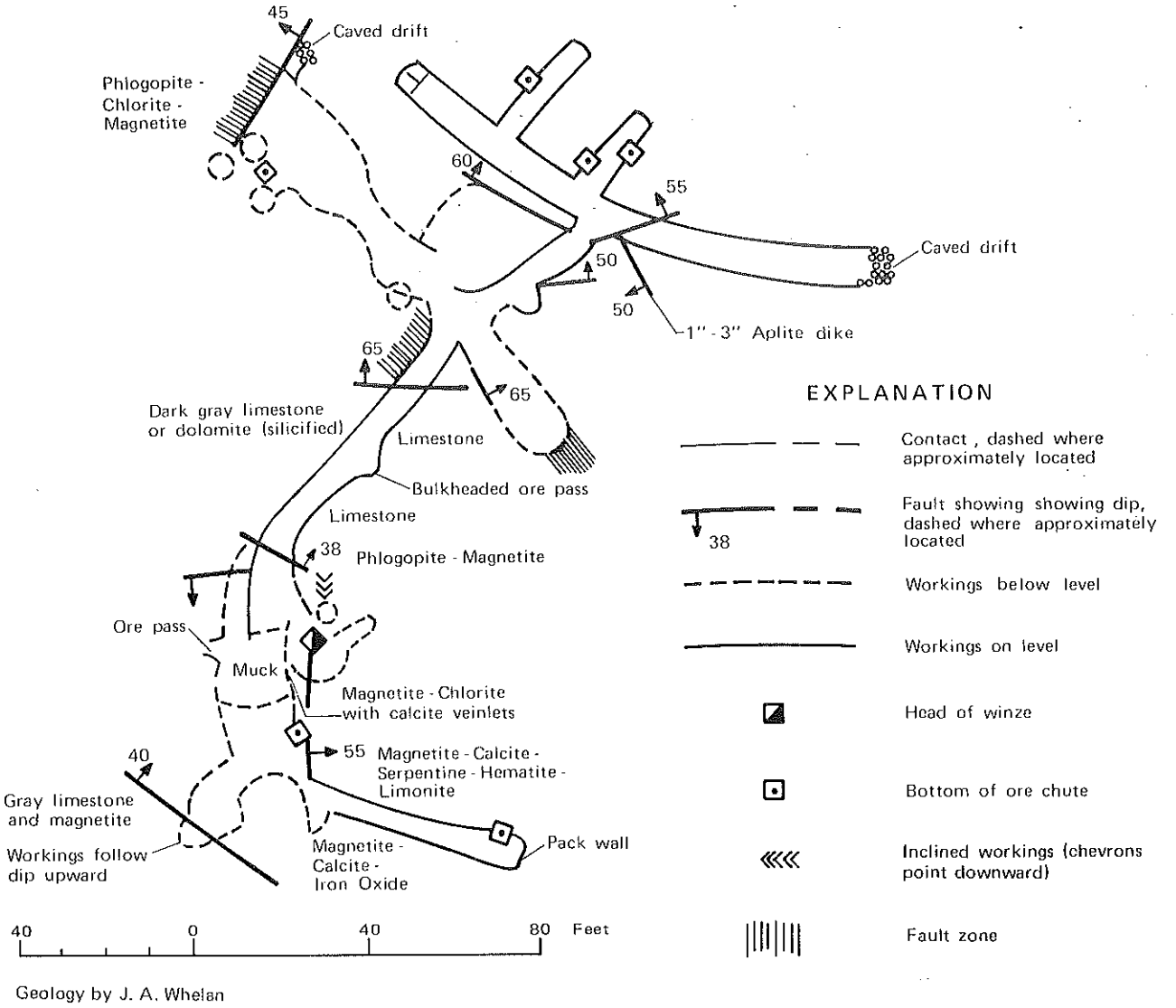


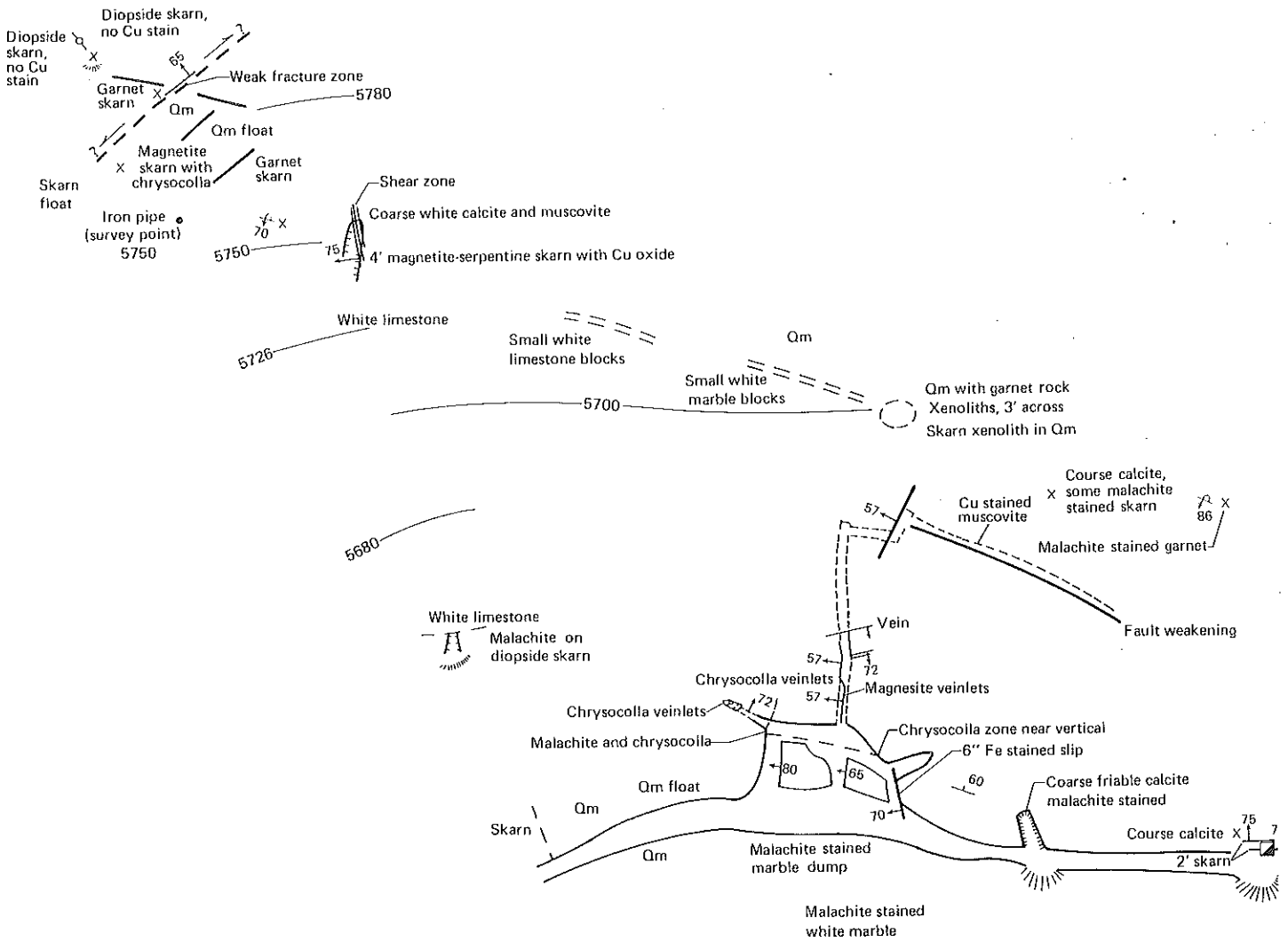
FIGURE 4c. Second underground level of the Magnetite Stope, Montreal mine, Beaver County, Utah

The skarn consisted of massive garnet, diopside, magnetite, recrystallized calcite, serpentine, idocrase, epidote, phlogopite, thaumasite, and kinaite. The ore body was oxidized to almost the present bottom of the pit. Chief ore minerals were chrysocolla and malachite with some covellite and tenorite. Stringhamite and Whelanite were both originally identified in this pit (Hindman, 1976; 1978). Primary ore minerals were bornite and chalcopyrite, frequently massive. Some scheelite crystals with powellite rims are present. The primary sulfides are closely associated with massive garnet rock.

Oxidation caused enrichment of the shallower portions of the ore body. The upper oxidized portions of the ore body averaged over three percent copper, the primary ore under two. The average ore grade was 2.65 percent. Approximately 450,000 tons of ore were mined. Treatment of the Bawana ores was carried out by flotation. The chrysocolla did not respond well to flotation and mill tailings average 0.6 percent copper. Average recovered grade was 2.01 percent.

The Maria Mine – The Maria was discovered by the Cerro Verde Mining Company, in the same era of magnetic prospecting that the Bawana and Hidden Treasure mines were. It is located on the southwest corner of the main portions of the range, in the NE¼, SW¼ 22, T. 27 S., R. 11 W. (Figure 1).

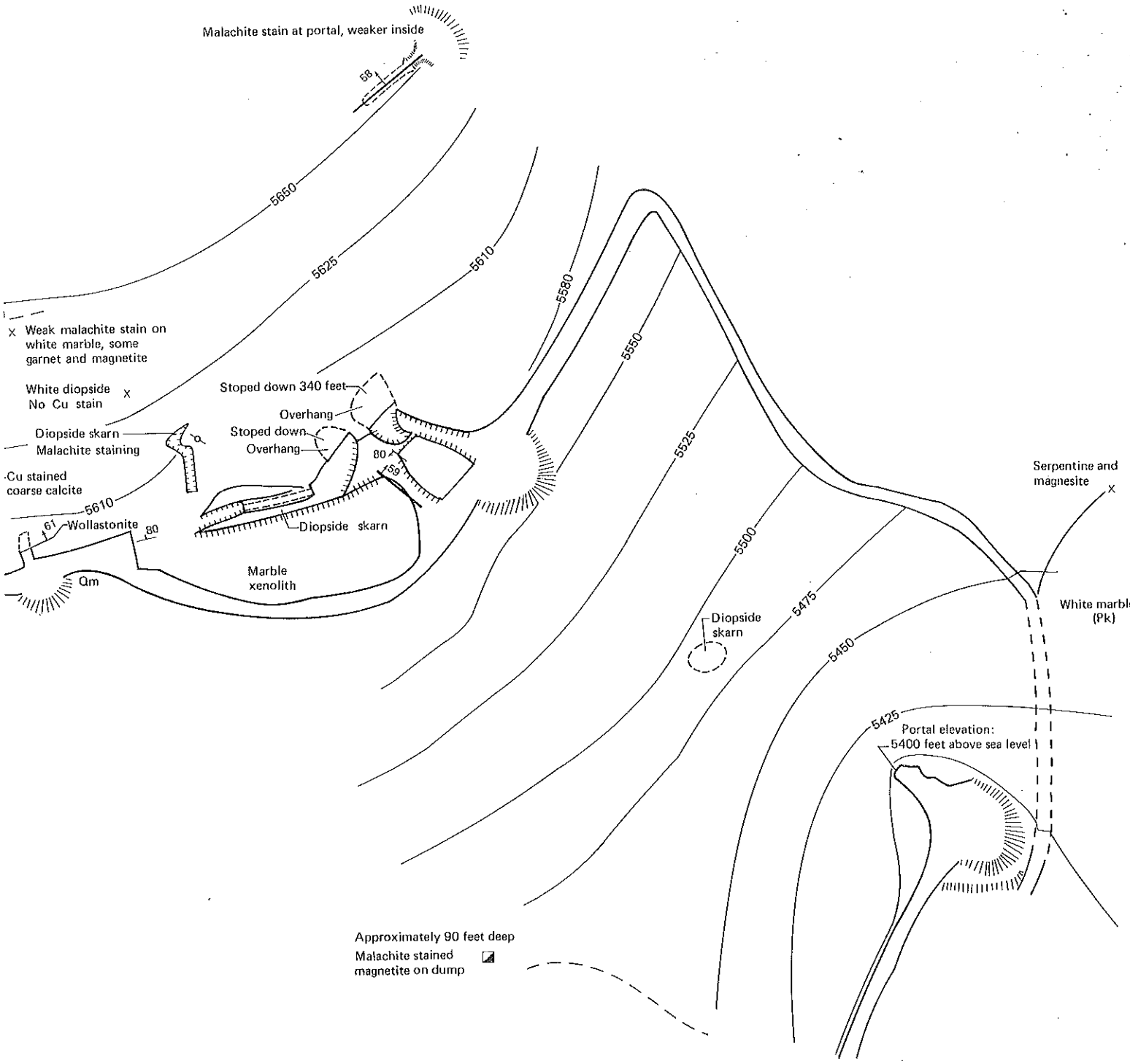
The ore body is, like the others described, a garnet-diopside-magnetite skarn in the metamorphosed Toroweap Formation. The gangue mineralogy is similar



EXPLANATION

Qm	Quartz monzonite		Underground workings
x	Test pit		Fault, dashed where inferred
	Shaft down		Contact, dashed where inferred
61	Strike and dip		Iron pipe (survey point)
70	Overturned bedding		
	Vertical bedding		

FIGURE 5a. Surface workings of the Niagra Tunnel, Montreal mine, Beaver County, Utah


Malachite stain at portal, weaker inside
58
5650
5625
5610
5580
5550
5525
5500
5475
5450
5425
X Weak malachite stain on white marble, some garnet and magnetite
White diopside No Cu stain
Stoped down 340 feet
Overhang
Stoped down
Overhang
Diopside skarn
Malachite staining
Cu stained coarse calcite
80
59
61
Wollastonite
80
Diopside skarn
Marble xenolith
Qm
Diopside skarn
Serpentine and magnesite
White marble (Pk)
Portal elevation:
5400 feet above sea level
Approximately 90 feet deep
Malachite stained magnetite on dump

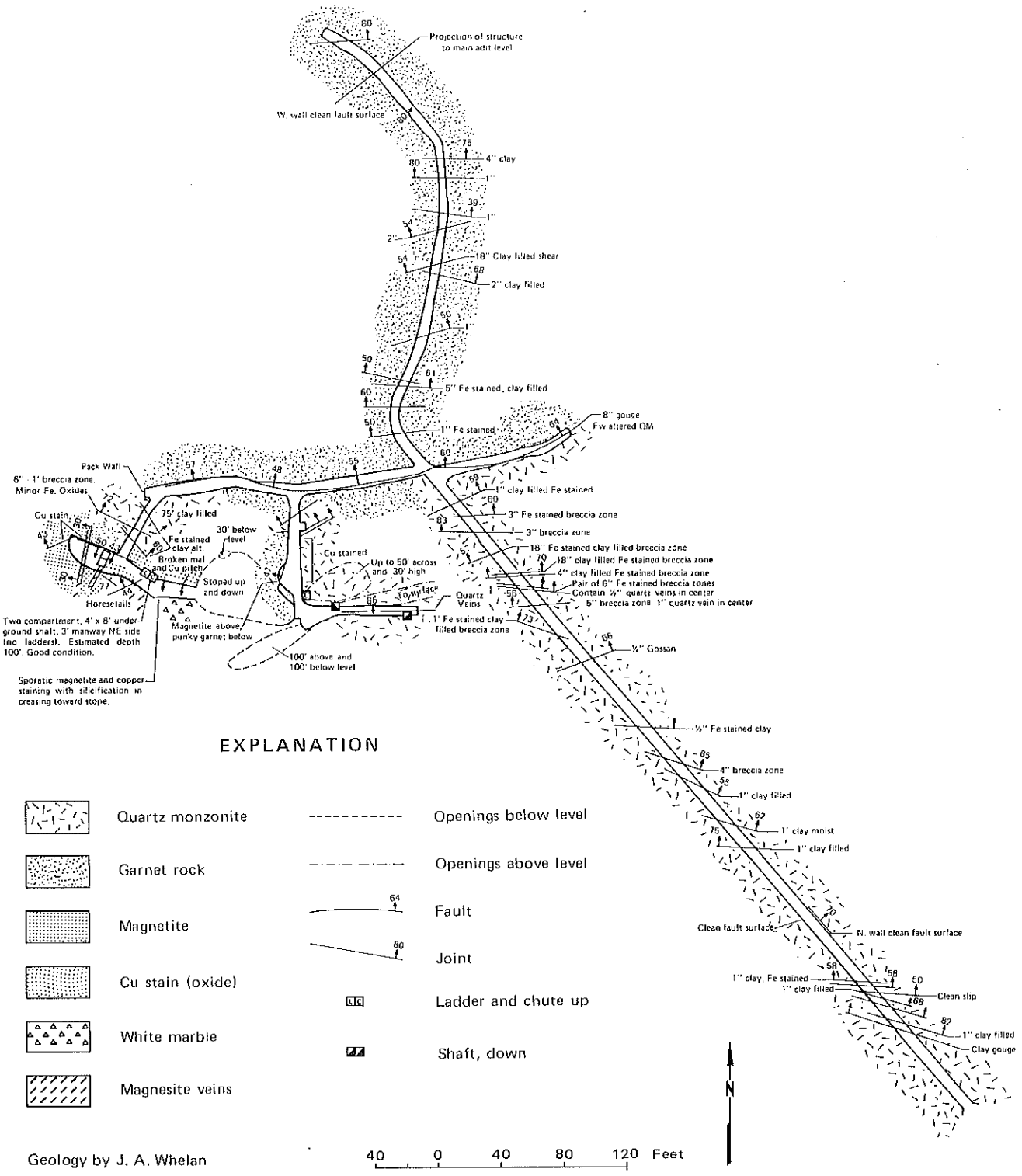


FIGURE 5b. Underground workings of the Niagra Tunnel, Montreal mine, Beaver County, Utah

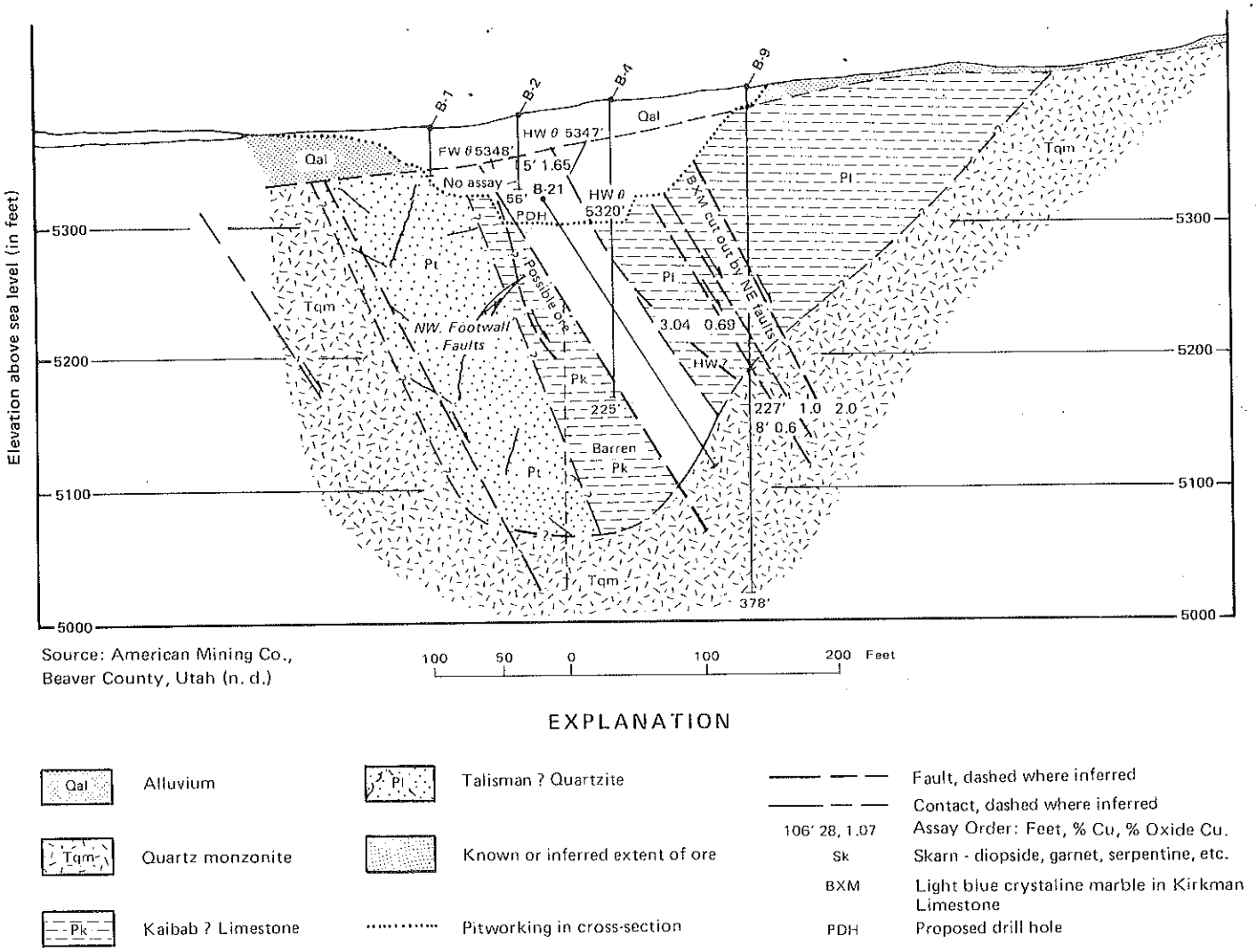
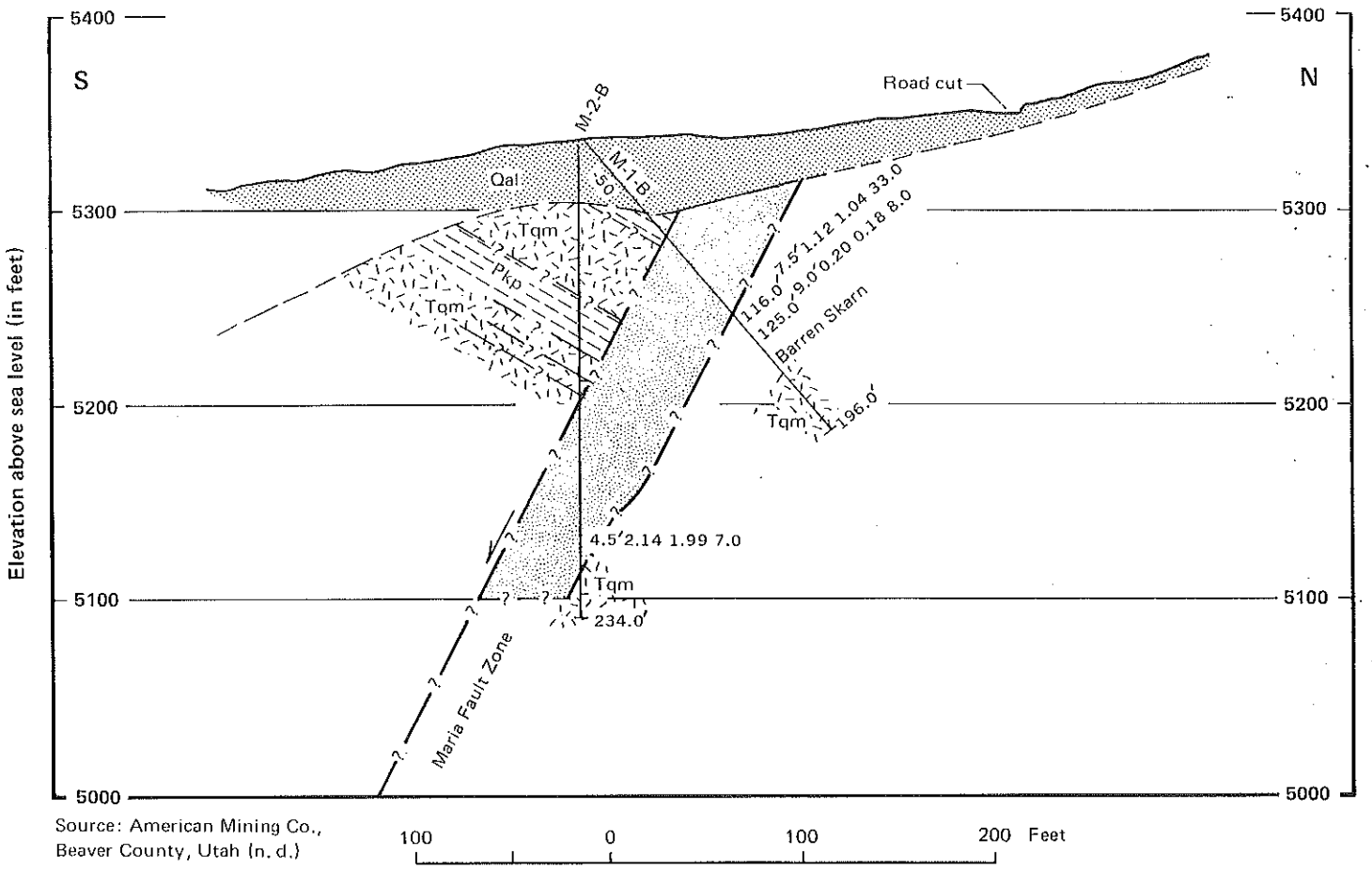


FIGURE 6. Cross-section of the Bawana mine, Beaver County, Utah

to that of the Old Hickory mine, the Niagra Falls stopes of the Montreal mine, and the Bawana mine; previously described. The quartz monzonite was cut by a great number of aplite dikes. The ore body where mined was about 500 feet long and 20 to 75 feet wide, averaging 50 feet. It strikes N 50° W and dips 60° S. A typical cross section is shown as Figure 7. Mining commenced in 1971 and ceased in 1974. Ore grade was averaged 1.65 percent copper. The writer estimates some 200,000 tons of ore were removed.

Ore mineralogy was generally similar to that of the properties mentioned above, consisting chiefly of malachite and chrysocolla with some minor covellite. Mining was shifted to the Hidden Treasure mine when heavy sulfides were encountered on the west end of the pit. The company could only float 350 tons of sulfides per day. Primary sulfides included bornite, chalcopyrite, and a trace of pyrite. There was less bornite and chalcopyrite than was at the Bawana. Molybdenite is fairly common, usually on joint surfaces, particularly on the western and eastern ends of the pit. Pyrite is rare. Most of the properties in the range do not contain pyrite although Butler notes it in the Old Hickory mine.

The Candy B. Anomaly – The Candy B. Anomaly is a magnetic anomaly discovered by the Cerro Verde Mining Company. The anomaly represents a garnet-magnetite tactite in the Toroweap Limestone, near the Talisman contact, where the sedimentary units have been intruded by quartz monzonite. The ore zone is on an eastward projection of the fault controlling the Maria mine. The following data were furnished by the American Mining Company:



EXPLANATION

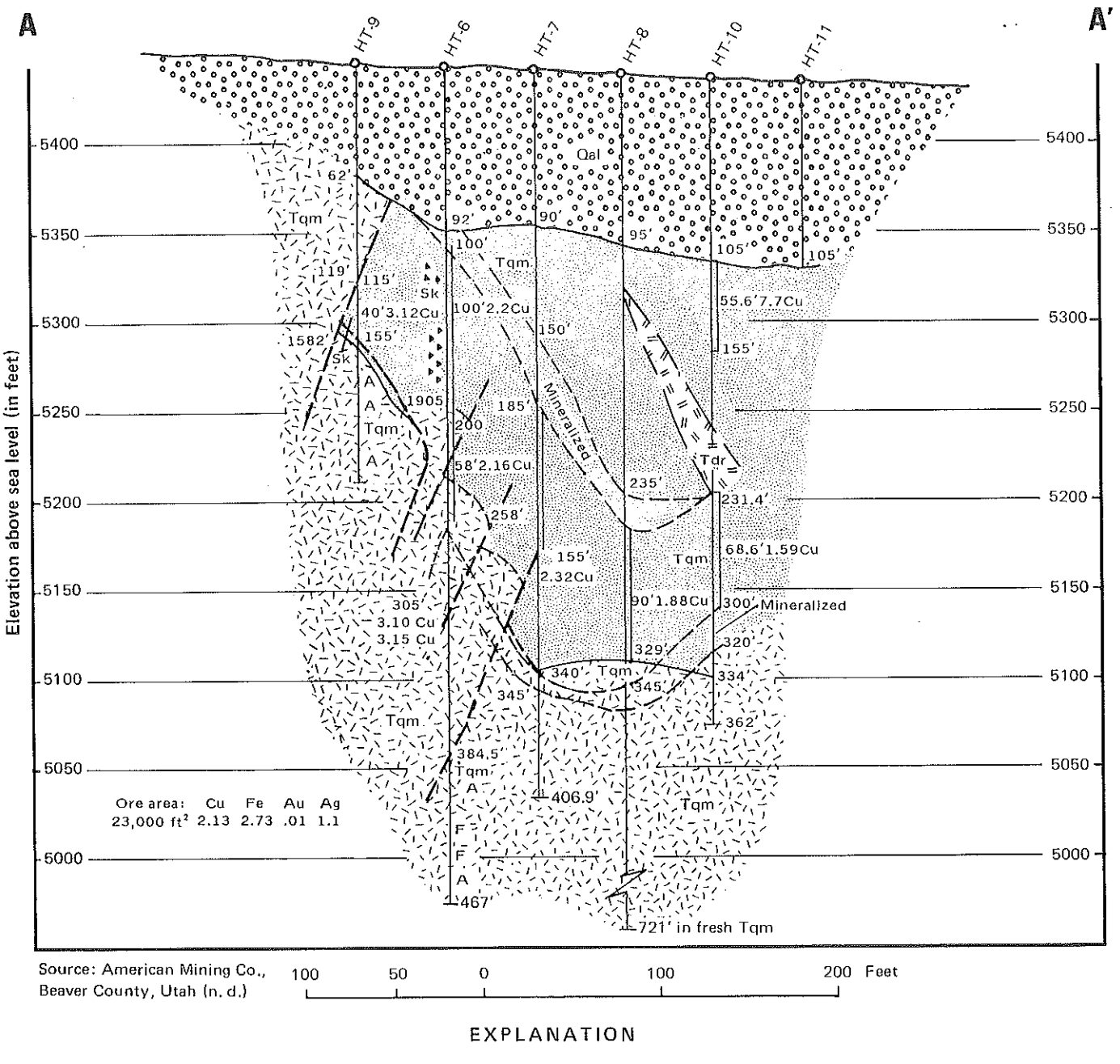
Qal	Alluvium	Assay Order:	Feet, % Cu, % Silicate Cu, % Fe
Tqm	Quartz monzonite		Fault, dashed where inferred
Pkp	Kaibab-Plympton undifferentiated		Contact, dashed where inferred

FIGURE 7. Cross-section of the Maria property, Beaver County, Utah

Thickness (feet)	% Cu	oz/T Au	oz/T Ag
15	1.18	0.01	0.3
10.5	1.45	0.03	0.8
129	0.55	0.01	0.6
84	1.11	0.01	0.9
62	0.37(?)	0.01	0.3
24.5	1.05	0.01	0.3
Thickness weighted mean	0.77	0.01	0.6

The anomaly was drilled by Essex International in 1972, but was not considered to be of sufficient grade or tonnage to mine.

Hidden Treasure — The Hidden Treasure, like the Bawana and Maria, was discovered by a ground magnetic survey. A cross section was prepared by Allen O. Taylor of American Mining Company and furnished to Bronson Stringham, and is included as Figure 8. The data below are abstracted from those furnished by the American Mining Company.



EXPLANATION

- Alluvium
- Quartz monzonite, A-Altered, F-Fresh
- Known or inferred extent of ore
- Post ore diorite dikes
- Breccia
- Fault, dashed where inferred
- Contact, dashed where inferred
- 100'2.2Cu — Assay Order: Feet, % Cu
- Sk — Skarn

FIGURE 8. Cross-section A–A′ of the Hidden Treasure ore body, Beaver County, Utah

The Hidden Treasure lies at the projected intersection of the Bawana and Niagara faults (Figure 1). Possibly northeast structures also exist.

The ore body consists of a wollastonite, magnetite, serpentine, diopside, and garnet skarn. Magnetite mineralization is confined to the skarn rocks but copper mineralization extends into the quartz monzonite at the base of the skarn mass.

Primary copper minerals are chalcopyrite with minor bornite. Secondary copper sulfide minerals include chalcocite and covellite. Oxide copper minerals in their approximate order of abundance include malachite, brochantite, chrysocolla, copper-pitch, tenorite, and aurichalcite.

Based on six drill holes, the American Mining Company made a preliminary estimate of 940,000 tons (± 25 percent) averaging 2 percent copper (± 50 percent), 27 percent iron, one ounce of silver, and 0.01 ounce of gold per ton. The writer has no data from later drilling. The pit was opened in 1974 by Essex International, and an unknown tonnage of ore removed.

The Sunrise Prospect – The Sunrise ore body was discovered early in 1973 by Essex International, Incorporated. It is located at the southeastern edge of the range, parallel to and east of the Old Hickory ore body (Figure 1).

It occurs in Toroweap Limestone and is approximately 400 feet along strike, 35 feet wide, and dips vertically.

The minerals apparent in the cut, which is about ten feet deep, are chrysocolla and malachite, wollastonite, garnet, and calcite. The grade of mineralization is over 5.6 percent copper with a lime content of about 850 pounds per ton. This deposit is of good grade, but is not suitable for treatment by acid leaching.

The Future of the District – The extensive exploration by the American Mining Company, the Cerro Verde Mining Company, and Essex International makes it doubtful that any large undiscovered ore bodies remain in the district.

Some additional ore could be removed from the Hidden Treasure mine. Small, but good exposures of chalcopyrite and bornite have been covered in the northwest corner of the Maria pit. Molybdenite was left in the eastern end. These could conceivably support a very small scale selective mining operation.

Other areas warranting exploration may be under the thrust fault in sections 14 and 15 and the adjacent lavas in section 14. Any ore bodies discovered would probably be small.

If the quartz monzonite north of the Bawana should be a sill, additional tactite ore bodies might be discovered at its base.

The large number of copper shows in the area in the Rocky, Beaver Lakes, Frisco, Star, and Mineral ranges, has lead the author and others to speculate if there is a porphyry copper source in the area. If one accepts the model of James (1971) there is a high probability that the tactites of the Rocky Range represent a lower portion of the stocks where no disseminated mineralization exists.

MINERALS FOUND IN THE ROCKY RANGE

Sulfides and Sulfosalts

Chalcocite (Cu_2S) occurs as a secondary sulfide in the Hidden Treasure ore body.

Covellite (CuS) also occurs as a secondary mineral in the Hidden Treasure ore body and at other places in the district.

Bornite (Cu_5FeS_4) occurs as a primary ore mineral in the Bawana and Maria mines.

Chalcopyrite ($CuFeS_2$) occurs as a primary ore mineral in the Bawana, Maria, and Old Hickory mines.

Pyrite (FeS_2) occurs as a primary sulfide in the Old Hickory mine (Butler, 1913, p. 194) and in the Maria mine. Pyrite is rare and is not found in most mines.

Molybdenite (MoS_2) occurs in quartz veinlets and on fracture surfaces in the Maria mine.

Oxides and Hydroxides

Hematite (Fe_2O_3) occurs in the skarn type ores of the district.

Magnetite ($FeO \cdot Fe_2O_3$) is a prominent mineral in the skarns of the Old Hickory mine, Montreal mine, Bawana mine, Maria mine and elsewhere in the district.

Goethite (FeO(OH)) is a common mineral associated with the ores of the district.

Hercynite ($FeO \cdot Al_2O_3$). A sample of hercynite, identified by X-ray diffraction, from the Rocky Range, was brought in by A. O. Taylor.

Tenorite (CuO) occurs in the Bawana pit and the Hidden Treasure pit.

Carbonates

Calcite ($CaCO_3$): Calcite is the chief component of the limestones and marbles of the district. Coarse recrystallized calcite occurs in the Bawana, the Maria, and the Montreal mines.

Dolomite ($CaMg(CO_3)_2$): Blue dolomite and tan dolomites occur in the undifferentiated Lower Paleozoic rocks. The Kaibab-and Plympton-undifferentiated and Toroweap formations also contain some dolomitic beds.

Magnesite ($MgCO_3$): Magnesite veins and veinlets are common in the Montreal mine area. Butler (1913, p. 99) gives the following analysis for these veins:

Composition of material from a vein cutting magnetite in prospect north of Hickory, Utah

Insoluble in HCl	0.27
$(Al, Fe)_2O_3$	0.18
CaO	4.72
MgO	42.77
CO_2, calculated	50.71
H_2O, difference from ignition	1.00
Total	99.65

This analysis corresponds to 89.80 percent magnesite and 8.46 percent calcite. The magnesite is younger than the contact alteration of the rocks in which it occurs.

Malachite ($Cu_2(OH)_2CO_3$): Malachite is a common mineral in the Old Hickory, Bawana, and Maria mines and in many prospects in the district.

Azurite ($Cu_3(OH)_2(CO_3)_2$): Minor amounts of azurite occur in the Bawana Pit.

Huntite ($Mg_3Ca(CO_3)_4$) is reported from the Little Rocky prospect by Bullock (1967, p. 16).

Sulfates

Brochantite ($Cu_4SO_4(OH)_6$) occurs in the Bawana and other mines in the range.

Gypsum ($CaSO_4 \cdot 2H_2O$): Secondary gypsum is found in the Bawana mine. The primary gypsum normally found at the top of the Toroweap Formation has been removed throughout the Rocky Range by thermal metamorphism.

Phosphates

Apatite ($Ca_5(F,OH)(PO_4)_3$) is a common accessory mineral of the igneous rocks of the area.

Molybdates and Tungstates

Scheelite ($CaWO_4$) occurs in the Old Hickory, Bawana, and Copper Ranch mines.

Powellite ($CaMoO_4$) occurs as rims on the scheelite of the Old Hickory, Bawana, and Copper Ranch mines.

Silicates

Orthoclase ($KAlSi_3O_8$) is a component of the igneous rocks of the district.

Plagioclase ($NaAlSi_3O_8$ - $CaAl_2Si_2O_8$) occurs abundantly in the igneous rocks of the area. It is usually andesine, but introduced albite occurs in the Talisman Quartzite near quartz monzonite contacts.

Quartz (SiO_2) is a primary component of many of the igneous rocks of the area. It is the principal mineral of the Talisman Quartzite, and occurs in veins in the district.

Diopside ($Ca(Mg, Fe)_2(SiO_3)_2$) forms by the contact metamorphism of dolomites and is present at the Old Hickory, Bawana, and Maria mines and in other tactites in the district. Butler (1913, p. 101) gives a partial analysis of diopside from the Old Hickory mine as follows:

SiO_2	49.94
FeO	0.99
Fe_2O_3	7.47
Al_2O_3	5.80

The high ferric iron content of this diopside is somewhat unusual.

Ferroaugite (Ca, Mg, Fe^{++}, Fe^{+++}, Ti, $Al)_2(Si, Al)_2O_6$) is an important constituent of some igneous rocks in the area.

Hypersthene ($(Fe, Mg)SiO_3$) occurs in the ferroaugite quartz diorite dikes.

Wollastonite ($CaSiO_3$) is found in the Sunrise exploration cut and in other tactites in the area.

Hornblende ($(Ca, Na, K)_{2\ 3}(Mg, Fe^{++}, Fe^{+++}, Al)_5(Si_6(Si, Al)_2O_{22})(OH, F)_2$) is present in many of the igneous rocks of the area.

Serpentine (antigorite) ($(Mg_3(Si_2O_5)(OH)_4$) is found in the Bawana pit and with magnetite in other skarns in the district.

Garnet ($Ca_3Al_2(SiO_4)_3$ - $Ca_3Fe_2(SiO_4)_3$) intermediate in composition between grossularite and andradite is common in the tactites of the Bawana pit.

Zircon ($ZrSiO_4$) is an accessory mineral in the acidic igneous rocks of the district.

Kinaite $Cu_2Co_2Co_2S_{13}O_{10} \cdot 2H_2O$ has been reported from the Bawana Pit by Hindman (n. d.).

Idocrase ($Ca_{10}(Mg, Fe)_2Al_4(SiO_4)_5(Si_2O_7)_2(OH)_4$ has been identified by James Hindman (personal communication, 1973) in the tactites of the Bawana pit.

Epidote ($Ca_2(Al,Fe)Al_2O(SiO_4(Si_2O_7)(OH)$ occurs in the altered limestones and intrusive andesites of the district.

Tourmaline ($XY_3Al_6(BO_3)_3(Si_6O_{18})(OH)_4(Na, Ca)(Li, Mg, Al)(Al, Fe, Mn)_6(BO_3)_3(S_{16}O_{18})(OH)_4Li_1Al$): Butler (1913, p. 102) noted tourmaline in a limestone contact north of the Hickory mine.

Phlogopite ($KMg_3AlS_{13}O_{10}(OH)_2$) occurs as coarse books in the Bawana and Maria mines and forms a halo around the magnetite ore body of the Montreal mine.

Biotite $K(Mg, Fe)_3AlSi_3O_{10}(OH)_2$ is a common mineral of the igneous rocks in the area.

Chlorite ($Mg_3Si_4O_{10}(OH)_2 \cdot Mg_3(OH)_6$): Various chlorites are present as alteration products in the igneous rocks.

Thaumasite ($CaSiO_3 \cdot CuCo_3 \cdot CaSO_4 \cdot 14 \cdot 5H_2O$) occurs in veins in the Old Hickory mine (Butler, 1913, p. 103-104), and in the Bawana and Maria mines. An analysis is given by Butler, as follows:

	Utah	Theoretical
SiO_2	10.14	9.64
SO_3	12.60	12.86
CO_2	6.98	7.08
CaO	26.81	27.01
H_2O	42.97	43.41
$(Al,Fe)_2O_3$	0.02	
MgO	0.23	
Na_2O	Trace	Trace
P_2O_5	"	"
Total	99.93	100.00

Chrysocolla ($CoSiO_3 \cdot nH_2O$) is an important ore copper at the Bawana and Maria mines.

Sphene ($CaTiSiO_3$) is a common accessory of the intermediate to acidic igneous intrusives in the range and frequently occurs in crystals large enough to be easily visible to the naked eye.

Whelanite ($Co_2Ca_5Si_6O_7 \ CO_3(OH)_2 \cdot 4H_2O$) is found in the Bawana mine where it was formed by the reaction of copper - bearing solutions on diopride (Hindman, 1978).

Stringhamite ($CuCaSiO_4 12H_2O$) is also found in the Bawana pit (Hindman 1976).

ACKNOWLEDGEMENTS

The writer wishes to acknowledge the assistance of John Powers, Patrick Powers, Dennis Temple, Allen O. Taylor and John Wilson, geologists who were working in the area during the field work, and who assisted the writer in many ways, providing some data and pointing out field relationships.

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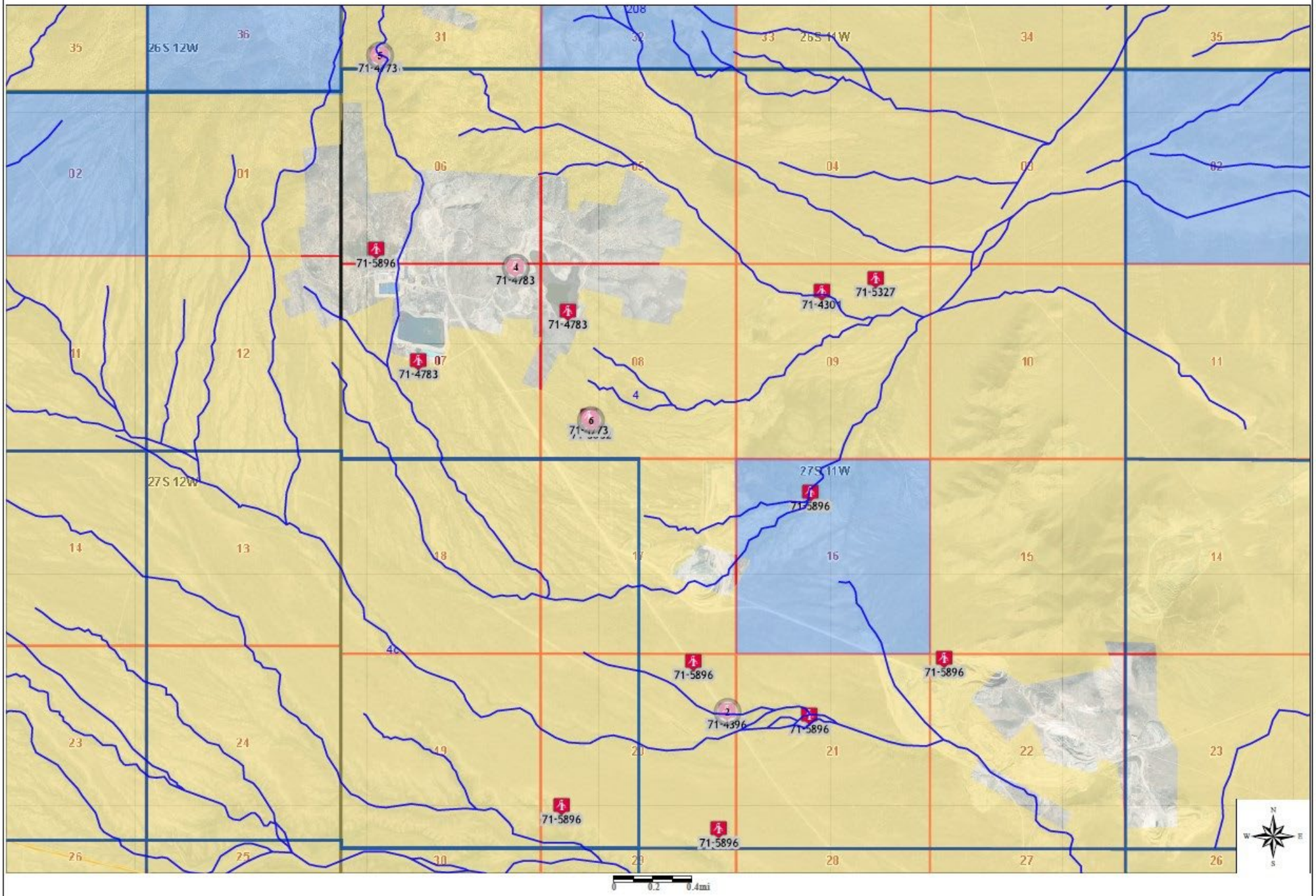
BAWANA MINE - ACID BASE ANALYSIS AND NET CARBONATE DATA									
Data compiled from ALS Minerals Report RE12061273									
SAMPLE DESC.	WEI-21 Recvd Wt. kg	(C_T) C-IR07 C %	(S_T) S-IR08 S %	(C_R) C-IR06a C organic %	(S_R) S-IR08r S %	AGP	ANP	NCV	Result
Bawana Overburden 1	0.22	1.20	0.03	0.08	<0.02	<-0.01	4.11	**<4.10**	**Moderately Basic**
Bawana Overburden 2	0.20	1.17	0.04	0.23	0.04	0.00	3.45	**3.45**	**Moderately Basic**
Bawana Overburden 3	0.28	0.57	0.01	0.05	<0.02	<0.01	1.91	**<1.92**	**Moderately Basic**
Bawana Overburden 4	0.28	0.54	0.01	0.03	<0.02	<0.01	1.87	**<1.89**	**Moderately Basic**
Bawana Overburden 5	0.18	1.60	0.04	0.37	0.04	0.00	4.51	**4.51**	**Moderately Basic**
Bawana Overburden 6	0.18	0.80	0.01	0.08	<0.02	<0.01	2.64	**<2.66**	**Moderately Basic**
Bawana Overburden 7	0.14	0.65	0.03	0.04	0.02	-0.01	2.24	**2.23**	**Moderately Basic**
Bawana Overburden 8	0.10	3.04	0.57	0.08	0.59	0.03	10.86	**10.89**	**Highly Basic**
Bawana Ore 1	0.30	3.74	0.05	0.06	0.05	0.00	13.51	**13.51**	**Highly Basic**
Bawana Ore 2	0.34	0.38	0.03	0.08	<0.02	<-0.01	1.10	**<1.09**	**Moderately Basic**
Bawana Ore 3	0.30	0.59	0.05	0.15	0.04	-0.01	1.61	**1.60**	**Moderately Basic**
Bawana Ore 4	0.36	0.75	0.03	0.12	<0.02	<-0.01	2.31	**<2.30**	**Moderately Basic**
Bawana Ore 5	0.24	0.02	1.11	0.04	0.72	-0.53	-0.07	**-0.61**	**Slightly Acidic**
Bawana Ore 6	0.10	0.47	0.40	0.14	0.36	-0.05	1.21	**1.16**	**Moderately Basic**
Bawana Ore 7	0.08	3.12	0.02	0.04	<0.02	<0.00	11.30	**<11.30**	**Highly Basic**
Bawana Ore 8	0.10	2.44	0.03	0.04	0.02	-0.01	8.81	**8.79**	**Highly Basic**
Bawana Pit Bottom 1	0.22	0.43	0.01	0.04	<0.02	<0.01	1.43	**<1.45**	**Moderately Basic**
Bawana Pit Bottom 2	0.22	0.58	0.02	0.29	0.02	0.00	1.06	**1.06**	**Moderately Basic**
Bawana Pit Bottom 3	0.22	0.48	0.02	0.15	<0.02	<0.00	1.21	**<1.21**	**Moderately Basic**
Bawana Pit Bottom 4	0.30	0.87	0.01	0.03	<0.02	<0.01	3.08	**<3.10**	**Moderately Basic**
Bawana Pit Bottom 5	0.14	0.99	0.01	0.13	<0.02	<0.01	3.16	**<3.17**	**Moderately Basic**
Bawana Pit Bottom 6	0.20	1.97	0.01	0.05	<0.02	<0.01	7.05	**<7.06**	**Highly Basic**
Bawana Pit Bottom 7	0.10	0.96	0.02	0.03	<0.02	<0.00	3.41	**<3.41**	**Moderately Basic**
Bawana Pit Bottom 8	0.16	0.22	0.02	0.03	<0.02	<0.00	0.70	**<0.70**	**Slightly Basic**
Tailings 1	0.32	1.46	0.06	0.05	0.04	-0.03	5.17	**5.15**	**Highly Basic**
Tailings 2	0.24	1.16	0.07	0.04	<0.02	<-0.07	4.11	**<4.04**	**Moderately Basic**
Tailings 3	0.34	1.10	0.05	0.04	0.04	-0.01	3.89	**3.88**	**Moderately Basic**
Tailings 4	0.22	1.28	0.08	0.06	0.08	0.00	4.48	**4.48**	**Moderately Basic**
Tailings 5	0.32	1.00	0.05	0.02	0.03	-0.03	3.60	**3.57**	**Moderately Basic**
Tailings 6	0.24	1.19	0.05	0.03	0.04	-0.01	4.26	**4.24**	**Moderately Basic**
Tailings 7	0.30	1.24	0.11	0.04	0.11	0.00	4.40	**4.40**	**Moderately Basic**
Tailings 8	0.22	0.93	0.10	0.03	0.10	0.00	3.30	**3.30**	**Moderately Basic**
Tailings 9	0.34	1.03	0.05	0.03	0.04	-0.01	3.67	**3.66**	**Moderately Basic**
Tailings 10	0.26	0.99	0.09	0.06	0.09	0.00	3.41	**3.41**	**Moderately Basic**

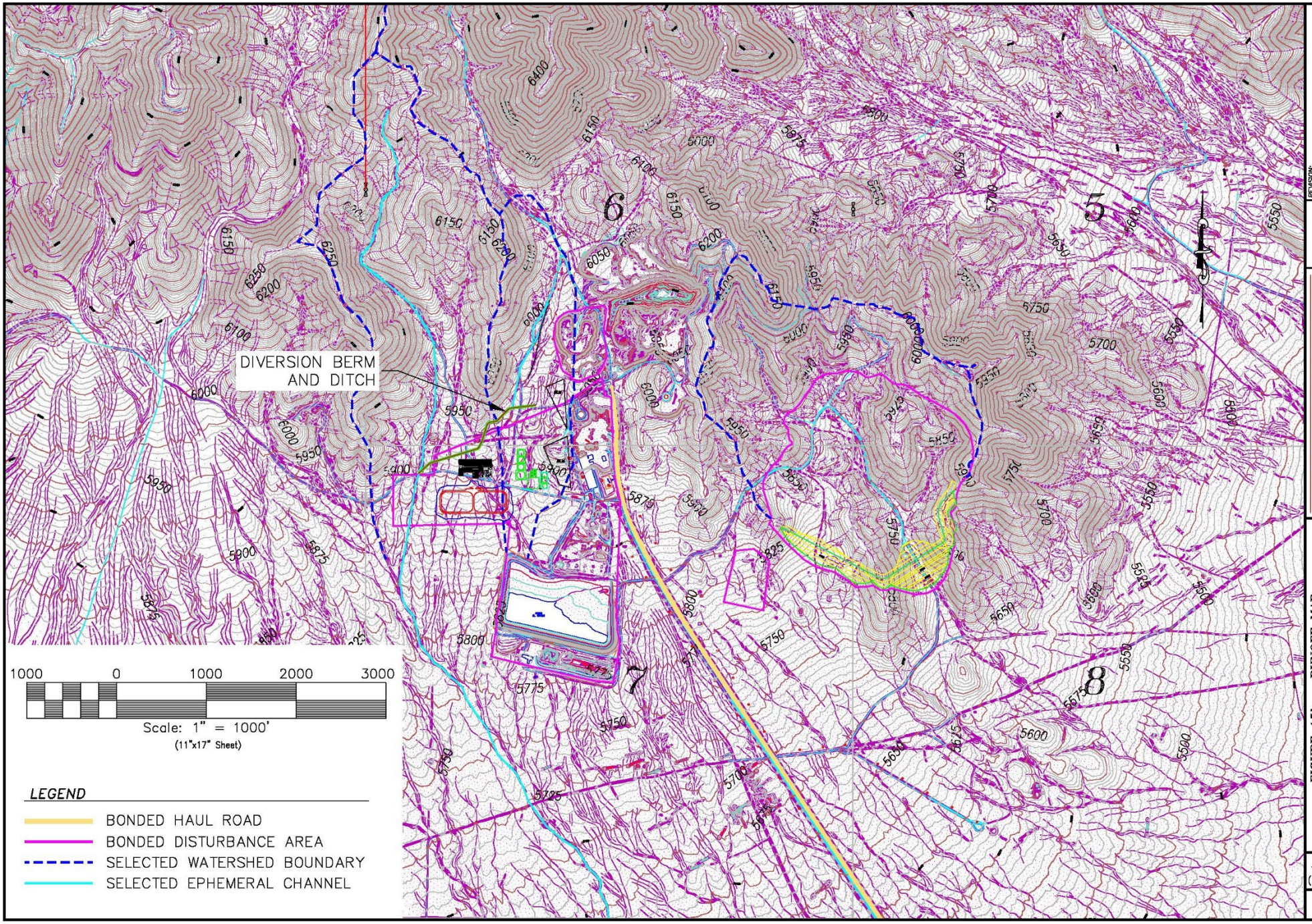
Notes:	**Net Carbonate Value Interpretation**
Total Carbon (C_T) - Total percentage of Carbon	Inert = 0.1 > NCV > -0.1 and ANP < 0.1 and AGP > -0.1
Total Sulfur (S_T)- Total Percentage of Sulfur	Neutral = 0.1 > NCV > -0.1 and (ANP > 0.1 or AGP < -0.1
Residual Carbon (C_R) - Residual Carbon after Hydrochloric Acid Digestion	Slightly Acidic = -0.1 => NCV > -1
Residual Sulfur (S_R) - Residual Sulfur after Pyrolysis at 550° C for 1 Hour	Moderately Acidic = -1 => NCV > -5
ANP : Acid Neutralization Potential = $3.67*(C_T-C_R)$	Highly Acidic = -5 => NCV
AGP : Acid Generation Potential = $-1.37*(S_T-S_R)$	Slightly Basic = 0.1 <= NCV < 1
NCV : Net Carbonate Value = ANP + AGP	Moderately Basic = 1 <= NCV < 5
	Highly Basic = 5 >= NCV

APPENDIX F

Hydrology

Milford Mining Company Utah - Hydrologic Map **(Figure 23)**





REVISION:	
DATE	DESCRIPTION
5-21-14	DOGM & R&B COMMENTS
8-8-14	DOGM & R&B COMMENTS
12-12-14	ADDED BERM & DITCH AT NEW SX PLANT

DRAWN: D. CLARKE
DATE: MAY 13, 2014
APPROVED:

PLATT & PLATT, INC.
CIVIL ENGINEERS & SURVEYORS
195 N. 100 E., CEDAR CITY, UTAH 84720
435-586-6151
fax 435-586-6507

FIGURE 15b – RUNOFF MAP
GREATER PLANT AREA
CS MINING, LLC
WITHIN SECTIONS 5, 6, 7, & 8, T 27 S, R 10 W, SLB&M

SCALE
1" = 1000'
(11"x17" Sheet)

23b

APPENDIX G

Biological

CS Mining, LLC

Biological Resources Site Survey Report

Prepared for:
CS Mining, LLC
1208 South 200 West
P.O. Box 608
Milford, Utah 84751



Prepared by:
JBR Environmental Consultants, Inc.
8160 S. Highland Drive,
Sandy, Utah 84093

November 12, 2013

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Appendix A – General Vegetation and Nest photos for the Survey Area
Appendix B – Adit Information for the Old Hickory and Niagara Mines

1.0 Introduction

CS Mining (CSM) is currently mining and processing copper ore near Milford, Utah. CSM is looking to expand operations to include a new pit, waste dump, and related haulage roads. The proposed expansion, labeled the Sunrise pit and waste dump, as well as the haul roads, will occur on a mixture of Bureau of Land Management (BLM) administered and private land. These areas have been surveyed for special status species (Threatened, Endangered, Candidate, Proposed, and Sensitive) that might be impacted as a result of the proposed operations.

The survey was conducted during the period July 8 through 12, 2013 by two JBR Environmental Consultants (JBR) biologists to determine if there was habitat and/or presence of special status species in the project area. A general survey was also conducted to record observations or signs of other animals and habitats of note, to observe the presence of raptors, and to map general vegetation communities.

Due to time and logistical constraints, the surveys that were conducted diverged from what was stated in the Biological Scope of Work (SOW). Main differences between the SOW and the final survey included the omission of surveying the facilities area, and area of the proposed Intermediate Tailings Disposal Facility (ITDF). These areas are located on privately owned land, and will not be impacted by the proposed Sunrise disturbance. Because of this, those areas were deemed unnecessary to survey at this time. Instead, greater focus was given to the Sunrise area, bat surveys, and raptor surveys.

2.0 Site Conditions

The survey area is located about 9 miles northwest of Milford and is accessible by Utah Highway 21 and a small, gravel, un-named county route (Figure 1). The project boundary covered portions of Sections 22, 23, and 26, Township 27 South, Range 11 West, Salt Lake Meridian. The northern part of the Rocky Range Mountains was also included in the survey area for raptors and golden eagles. The northern portion of the Star Range that was within a five-mile buffer of the project boundary, as well as the southern portion of the Beaver Lake Mountains that was within a five-mile buffer of the project boundary, were surveyed for the presence of golden eagles.

The survey area is located between 5,200 and 5,800 feet elevation in an area with flats dominated by big sagebrush (*Artemisia tridentata*), and the hills/mountains dominated by black sagebrush (*Artemisia nova*). Appendix A shows the typical landscape of the survey area. Figure 2 shows the vegetation communities and locations for the wildlife and raptor survey results.

2.1 Special Status Species

Table 1 lists all special status animal species occurring in the Cedar City Field Office. Prior to conducting surveys, JBR and the BLM identified 8 special status species that have a moderate to high probability of occurring within or adjacent to the project area: bald eagle, burrowing owl, ferruginous hawk, big free-tailed bat, fringed myotis, kit fox, pygmy rabbit, and Townsend's big-eared bat. Other species would not be found in the survey area due to poor or non-existent habitat. Details about their habitat are listed in Table 1 below, as well as in the previously submitted Biological Scope of Work, dated June 27, 2013.

Table 1: Threatened, Endangered, Sensitive, and Candidate Animal Species Known to Occur in the Cedar City Field Office

Common Name	Scientific Name	Probability of Occurrence	BLM Status
FISH			
Bonneville cutthroat trout	*Oncorhynchus clarkii utah*	**None –** No streams or lakes occur within the project area.	CA
Desert sucker	*Catostomus clarkii*	**None –** No streams or lakes occur within the project area.	SS
Least chub	*Iotichthys phlegethontis*	**None –** No streams or lakes occur within the project area.	CN
Southern leatherside chub	*Lepidomeda aliciae*	**None -** No streams or lakes occur in the Project Area.	CA
AMPHIBIANS			
Arizona toad	*Bufo microscaphus*	**None –** No water bodies occur in the Project Area	SS
Western (boreal) toad	*Bufo boreas*	**None –** No water bodies occur in the Project Area	CA
REPTILES			
None present			
BIRDS			
American white pelican	*Pelecanus erythrorhynchus*	**None -** No lakes or reservoirs occur within or near the Project Area.	SS
Bald eagle	*Haliaeetus leucocephalus*	**Moderate -** No lakes or reservoirs occur within or near the Project Area. Potential foraging habitat.	SS
Black swift	*Cypseloides niger*	**None –** There are no waterfalls or bodies of water in or near the Project Area	SS

Common Name	Scientific Name	Probability of Occurrence	BLM Status
Burrowing owl	*Athene cunicularia*	**High -** Shrub dominated habitats present. Suitable burrows likely present. Known occurrences in the area.	SS
California condor		**Low-** foraging habitat is present and birds have been documented in the general area. Project area is about 73 miles from known condor roosting locations. No survey needed. No effect.	E
Ferruginous hawk	*Buteo regalis*	**High** - Suitable habitat present throughout most of the Project Area. Known occurrences in the area.	SS
Greater sage-grouse	*Centrocercus urophasianus*	**None - Project area is located approximately 8.5 outside of UDWR mapped habitat.**	CN
Lewis' woodpecker	*Melanerpes lewis*	**None –** There are no diciduous forests located in or near the Project Area	SS
Long-billed curlew	*Numenius americana*	**Low –** Most grassland-type habitat in the Project Area is agricultural in nature and do not provide preferred habitat for the species.	SS
Mexican spotted owl		**None –** no known occurrences within Beaver County.	T
Northern goshawk	*Accipiter gentiles*	**Low -** The project area provides forested habitats, but lacks multiple canopies and intermediate to high canopy-closure. No known occurrences.	CA
Short-eared owl	*Asio flammeus*	**Low –** No known occurrences in the Project Area.	SS
Southwestern willow flycatcher		**None –** No habitat within the Project Area.	E

Common Name	Scientific Name	Probability of Occurrence	BLM Status
Three-toed woodpecker	*Picoides tridactylus*	**None -** Forested habitats present, but not the type typically preferred by the species. No known records.	SS
Western yellow-billed cuckoo	*Coccyzus americanus*	**None –** No known habitat in the Project Area.	CN
INSECTS			
None present			
MAMMALS			
Allen's big-eared bat	*Idionycteris phyllotis*	**None –** No known habitat in the Project Area.	SS
Big free-tailed bat	*Nyctinomops macrotis*	**Moderate -** Woodland habitat present.	SS
Dark kangaroo mouse	*Microdipodops megacephalus*	**None -** Suitable, sandy soils not present in the Project Area.	SS
Fringed myotis	*Myotis thysanodes*	**Moderate -** Habitat present. No known occurrences.	SS
Kit fox	*Vulpes macrotis*	**Moderate -** The Project Area contains sagebrush and open desert.	SS
Pygmy rabbit	*Brachylagus idahoensis*	**Moderate -** The Project Area contains big sagebrush and soils suitable for creating burrows. No known occurrences.	SS
Spotted bat	*Euderma maculatum*	**Low -** Roosting and foraging habitat present in the Project Area. No known records in the area.	SS
Townsend's big-eared bat	*Corynorhinus townsendii*	**High –** Adits and mine shafts present in the project area.	SS
Utah prairie dog	*Cynomys parvidens*	**None –** outside of area where USFWS requires surveys.	T
Western red bat	*Lasiurus blossevillii*	**Low –** There are no bodies of water in or near the Project Area. Sightings in Beaver County.	SS

The Species highlighted in green are those with a moderate to high potential to occur in or near the Project Area.

E – Endangered, SS = Sensitive, CN = Candidate, T = Threatened, CA = Conservation Agreement Species, also considered Sensitive by BLM
Source: USFWS 2013 and BLM

There are no special status plant species with the potential to occur in or near the survey area.

3.0 Findings

3.1 Vegetation or Habitat Survey Results

The survey area contains two main ecological communities and disturbed areas. These are the big sagebrush-dominated flats, black sagebrush-dominated hills/mountains, and disturbed land (roads, pits, and dumps).

The vegetation in the survey area is dominated by native plants common to the location, elevation, and underlying geology of the area. Cheatgrass (*Bromus tectorum*) was found in scattered patches throughout the project area. Table 2 contains a list of the plant species found and identified during the survey.

Table 2: Plant Species Noted during the Project Survey

Common Name	Scientific Name
Indian rice grass	*Achnatherum hymenoides*
Black sagebrush	*Artemisia nova*
Big sagebrush	*Artemisia tridentata*
Bud sage	*Artemisia / Picrothamnus spinescens / desertorum*
Shadscale	*Atriplex confertifolia*
4 wing salt brush	*Atriplex canescens*
Cheatgrass	*Bromus tectorum*
Mustard	*Chorispora* sp.
Yellow rabbitbrush	*Chrysothamnus viscidiflorus*
Squirrel tail	*Elymus elymoides*
Mormon tea	*Ephedra nevadensis*
Rabbit brush	*Ericameria nauseosa*
Oval-leaved buckwheat	*Eriogonum ovalifolium*
Hopsage	*Grayia spinosa*
Broom snakeweed	*Gutierrezia sarothrae*
Sticky snakeweed	*Gutierrezia microcephala*
Halogeton	*Halogeton glomeratus*
Marshelders	*Iva* sp.
Cactus	*Opuntia* sp.
Phlox	*Phlox* sp.
Bitter brush	*Purshia tridentata*
Tumbleweed	*Salsola tragus*
Globemallow	*Sphaeralcea coccinea*
Tamarisk	*Tamarix ramosissima*

Based on soils mapping, three NRCS Ecological Site Descriptions (ESDs) are represented in the survey area (NRCS 2003). These are:

- Semidesert Loam (Wyoming Big Sagebrush) (034XY212UT): Wyoming big sagebrush, Indian ricegrass.
- Semidesert Sandy Loam (Wyoming Big Sagebrush) (035XY216UT): Indian ricegrass, needleandthread, Wyoming big sagebrush, fourwing saltbrush.
- Semidesert Gravelly Loam (Wyoming Big Sagebrush) South (028AY214UT): Wyoming big sagebrush, Indian ricegrass.

These descriptions align with the communities identified on the survey area through data gathering.

Data was collected from walking meandering transects throughout the survey area.

3.2 General Wildlife Findings

The following animals were observed within or directly adjacent to the survey area:

Table 3: Animals Observed During Survey

Common Name	Scientific Name
Black-tailed jackrabbit	*Lepus californicus*
Desert cottontail	*Sylvilagus auduboni*
White-tailed antelope squirrel	*Ammospermophilus leucurus*
Great Basin rattlesnake	*Crotalus oreganus lutosus*
Desert horned lizard	*Phrynosoma platyrhinos*
Long-nosed leopard lizard	*Gambelia wislizenii*
Whiptail	*Aspidoscelis velox*
Desert spiny lizard	*Sceloporus magister*
Common side-blotched lizard	*Uta stansburiana*
Coachwhip	*Masticophis flagellum*

Two coyote (*Canis latrans*) dens were noted during the survey, indicating the presence of coyotes in the area.

3.2.1 Raptor and Migratory Bird Findings

Eighteen raptor nests were found within the general wildlife and golden eagle survey areas, which included the Rocky Range Mountains, the southern portion of the Beaver Lake Mountains, and the northern portion of the Star Range. Locations of the nests can be found on Figure 2. During the survey JBR employees also checked the status of the previously recorded nests within the survey area. Many of the nests previously recorded were no longer present (Figure 2). Of the nests found, only one was active. Table 4 contains a summary of the findings.

Table 4: Summary of Raptor Nest Findings

New/known	Nest Number	Species	Status	UTM NAD83 X	UTM NAD83 Y	Date	Comment
Known	UT040000693	Golden eagle	Gone	316,668	4,253,778	7/8/2013	
Known	UT040000692	Golden eagle	Inactive	316,608	4,253,914	7/8/2013	
Known	UT040000691	Golden eagle	Inactive	316,556	4,253,988	7/8/2013	
Known	UT040000668	Golden eagle	Gone	315,964	4,269,110	7/8/2013	
Known	UT040000682	Unknown	Inactive	319,928	4,258,552	7/8/2013	
Known	UT040000683	Unknown	Inactive	316,609	4,267,583	7/8/2013	
Known	UT040000798	Golden eagle	Gone	315,885	4,268,784	7/8/2013	
Known	UT040000812	Golden eagle	Gone	317,270	4,253,912	7/8/2013	
Known	UT040004188	Unknown	Inactive	318,834	4,248,928	7/8/2013	
Known	UT040004189	Common raven	Inactive	319,135	4,249,742	7/8/2013	
Known	UT040004190	Common raven	Inactive	319,519	4,250,853	7/8/2013	
Known	UT040004191	Ferruginous hawk.	Active	319,476	4,250,872	7/8/2013	Lattice tower, 2 ferruginous hawks observed.
Known	UT040004194	Unknown	Gone	320,451	4,254,597	7/8/2013	
Known	UT040004195	Common raven	Gone	320,685	4,254,977	7/8/2013	
Known	UT040004196	Common raven	Gone	320,925	4,255,356	7/8/2013	
Known	UT040004197	Common raven	Gone	321,369	4,256,062	7/8/2013	
Known	UT040004198	Common raven	Gone	321,385	4,256,714	7/8/2013	
Known	UT040004199	Red tailed hawk	Gone	321,316	4,257,150	7/8/2013	
New	UT040002004	Unknown	Inactive	316,566	4,253,406	7/8/2013	Rock crevasse, near peak, west aspect, no sign of recent activity.
New	UT040002005	Possible ferruginous hawk.	Inactive	316,492	4,269,032	7/8/2013	East aspect, cliff/overhang.

New/known	Nest Number	Species	Status	UTM NAD83 X	UTM NAD83 Y	Date	Comment
New	UT040002006	Unknown	Inactive	316,522	4,269,702	7/9/2013	Large sticks, cliff, south aspect, possibly used last year.
New	UT040002007	Possible red tailed hawk	Inactive	316,444	4,269,729	7/9/2013	Cliff with overhang, southwest aspect. Small mammal bones below nest.
New	UT040002008	Possible golden eagle	Inactive	315,194	4,267,940	7/9/2013	Ledge outcrop on cliff, PJ habitat, north aspect.
New	UT040002009	Unknown	Inactive	315,057	4,267,827	7/9/2013	2 nests close (about 4' apart) on cliff, west aspect.
New	UT0420002010	Unknown	Inactive	314,749	4,267,795	7/9/2013	Lat/log approximately 500' north of stick nest. Nest small, north aspect.
New	UT0420002011	Unknown	Inactive	315,418	4,267,797	7/9/2013	Cliff, nest dilapidated, north aspect.
New	UT0420002012	Possible golden eagle	Inactive	315,880	4,269,933	7/9/2013	Lat/log approximately 50 m south of nest; filled with midden.
New	UT0420002013	Possible golden eagle	Inactive	319,003	4,260,328	7/9/2013	Lat/long approximately 150 east of nest. Cliff on top of pinnacle, east aspect.
New	UT0420002014	Unknown	Inactive	318,940	4,260,068	7/9/2013	Nests UT...2014 and UT...2015 are adjacent. Nest in good condition, NW aspect, cliff.

New/known	Nest Number	Species	Status	UTM NAD83 X	UTM NAD83 Y	Date	Comment
New	UT0420002015	Unknown	Inactive	318,940	4,260,068	7/9/2013	Nests UT...2014 and UT...2015 are adjacent. Nest in good condition, NW aspect, cliff.
New	UT0420002016	Unknown	Inactive	319,140	4,260,029	7/10/2013	Two stick nests close together, east aspect. White wash nearby, possibly active last year.
New	UT0420002017	Unknown	Inactive	284,785	4,260,495	7/10/2013	Small stick nest, white wash nearby, south aspect, cliff.

A few raptor individuals were also observed during the survey: two golden eagles soaring, one golden eagle low-level hunting, and two perched in trees. A burrowing owl pellet was also noted on a mound at UTM NAD83 319,400 X and 4,256,880 Y. No burrowing owl was observed at that time and no follow-up was done to see if an owl was present. A complete list of birds noted during the survey is located in Table 5 (Figure 4).

Table 5: Birds Observed During the Survey

Common Name	Scientific Name	Utah CWCS Tier Status	Conservation Status	BLM Status	Utah PIF IA Score	Utah PIF Population Trend
Black-throated sparrow	*Amphispiza bilineata*		Common migratory bird		Low	Apparently Stable or Trend Unknown
Brewer's sparrow	*Spizella breweri*	III	BMC		Low	Possible Decreasing Trend
Brown-headed cowbird	*Molothrus ater*		Common migratory bird		Low	Possible Increasing Trend
Chukar	*Alectoris chukar*		Common game bird		Moderate	Apparently Stable or Trend Unknown
Common raven	*Corvus corax*		Common migratory bird		Low	Apparently Stable or Trend Unknown
Ferruginous hawk	*Buteo regalis*	II	BCR 9 BCC	SS	Moderate	Apparently Stable or Trend Unknown
Golden eagle	*Aquila chrysaetos*		Common		Low	Possible Increasing Trend

Common Name	Scientific Name	Utah CWCS Tier Status	Conservation Status	BLM Status	Utah PIF IA Score	Utah PIF Population Trend
Horned lark	*Eremophila alpestris*		Common migratory bird		Very Low	Apparently Stable or Trend Unknown
Lesser nighthawk	*Chordeiles acutipennis*		Common migratory bird		Very Low	Apparently Stable or Trend Unknown
Loggerhead shrike	*Lanius ludovicianus*		BMC		Low	Apparently Stable or Trend Unknown
Pinyon jay	*Gymnorhinus cyanocephalus*		Common migratory bird		High	Apparently Stable or Trend Unknown
Rock wren	*Salpinctes obsoletus*		Common migratory bird		Low	Apparently Stable or Trend Unknown
Sage sparrow	*Amphispiza belli*	III	Common migratory bird		Moderate	Apparently Stable or Trend Unknown
Turkey vulture	*Cathartes aura*		Common migratory bird		Low	Possible Increasing Trend
Western kingbird	*Tyrannus verticalis*		Common migratory bird		Low	Apparently Stable or Trend Unknown
Western meadowlark	*Sturnella neglecta*		Common migratory bird		Moderate	Possible Increasing Trend

Citations include UDWR 2002, UDWR 2005, and USFWS 2008.

BMC - Bird of Management Concern

BCR 9 BCC - Bird of Conservation Concern for Bird Conservation Region 9 (Great Basin)

IA Score - Importance of Utah to Each Species

PIF - Partners in Flight

SS – BLM Sensitive Species

CWCS Tier Status - defines and prioritizes Utah's native animal species according to conservation need.
Tier I includes federally listed species and species for which a Conservation Agreement has been completed and implemented.

Tier II includes those listed on the Utah Species of Concern List under sole state authority.
Tier II includes species that are of conservation concern because they are linked to an at-risk habitat, have suffered marked population declines, or there is little information available regarding the ecology or status of the species.

Of the birds observed, the ferruginous hawk, Brewer's sparrow, and the sage sparrow are on the Utah Partners in Flight Priority Bird Species List (UDWR 2002). The ferruginous hawk is a special status species (sensitive, Table 1).

3.2.2 AnaBat Findings

There were four locations noted on or near the survey area that may contain bats. These locations were the old Sunrise adit, the Montreal adit, the Old Hickory 100 Level adit, and the Niagara adit. Once on site, it was noted that the Montreal adit had been covered, and no sign of activity was present. For the other three locations, JBR used an AnaBat Detector to survey for bat species (Figure 3). The AnaBat was placed in or near the adit entrances and was allowed to collect data for a period of 12+ continual hours. Due to the requirement of escorts on active mining sites, JBR did not stay at the adit locations after dropping off the AnaBat.

The Sunrise adit consists of one main tunnel, which extends for 225 feet, and one small upper tunnel that extends for approximately 50 feet. The AnaBat was placed near the Sunrise adit opening around noon on August 5th, and ran continually until approximately 9:00 AM on August 7th; the AnaBat was thus recording during the most active bat period of one hour before sunset to one hour after sunrise. A total of 264 bat calls were recorded. All calls recorded for this report were analyzed by a qualified individual, Dr. Michael J. O'Farrell (www.mammalogist.org). Nine individual species were identified at the Sunrise Adit (Table 6).

Table 6: Bat Recordings for the Sunrise Adit

Common Name	Scientific Name	Number of Calls Recorded
Pallid bat	*Antrozous pallidus*	14
Townsend's Big-Eared Bat	*Corynorhinus townsendii*	10
Big brown bat	*Eptesicus fuscus*	29
California myotis	*Myotis californicus*	27*
Western small-footed myotis	*Myotis ciliolabrum*	102*
Little brown myotis	*Myotis lucifugus*	1*
Long-legged myotis	*Myotis volans*	77*
Canyon bat	*Parastrellus hesperus*	2
Brazilian free-tailed bat	*Tadarida brasiliensis*	2

Bat references utilized include UDWR 2013, BCI 2013, and Oliver 2000.
* Myotis species can be difficult to distinguish from each other, and actual counts by species may vary slightly.

The Old Hickory mine consists of a shaft 300 feet deep, an adit which cuts the orebody 100 feet downhill of the shaft entrance, and four sublevels (Whelan 1982, Appendix B). Around noon on August 7th, the AnaBat was moved to the Old Hickory 100-foot level adit where it ran continually until approximately 9:00 AM on August 8th; the AnaBat was thus recording during the most active bat period of one hour before sunset to one hour after sunrise. No bat calls were recorded.

The Niagara adit is a northwest trending adit that continues into the mountainside for approximately 1230 feet, where the adit has been pack walled off (Appendix B). Around noon on August 8th, the AnaBat was moved to the Niagara adit, where it ran continually until approximately 9:00 AM on August 9th; the AnaBat was thus recording during the most active bat period of one hour before sunset to one hour after sunrise. A total of 1,224 bat calls were recorded and 11 individual species were identified (Table 7).

Table 7: Bat Recordings for the Niagara Adit

Common Name	Scientific Name	Number of Calls Recorded
Pallid bat	*Antrozous pallidus*	5
Townsend's Big-Eared Bat	*Corynorhinus townsendii*	44
Big brown bat	*Eptesicus fuscus*	10
Western red bat	*Lasiurus blossevillii*	2
California myotis	*Myotis californicus*	215*

Common Name	Scientific Name	Number of Calls Recorded
Western small-footed myotis	*Myotis ciliolabrum*	300*
Long-eared myotis	*Myotis evotis*	24*
Long-legged myotis	*Myotis volans*	607*
Yuma myotis	*Myotis yumanensis*	6*
Canyon bat	*Parastrellus Hesperus*	1
Brazilian free-tailed bat	*Tadarida brasiliensis*	10

Bat references utilized include UDWR 2013, BCI 2013, and Oliver 2000.

* Myotis species can be difficult to distinguish from each other, and actual counts by species may vary slightly.

Of the bat species detected, only the Townsend's big-eared bat and the Western red bat are considered special status species (sensitive). The Townsend's big-eared bat was detected on the recordings at both the Niagara and Sunrise adits while the Western red bat was only detected at the Niagara adit, which is not proposed to be disturbed.

3.2.3 Noxious Species

In conjunction with the general biology and other surveys, JBR looked for the presence of any Utah listed noxious species in the survey area. No noxious species were observed.

3.2.4 Wetlands and Waters of the US

No wetlands or waters of the US were found to occur within the proposed area of impact. A small bog was found in the Beaver Lake Mountains during the raptor survey (Photo 12, Appendix A). However, the bog is more than five miles from the proposed Sunrise pit, waste dump, and haul roads.

4.0 References:

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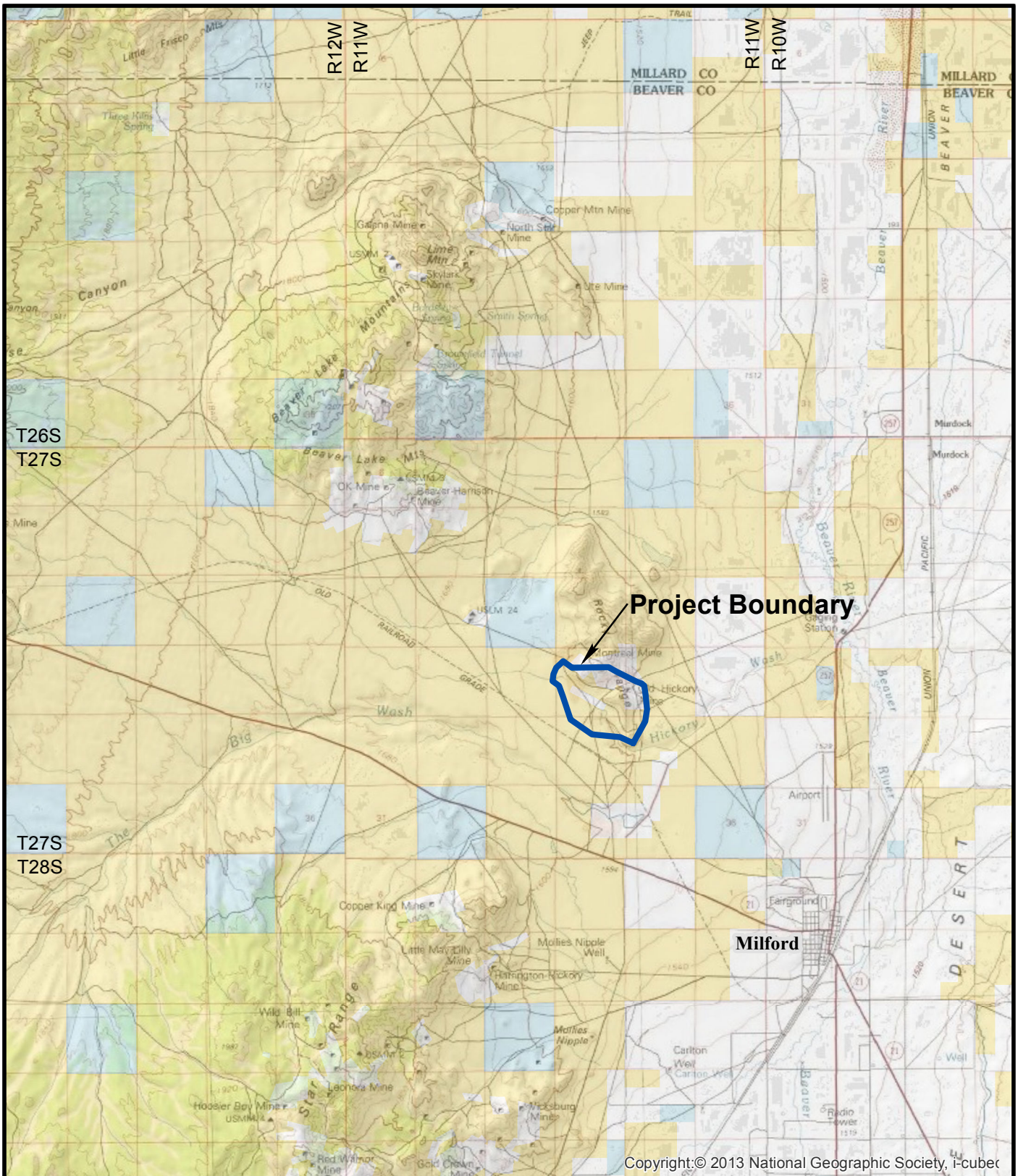


Legend

Project Boundary

Land Ownership

Bureau of Land Management (BLM)

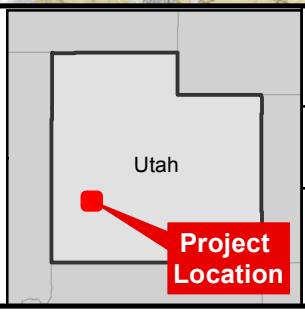
State

Private

N

2 1 0 2

Miles



CS MINING
SUNRISE AMENDMENT

FIGURE 1
PROJECT LOCATION AND LAND STATUS

JBR

DRAWN BY	CP
DATE DRAWN	8/27/2013
SCALE	1 in = 2 miles
PROJECT	B.A13061.00 - BIO

Path: X:\UT\Clients\CS_Mining\SunriseAmendment_BA1306100\MXDs\BIO_mxds\Figure 1 Project Location and Land Status.mxd

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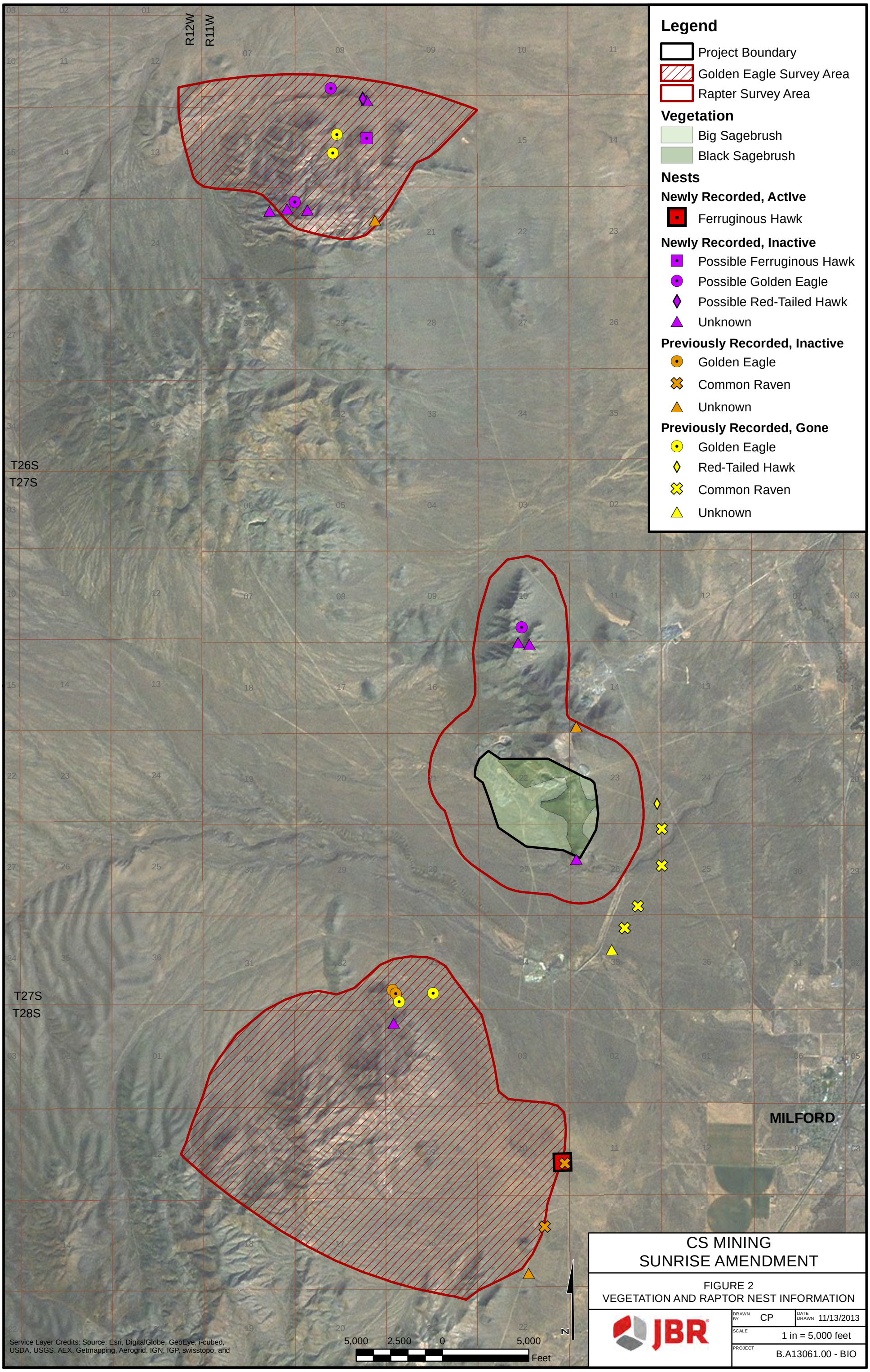

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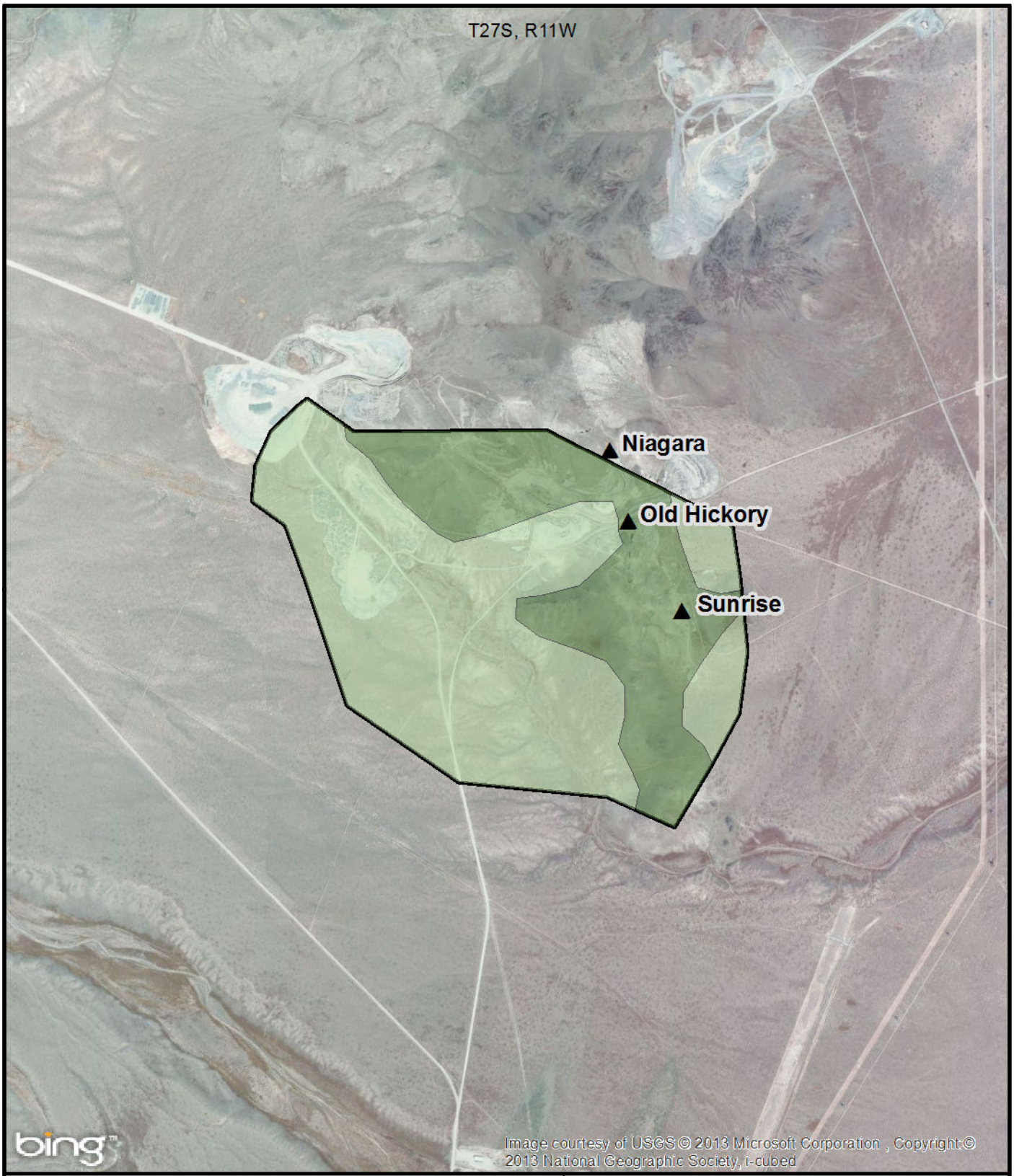

Legend

▲ AnaBat Locations

Vegetation

Big Sagebrush

Black Sagebrush

2,000 1,000 0 2,000

Feet

CS MINING
SUNRISE AMENDMENT

FIGURE 3
ANABAT LOCATIONS

JBR

DRAWN BY	CP
DATE DRAWN	9/10/2013
SCALE	1 in = 2,000 feet
PROJECT	B.A13061.00 - BIO

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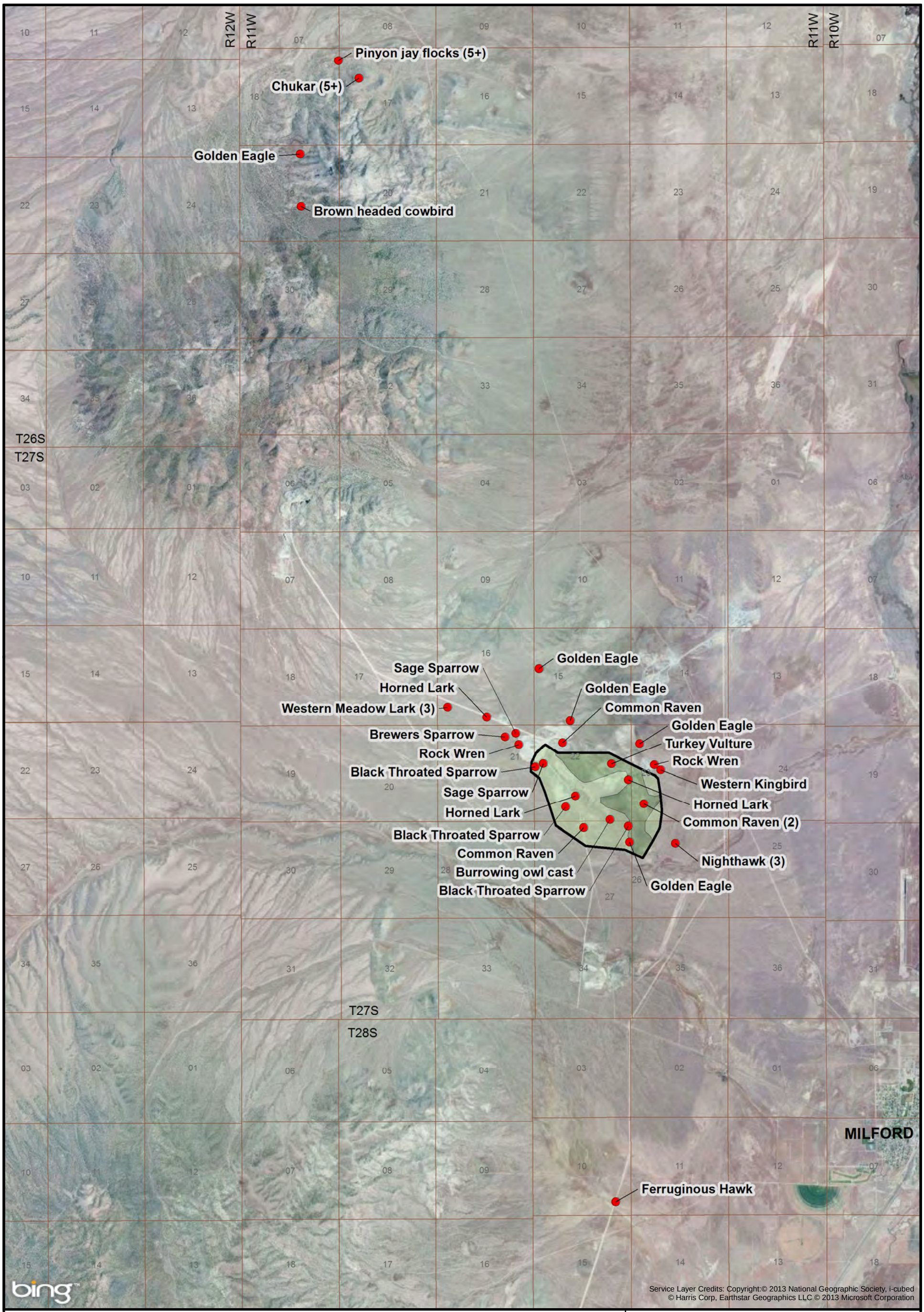
Path: X:\UT\Clients\CS_Mining\SunriseAmendment_BA1306100\MXDs\BIO_mxds\Figure 4 Bird Sightings.mxd



Legend

Project Boundary

Bird Sightings

Vegetation

Big Sagebrush

Black Sagebrush

N

5,000 2,500 0 5,000

Feet

CS MINING
SUNRISE AMENDMENT

FIGURE 4
BIRD SIGHTINGS

JBR

DRAWN BY	CP
DATE DRAWN	9/25/2013
SCALE	1 in = 5,000 feet
PROJECT	B.A13061.00 - BIO

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Appendix A

General Nest and Vegetation Photos for the Survey Area

General Nest and Vegetation Photos for the Northeast portion of the Star Range



Photo 1:

Looking northeast toward Hidden Treasure and Bawana



Photo 2:

Standing in the flats looking west toward Star Range



Photo 3:

Unknown stick nest – UT040002004

General Nest and Vegetation Photos for the Southern portion of the Beaver Lake Mountains



Photo 4:

Possible golden eagle nest – northernmost portion of Beaver Lake Mountains survey area– UT040002007



Photo 5:

Possible red-tailed hawk nest – northeastern portion of Beaver Lake Mountains survey area – UT040002006



Photo 6:

Unknown stick nest – northeastern portion of Beaver Lake Mountains survey area – UT040002005



Photo 7:

Possible golden eagle nest – southern portion of Beaver Lake Mountains survey area – UT040002008



Photo 8:

Unknown stick nest – southern portion of Beaver Lake Mountains survey area – UT040002009



Photo 9:

Unknown stick nest – southern portion of Beaver Lake Mountains survey area– UT040002010



Photo 10:

Standing on the southwest flank of the Beaver Lake Mountains looking northwest



Photo 11:

Standing in the flats north of the Beaver Lake Mountains looking northwest



Photo 12:

Bog found in the southern portion of the Beaver Lake Mountains

General Nest and Vegetation Photos for the Proposed Sunrise Pit, Dump, and Haul Road



Photo 13:

Possible golden eagle nest- UT040002016



Photo 14:

Standing in the flats looking west



Photo 15:

Standing on the mountain slope looking north



Photo 16:

Ground cover in the location of the proposed Sunrise pit



Photo 17:

Ground cover in the location of the proposed Sunrise waste dump



Photo 18:

Historic mining in the Sunrise area



Photo 19:

Historic mining in the Sunrise area

AnaBat Locations – Niagara, Old Hickory, and Sunrise



Photo 20:

Niagara Adit



Photo 21:

Old Hickory Adit



Photo 22:

Sunrise Adit

Appendix B

Adit Information for the Old Hickory and Niagara Mines

GEOLOGY, ORE DEPOSITS AND MINERALOGY OF THE ROCKY RANGE, NEAR MILFORD BEAVER COUNTY, UTAH

J. A. Whelan

UTAH GEOLOGICAL AND MINERAL SURVEY
a division of
Utah Department of Natural Resources and Energy

SPECIAL STUDIES 57 NOVEMBER 1982

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the contact of the igneous rock with the limestone. In the upper part of the mine the distribution of the drifts and stopes illustrates the dependence on bedding The material mined from these workings was all secondary copper carbonate ore, but scheelite has been found to be widely scattered through the adjacent ground, mostly in one or two rather well defined beds two to three feet in thickness. The debris, also, which fills the large stopes east of and below the upper section of the shaft might possibly contain enough scheelite to be considered a low-grade ore. In the lower workings the scheelite is more closely associated with the contacts of quartz monzonite than with particular beds of limestone. It occurs only in small pockets, which probably contain altogether only a small quantity of the mineral.

Here as elsewhere in the district, the scheelite fluoresces with a marked yellowish color. This is especially true in the upper part of the workings, where the mineral is soft and in large part powdery. All these characteristics suggest a high molybdenum content.

Reserves Assays of material from the pits in front of the main shaft are reported to show one to two percent of WO_3 but this material was probably handpicked. The distribution of the material in the mine, together with its relatively high molybdenum content, would probably reduce the average grade of any considerable amount of the ore to 0.25 or 0 5 percent WO_3. A conservative estimate would give about 2,200 tons of measured ore of this grade. On the basis of the exposures immediately south of the main shaft, there is probably two to three times this amount of indicated ore. Any plan to work such ore, however, must take into account a high and quite variable molybdenum content which not only reduces the amount of WO_3 in the ore but also makes necessary the separation of these two components in preparing the final product.

The Old Hickory Mine – A good description of the Old Hickory Mine is that given by Hobbs (1945, p. 94-99):

> The Old Hickory mine is on a southern spur of the Rocky Range, about five miles northwest of Milford (pl. 32). This spur consists of a group of low hills, the highest of which rises only 300 feet above the alluvial plain, and the mine lies just south of a low saddle which nearly separates these hills from the main body of the range. The mine is reached by good roads from the town and consequently has easy access to both main highways and railroads.
>
> The Old Hickory mine, though long known to contain a body of copper-magnetite ore, was never extensively worked except in 1906-07, when the high price of copper made it commercially profitable to mine the ore for copper. In 1917-18, when the mine was again worked, it was only because the magnetite in the ore was needed as a flux at the smelters.
>
> The old mine consisted of a shaft 300 feet deep, a tunnel, called the second level, which cuts the ore body about 100 feet below the shaft collar, and four other levels, the first or 80-foot level about 20 feet above the tunnel, and the third, fourth, and fifth levels below the tunnel at depths of 150, 200, and 300 feet respectively. Most of the ore above the 80-foot level has been stoped out to the surface, leaving a deep, long glory hole The original timbering was burned out of the mine and completely destroyed, but the shaft and the workings immediately adjacent to it were retimbered and placed in good working order by C. H. Segerstrom in 1941 in preparation for mining the newly discovered tungsten ore. The mine was worked by Mr. Segerstrom for tungsten from the fall of 1941 to December 1943, when the operation was closed and the mine was turned back to E. J. Schoo the former owner.
>
> Geology The Old Hickory mine lies in a belt of Triassic rocks at a place where they are rather complexly intruded by stocks and dikes of quartz monzonite. Plate 1[1] shows the topography and geology in the vicinity of the mine. The Triassic rocks, which belong to the Harrington Formation, are composed of thin-bedded shales with beds of limestone and lenses of quartzite. The contact metamorphic rocks around the intrusive bodies include one zone that is composed largely of magnetite, it is in this zone that the best scheelite ore has been found. In the vicinity of the Old Hickory, the rocks strike nearly north-south, directly toward the main masses of intrusive quartz monzonite and granodiorite porphyry, which lie about 1,100 feet north of the shaft. Surface exposures close to the mine workings are poor, but small scattered outcrops of quartz monzonite and abundant exposures of it in the mine indicate that the scheelite occurs close to igneous contacts.
>
> *Sedimentary rocks.* At the mine the lithologic sequence from west to east in the Harrington Formation is as follows: a massive layer of quartzite[2], variable in thickness, on the west side is followed by the ore body, which is in a completely replaced limestone layer[3], probably more susceptible to alteration because of original impurities and porosity, and now composed chiefly of magnetite accompanied by some silicate, sulfide, and scheelite. To the east of the ore body the rocks are thoroughly metamorphosed, but it is inferred from their present composition that they originally consisted of impure shaly limestones and calcareous shales with lenses of quartzite and pure limestone. A few dikes of granodiorite porphyry are intruded parallel to the bedding.
>
> This series of altered sedimentary rocks displayed near the mine and shaft may be traced southward for at least 1,500 feet along the strike, despite considerable variations in the intensity of the metamorphism, which depends on the varying relation of the sedimentary to the igneous rocks. The zone containing magnetite and scheelite extends for only about 500 feet south of the shaft. Beyond the shaft, there is garnet rock with only sparse and scattered showings of scheelite.
>
> *Igneous rocks.* The igneous rocks in and near the Old Hickory mine are quartz monzonite and granodiorite porphyry. The quartz monzonite seems to be more abundant and to be more closely related to the ore deposit than the prophyry, and, in both its coarse and fine-grained phases, it forms dikes, sills, and small irregular intrusive masses in the limestone. The general charact-

[1] Figure 3 of this report

[2] Talisman Quartzite

[3] Toroweap and Kaibab Plympton Undifferentiated formations

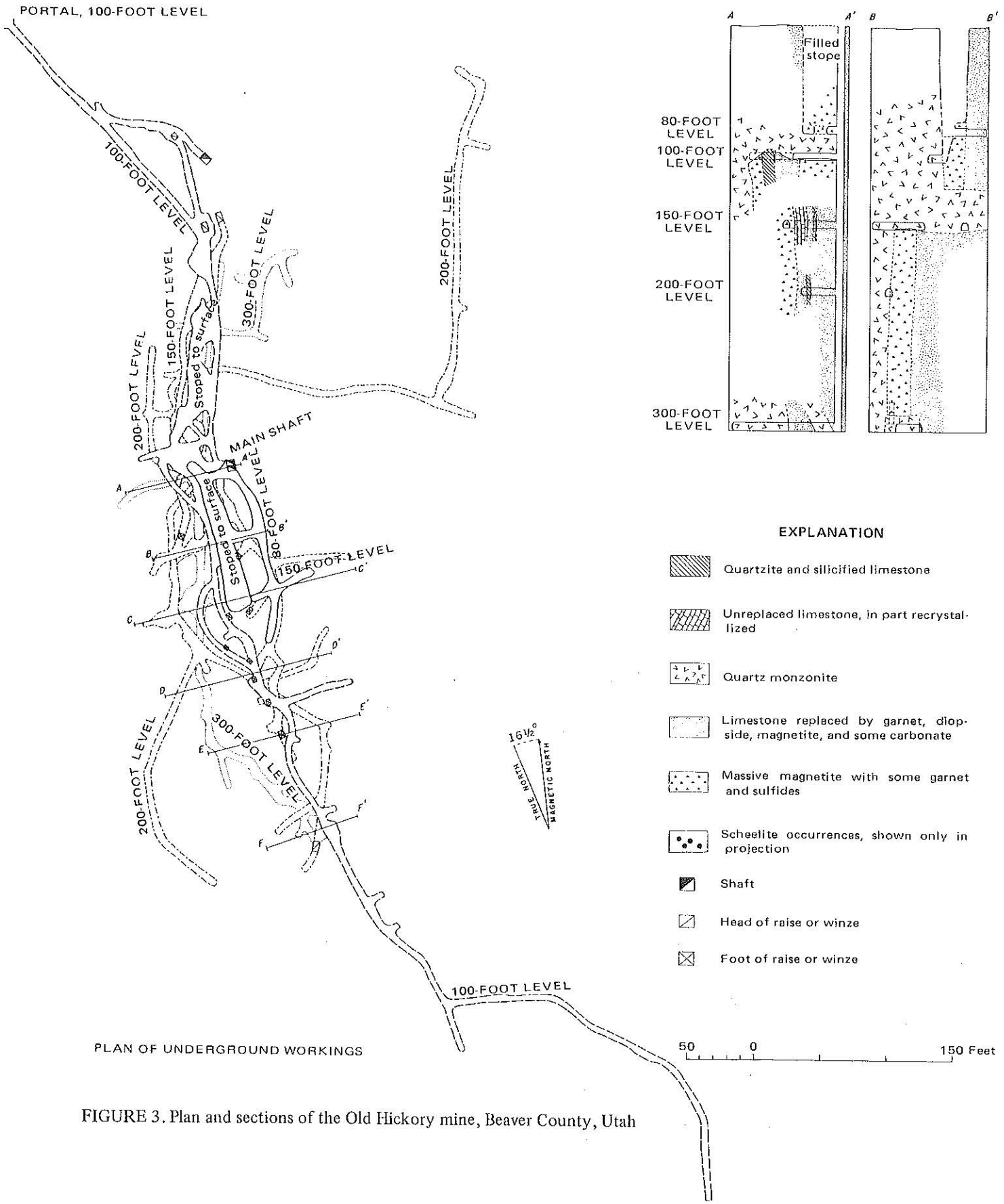
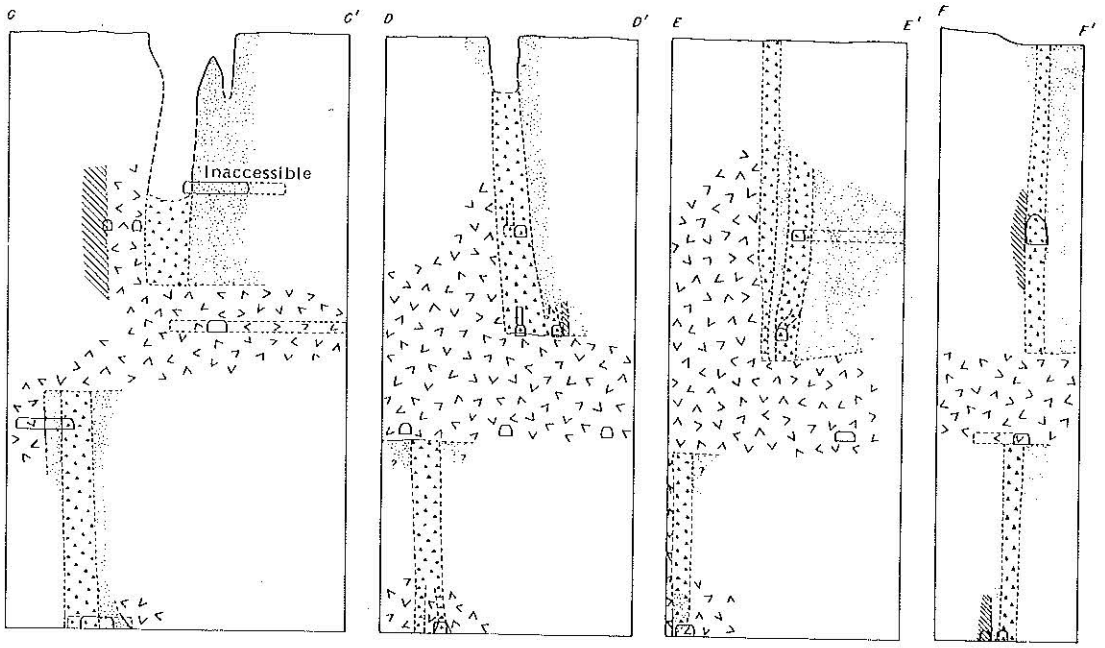
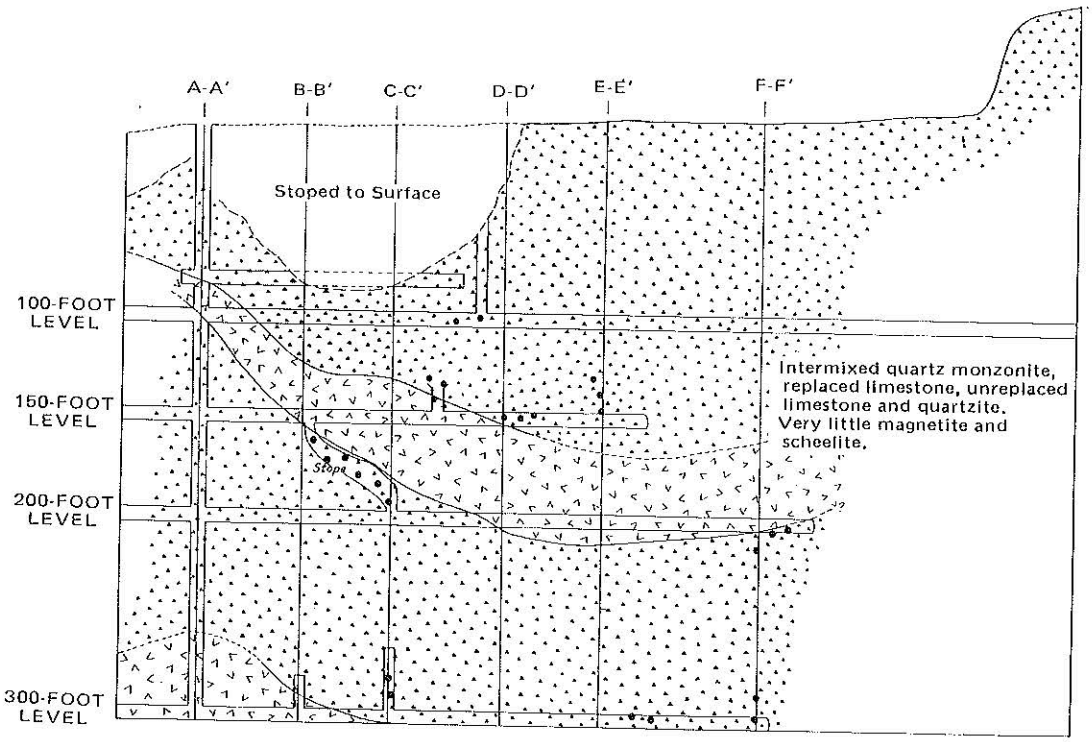


FIGURE 3. Plan and sections of the Old Hickory mine, Beaver County, Utah



STRUCTURE SECTIONS

N. S.



GENERALIZED LONGITUDINAL PROJECTION OF MAGNETITE ORE BODIES

Source: S. W. Hobbs (1945).

er of the igneous rock indicates that the sedimentary rocks at the Old Hickory probably constitute a large roof pendant in the quartz monzonite.

Structure. The sedimentary strata in general stand nearly vertical and strike nearly north, with little variation in dip or strike. The principal structure complications are due to the irregular intrusion of the igenous rocks, which follow the bedding planes of the sedimentary rocks for the most part but frequently cut across them as rather gently dipping dikes or as irregular masses.

One dike, striking nearly east and dipping gently to the south separates the sedimentary rocks including the ore body, into two segments The upper segment is displaced relative to the lower about 50 or 60 feet to the east as is shown in the structure sections (pl. 1)[1]. The measure of the displacement is based entirely upon the offset produced in the magnetite zone and the vertical igneous contact west of the ore body. This offset may have been caused by a fault along which the dike was later intruded, or by movement along the dike either before or after it solidified. Possibly the offset is not due to faulting at all but marks a jog in a zone of alteration formed along an irregular igneous contact, at the place where the horizontal dike was by chance injected. Faulting, however, seems the most probable cause of the offset for in one place the quartzite, the one member of the series that can be identified both above and below the dike, is apparently displaced. Other faults are of minor importance in the immediate vicinity of the mine, where post-mineral movement, although it has produced gouge along some of the contacts of the ore body, has nowhere significantly offset the contacts

Ore deposit *Mineralogy.* The scheelite of the Old Hickory mine occurs in a contact-metamorphic deposit produced by the intrustion of quartz monzonite into calcareous sediments. The ore appears to be localized principally in one or more beds of limestone that are especially susceptible to replacement. The main deposit is in an elongate tabular body, 15 to 25 feet wide, consisting chiefly of magnetite and silicates, the most abundant of which are garnet and diopside. Gradual changes of composition may be observed not only in crossing the strike but also along it, and in many places the deposit is made up of thin layers evidently differing in composition. The proportion of magnetite to silicates varies widely from about 90 percent magnetite and ten percent silicates to 90 percent silicates and ten percent magnetite. Minor constituents of the deposit are the sulfides pyrite, chalcopyrite, and bornite, some secondary copper minerals, and scheelite. The scheelite is generally most abundant in rock that contains abundant magnetite, and such rock occurs mainly at or very close to igneous contacts. Most of the magnetite is localized in the 15- to 25-foot tabular zone adjoining the quartzite and monzonite on the west but scattered grains of magnetite and scheelite are found in garnet-diopside rock 100 feet or more from the contact. Still farther from the main contact certain favorable layers are completely altered to garnet-diopside-magnetite rock containing little or no scheelite, but most of the rest of the sedimentary series is only recrystallized or slightly altered.

[1] Figure 3 of this report

The primary copper sulfides are so sparsely scattered that the rock containing them can have no value as an ore of copper, but a small amount of copper has been obtained from some rock near the surface where copper carbonate is concentrated in the numerous fractures.

The scheelite in the magnetite-garnet rock occurs in two forms. A few two to three-inch veins of nearly solid scheelite in large, translucent, greenish-gray crystals have been found at the base of the open cut 50 feet south of the main shaft, but these veins are traceable for only 10 to 15 feet. Most of the scheelite occurs in small grains, or more commonly in clusters of small grains, one half to one-inch long in the magnetite. Each cluster appears superficially to be a single large crystal, but close examination reveals its composite character. All gradations are found between rock in which these clusters are widely scattered and zones 10 to 15 feet long in which the clusters are crowded together.

All of the scheelite in the Old Hickory mine, like that in the Cupric property, has a yellowish-white or yellowish fluorescence color, indicating that it contains a good deal of calcium molybdate. The color varies considerably from place to place, and assays of the mineral are said to show that some of it contains only a few percent and some of it 20 or 30 percent of calcium molybdate. None of the mineral in the Old Hickory mine has a blue-white fluorescence color.

The minerals in the deposit are probably almost contemporaneous. In some places magnetite and sulfides cut earlier garnet and diopside, and veins of scheelite cutting magnetite show that some of it is later than magnetite, although some is earlier or of the same age The whole sequence, however, is related to the same period of igneous activity

At the Old Hickory mine, as at the Cupric mine, the important factors in localization of the scheelite and primary sulfides are country rock of favorable composition and the immediate proximity of the igneous intrusive contact. Fracturing played a minor part, although it prepared the ground for the deposition of oxidized copper ore near the surface.

Ore shoots and limits of ore. Scheelite is not only associated with magnetite, as already noted, but is concentrated in rather definite ore shoots within the rock rich in magnetite. One of these ore shoots which extends from the 200-foot to the 150-foot level, lies beneath the low-dipping quartz monzonite dike already mentioned (p. 96), and extends along the junction of the dike with the vertical contact of the monzonite body on the east. The contacts between the ore shoot and the igneous rocks are sharp. It is possible that the ore minerals were derived directly from the adjacent igneous rock, but it is more likely that the inverted trough formed by the intrusive contacts directed solutions from below and thus concentrated them in definite shoots.

Other prominent shoots have been found in the mine, but much of the scheelite is irregularly distributed through the magnetite rock. Small quantities of scheelite have been noted in zones east of the main contact deposit, but igneous rock has always been found nearby when it was looked for.

Both the abundance of igneous rock in the mine and its distribution strongly suggest that the sedimentary rocks in which the ore occurs form a large roof pendant

in the igneous rock. This view is further substantiated by the fact that the abundance of igneous rock in general increases with depth. It seems likely, indeed, that the sedimentary rocks and consequently the ore deposit will be completely cut out at no great distance below the present 300-foot level of the mine.

Five hundred feet south of the shaft the strike of the sedimentary rocks swings slightly to the east and a thick band of quartzite comes in on the surface between the limestone and the igneous rock. This is probably the reason for the scarcity of magnetite in surface exposures to the south. Underground the 100-foot level extends along the strike of some magnetite lenses associated with dike rocks, to a point 750 feet south of the shaft, but scheelite is here very sparse or entirely lacking.

Production and reserves Although a little of the garnet-diopside rock south of the open cut contains scheelite, all the ore that had been mined by early 1944 was in rock that contained at least 50 percent of magnetite, so the amount of indicated ore available depends primarily upon the amount of magnetite-rich rock in the mine. Not all of this rock, however, is scheelite ore, and it is therefore necessary, in calculating reserves, to take account of the distribution of scheelite within the magnetite rock.

The localization of the scheelite ore is controlled mainly by two factors, whose relative importance varies from place to place. The more important factor is proximity to a contact. The other is control of the movements of the ore-bearing solutions by impervious igneous rock. The low-angle dike already noted, for example, apparently has acted in at least one place to concentrate solutions on its lower side. In general, however, the magnetite above the low-angle dike is more uniformly impregnated with scheelite than that below, where the scheelite is more spotty.

The structure sections and the longitudinal projection of the ore body in plate 37[1] give a picture of the extent and distribution of the ore that is helpful in calculating reserves. The zone rich in magnetite extends for several hundred feet north of the shaft, but very little scheelite has been found in the old mine workings that explore this part of the zone and it is not included in the estimates of reserves

The structure sections in plate 37[1] illustrate the decrease in thickness of the magnetite zone toward the south and show that it seems to be ore-bearing for only a short distance in that direction. On the surface, very little scheelite-bearing magnetite was found beyond a point about 100 feet south of the open cut and on the 100-foot level the ore disappears almost directly beneath this point The scheelite ore tends also to pinch out in depth, and below the 300-foot level there is probably very little ore. This is partly because the magnetite body narrows downward, partly because the scheelite content of the magnetite rock diminishes downward.

Most of the pockets of higher-grade ore were mined out by December 1943, and mining was discontinued. Between the fall of 1941 and December 1943 the mine supplied 18,000 tons of rock from which 6,800 tons of ore containing 0.6 percent WO_3 was sorted. The average grade of the rock removed from the mine thus is 0.226 percent WO_3.

Most of the possible scheelite ore in the mine is contained in a block of magnetite-rich contact rock roughly 300 feet deep, 450 feet long, and 6 to 30 feet wide. From its volume about 75,000 cubic yards, there must be subtracted the volume of included igneous rock and that of the empty stopes, estimated at 51,000 cubic yards. The net volume of magnetite-rich rock would be 24,000 cubic yards which at 7,210 pounds per cubic yard would weigh approximately 86,500 tons. To this may be added 20,000 tons of ore calculated from surface exposures beyond the limits of the underground workings, making a total of 106,500 tons of magnetite-rich rock in the deposit. It is known from direct observation that a large part of this material is barren. The erratic distribution of the scheelite in the magnetite may be regarded, by a liberal construction, as making all unexplored parts of the magnetite body potential sources of ore, but there is no reason to suppose that they will be any richer on the average than the parts that have been mined.

By December 1943, all of the better ore shoots had been mined out and any ore left in the ground was either of lower grade or in as yet undiscovered ore shoots. At the beginning of operations in 1941 ore reserves at the Old Hickory mine were estimated by the writer to be about 15,000 tons of measured and indicated ore containing approximately 0.5 percent WO_3, and 43,000 tons of inferred ore containing 0.25 percent WO_3. Actual production has amounted to 18,000 tons which averaged slightly under 0.25 percent WO_3. This production has essentially removed all of the ore formerly classed as measured and indicated.

Mining activity in 1943 opened more of the mine for examination, permitted a more accurate appraisal of ore reserves, and showed the distribution of sheelite-bearing rock to be quite restricted. Thus, it does not seem probable that there are any large potential reserves of ore in high-grade pockets or of large tonnages of low-grade material.

It is estimated that about 400 tons of ore containing from 0.75 to 1.00 percent of WO_3 could be sorted from scheelite-bearing material left in the mine. This amount of ore is classed as indicated as much of it is partly exposed by underground workings. It is possible that some undiscovered pockets of ore, minable under conditions existing in 1944, are present, but there is no basis on which to estimate the tonnage. About 5,000 tons of rock containing approximately 0.1 to 0.2 percent WO_3 may be inferred. This is not ore, but could possibly be a source of small production under emergency conditions.

Magnetite Stopes, Montreal Mine – The magnetite stopes of the Montreal mine are located in the SW¼, NW¼, section 23, T. 27 S., R. 11 W., Salt Lake Base and Meridian (Figure 1). It consists of an open pit and two levels of underground workings (Figures 4 - 4c).

The ore is a tactite where Permian Kaibab limestone has been contact metamorphosed by the Montreal mine granodiorite. The skarn is characterized by much simpler mineralogy than those associated with the quartz monzonite; the minerals being chiefly magnetite, chlor-

[1] Figure 3 of this report

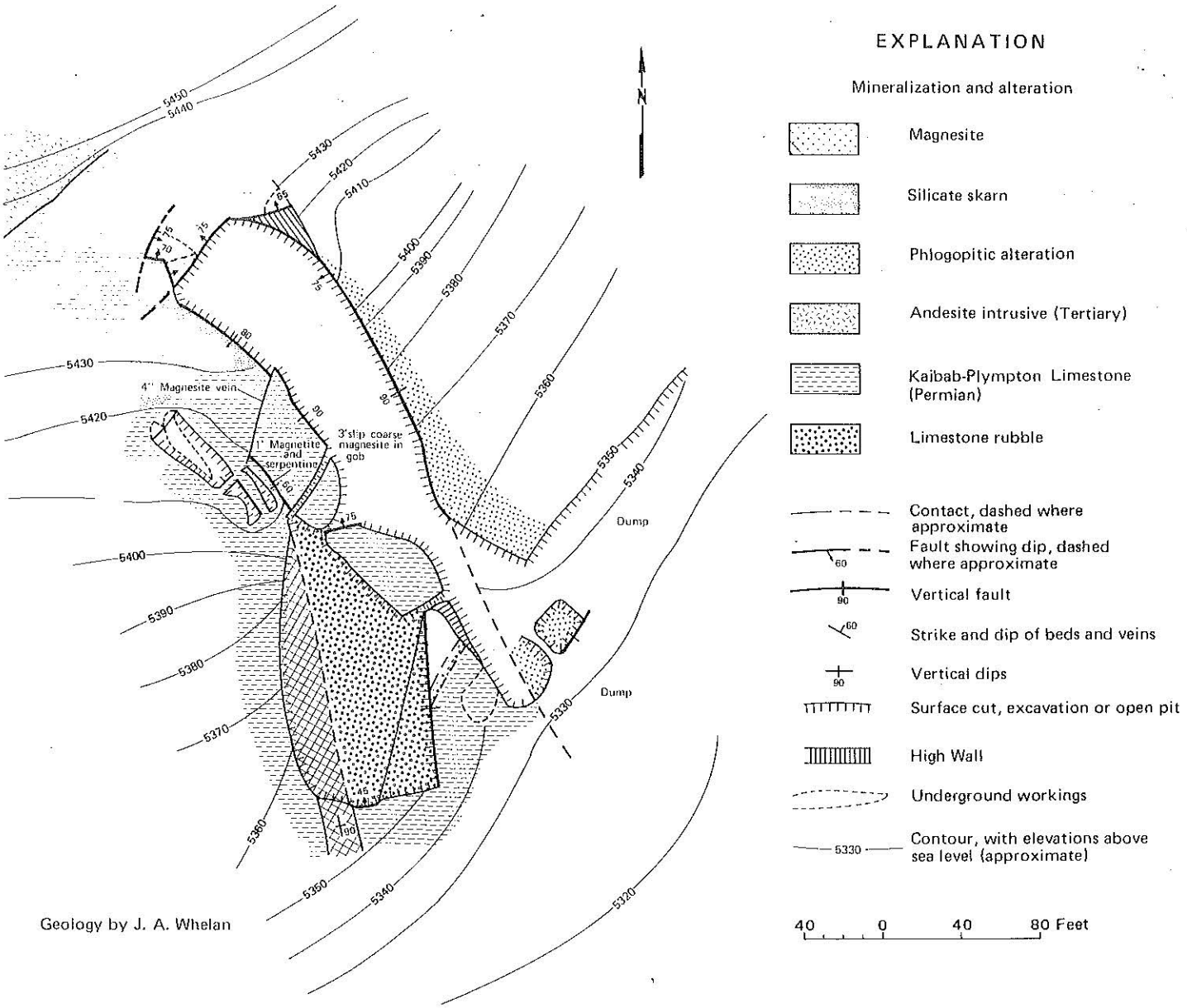


FIGURE 4. Surface workings of the Magnetite Stope, Montreal mine, Beaver County, Utah

ite, phlogopite and some serpentine on the lower level. Copper minerals are essentially absent.

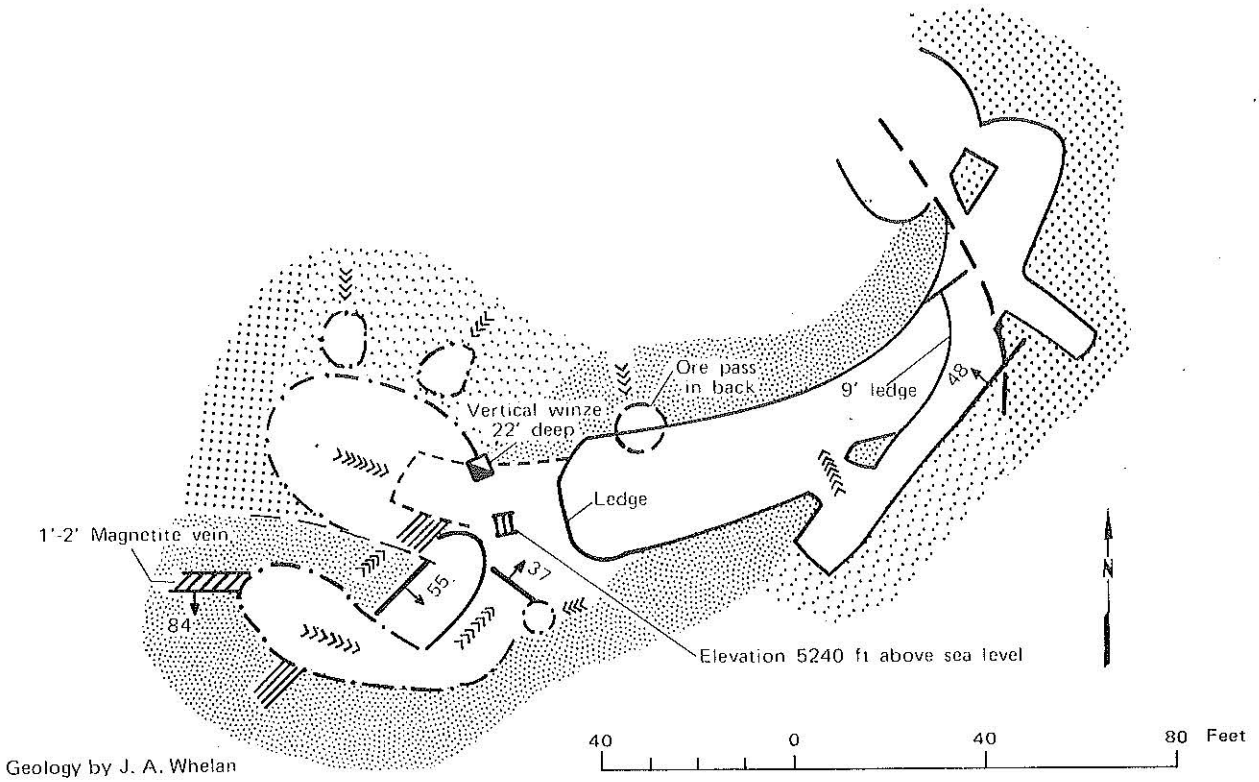
The limestone is marbleized. It is cut by veinlets of silicified magnesite. The granodiorite is propylitically altered, containing much epidote on joint surfaces, with hornblende and biotite partially altered to chlorite.

The ore body shows a rude zoning. The tabular magnetite is enclosed in a zone of magnetite-chlorite. The contact of the ore body with the intrusive is characterized by rather clean, fine, golden phlogopite. This contact is a fault, however, and the phlogopite may be the result of later hydrothermal activity along the fault.

The magnetite was shipped as a smelter flux. Production from the pit and underground workings was small, probably not exceeding ten to twenty thousand tons.

Niagra Falls Claims – The exact date work started on the Niagra Falls claims is not known. However, the adit, Figures 5a - b, was driven prior to 1913 (Ralph, 1915, p. 2 and 4).

The ore body was a pipe of contact metamorphic minerals formed in Kaibab Limestone at the contact with quartz monzonite. It was localized by the intersection of northwest trending faults and east to east-



EXPLANATION

Magnetite with phlogopitic alteration

Magnetite with chlorite

Massive magnetite

Contact, dashed where approximately located

37 Fault showing dip, dashed where approximately located

Workings on level

Workings above lower level

Workings below level

Head of winze

84 Vein, showing dip

Grizzly

Fault zone

Inclined workings (chevrons point downward)

FIGURE 4a. First underground level of the Magnetite Stope, Montreal mine, Beaver County, Utah

southeast trending faults, probably of small displacement. The east trending faults parallel the jointing in the quartz monzonite. The ore body plunges about 70° N, 60° W. The ore was a skarn composed of magnetite and diopside but with significant quantities of garnet, actinolite, serpentine, phlogopite, chlorite and magnesite. The limestone is in places turned into a solid grossularite garnet rock and is everywhere recrystallized to marble. Ralph (1915, p. 6) gave the following assay of the ore:

copper	2.13 percent
iron	36.04 percent
insoluble increment	13.70 percent
silver	0.71 oz/t

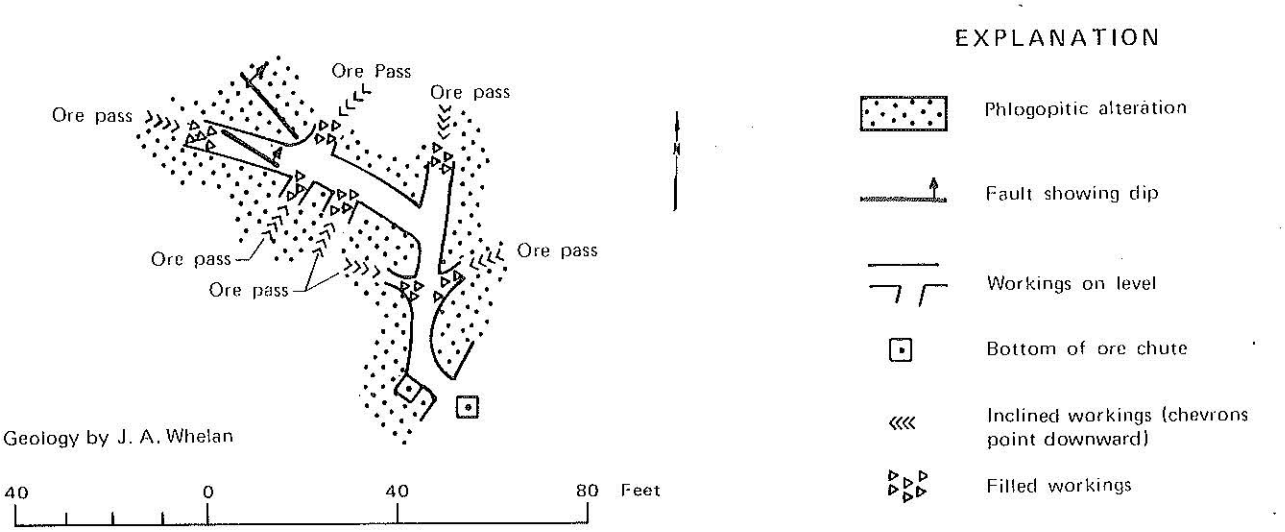


FIGURE 4b. Underground sub-level of the Magnetite Stope, Montreal mine, Beaver County, Utah

During mapping for this project grab samples were taken as follows:

Location	Percent copper
Magnetite rich stopes, adit level	1.74
Raise by ore chute, adit level	0.99
Diopside rich ore, adit level	0.90
East stope, adit level	1.40
Ore pile, surface prospect above Niagra Falls Stopes	3.70
Ore pile, outcrop Niagra Falls Stopes	0.90

The workings (Figure 5b) consist of northwest trending adit through quartz monzonite, about 550 feet to the quartz monzonite-limestone (now garnet rock) contact. A drift here, about 80 feet to the east, along the contact, proved to be barren. Drifting continued into the garnet rock, to the northwest for about 300 feet, again in barren rock. Drifting was also continued westward for about 350 feet, now pack walled off at 300 feet. Two cross cuts to the south from this drift intersect the ore body. It is interesting to note Ralph's comments (1915, p. 4 and 5) on the work:

> "The body of limestone in about the center of the property which became 'included' in the monzonite at least on three sides, and which is roughly of horse shoe shape, constitutes the nucleus for an important contact deposit of cupriferous magnetite, the most prominent outcrop of which is at the 'toe'. This outcrop was apparently the chief point of interest to the original locators of the property, and in an effort to develop this ore body at depth an adit was run into the hill side 550 feet, and where the 'face' was vertically beneath the outcrop in question. No mineral being encountered at this point two 'forks' were run - the included angle being approximately 100° - one to the extent of 350 feet and the other 250 feet making a total of nearly 1,200 feet of prospecting No sign of ore being encountered further effort was abandoned.
>
> A study of this set of conditions in 1913 suggested to the writer that failure to encounter the contact at depth was by reason of nonappreciation of the 'dip' of the limestone, and at a point about 150 feet beyond where the left 'fork' diverged from the main cross cut a swinging back at right angles was suggested, and which resulted, after only 30 feet of work, in encountering the north 'wing' of the contact. This development showed that the main adit had plunged directly under the overchanging 'nose' of the tilted limestone; that the right hand fork had veered hopelessly farther into the monzonite while the left fork had practically been skirting the contact through the whole of its distance."

There is considerable stoping on the adit level, and above and below it. A two compartment shaft goes to a lower level or levels, but they were not explored or mapped. The main ore body is stoped from the adit level to the surface. The writer estimates about 20,000 tons of two percent copper ore has been mined from this property.

The Bawana Mine – The Bawana mine was discovered as a gravity anomaly in the late 1950s. It is a skarn type copper deposit in the Toroweap Formation. The ore body was about 400 feet long and about 80 feet wide. It has been mined to a depth of about 200 feet. Its strike was about N 60° W and its dip 65° NE. A section across the middle of the ore body is shown in Figure 6.

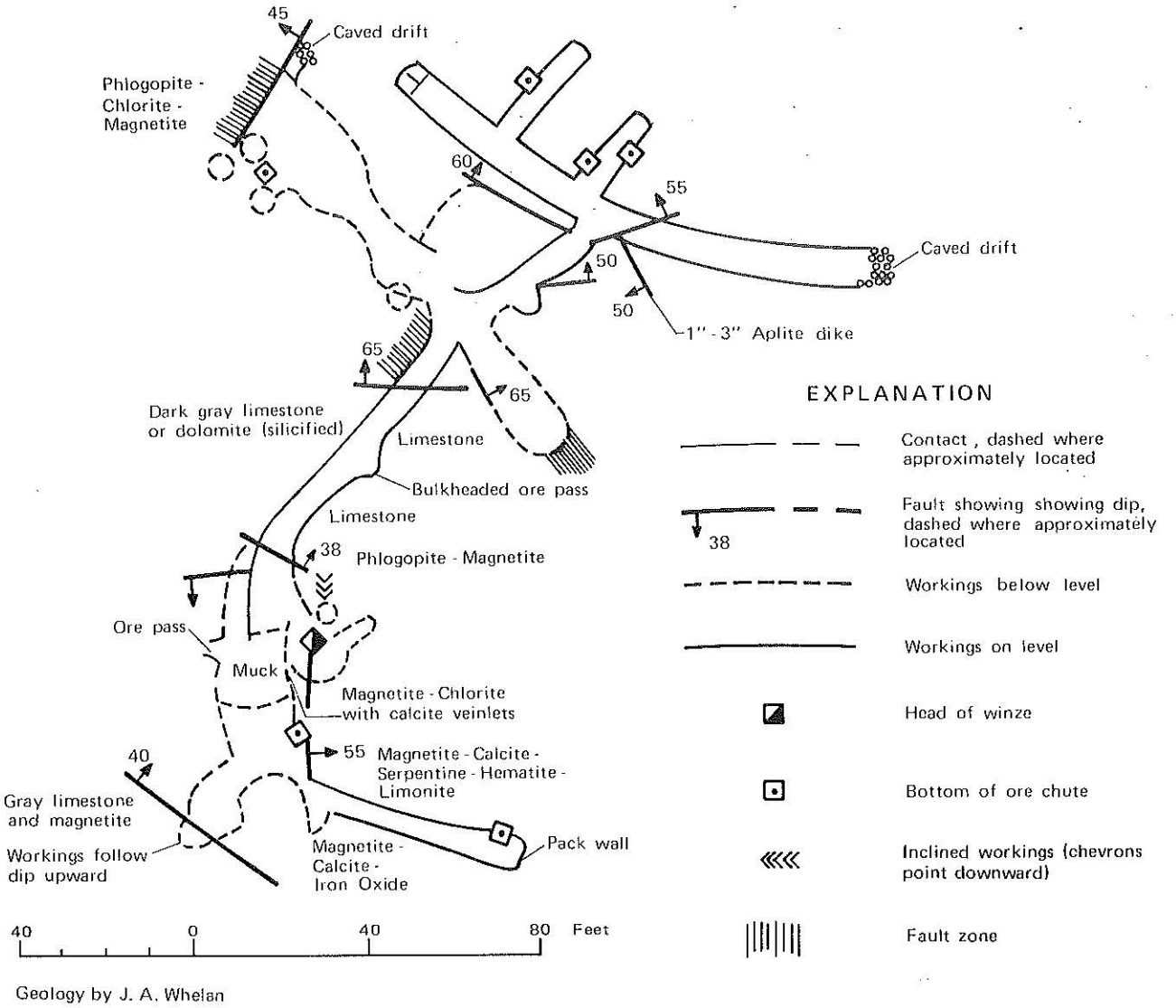


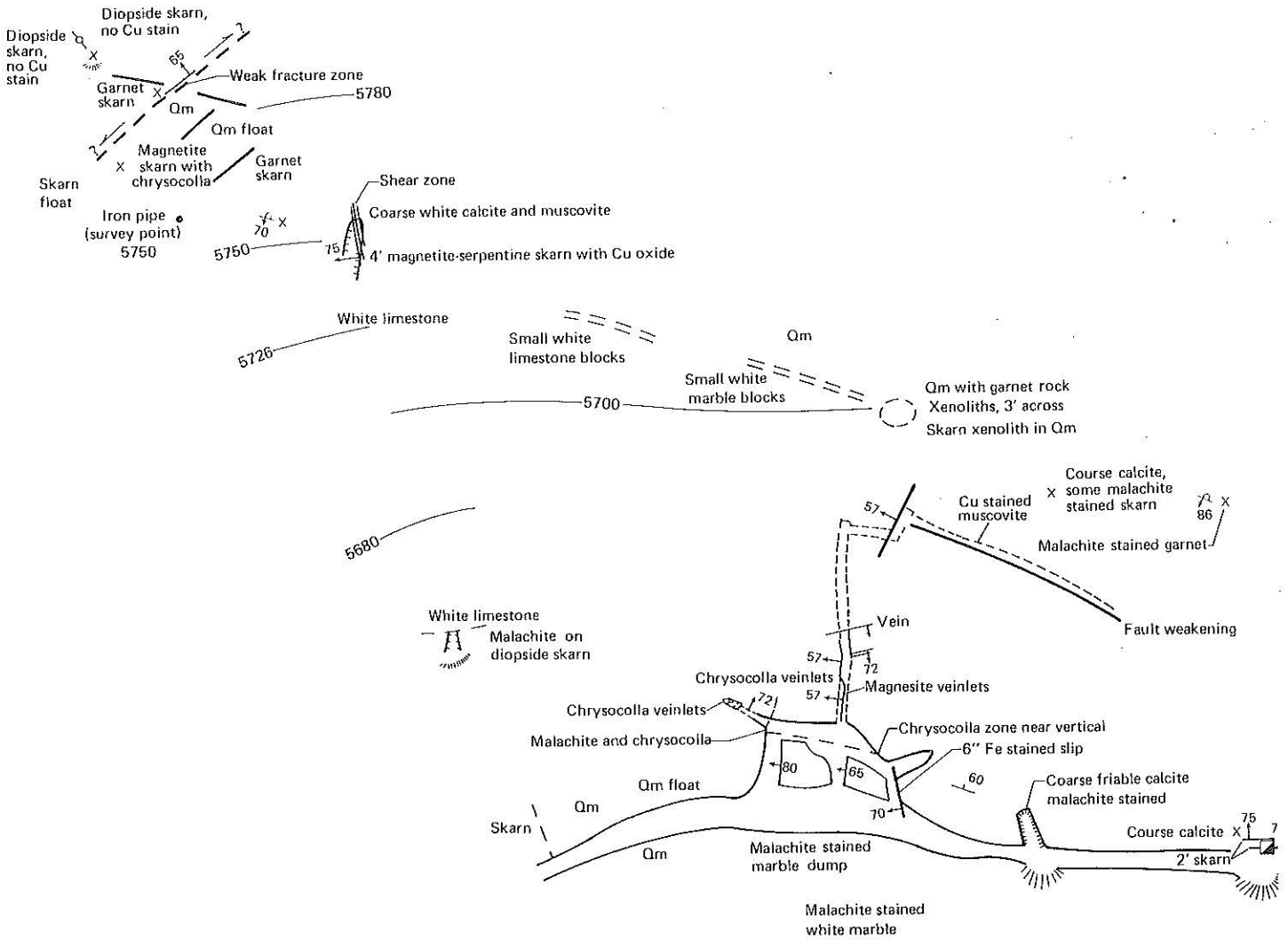
FIGURE 4c. Second underground level of the Magnetite Stope, Montreal mine, Beaver County, Utah

The skarn consisted of massive garnet, diopside, magnetite, recrystallized calcite, serpentine, idocrase, epidote, phlogopite, thaumasite, and kinaite. The ore body was oxidized to almost the present bottom of the pit. Chief ore minerals were chrysocolla and malachite with some covellite and tenorite. Stringhamite and Whelanite were both originally identified in this pit (Hindman, 1976; 1978). Primary ore minerals were bornite and chalcopyrite, frequently massive. Some scheelite crystals with powellite rims are present. The primary sulfides are closely associated with massive garnet rock.

Oxidation caused enrichment of the shallower portions of the ore body. The upper oxidized portions of the ore body averaged over three percent copper, the primary ore under two. The average ore grade was 2.65 percent. Approximately 450,000 tons of ore were mined. Treatment of the Bawana ores was carried out by flotation. The chrysocolla did not respond well to flotation and mill tailings average 0.6 percent copper. Average recovered grade was 2.01 percent.

The Maria Mine – The Maria was discovered by the Cerro Verde Mining Company, in the same era of magnetic prospecting that the Bawana and Hidden Treasure mines were. It is located on the southwest corner of the main portions of the range, in the NE¼, SW¼ 22, T. 27 S., R. 11 W. (Figure 1).

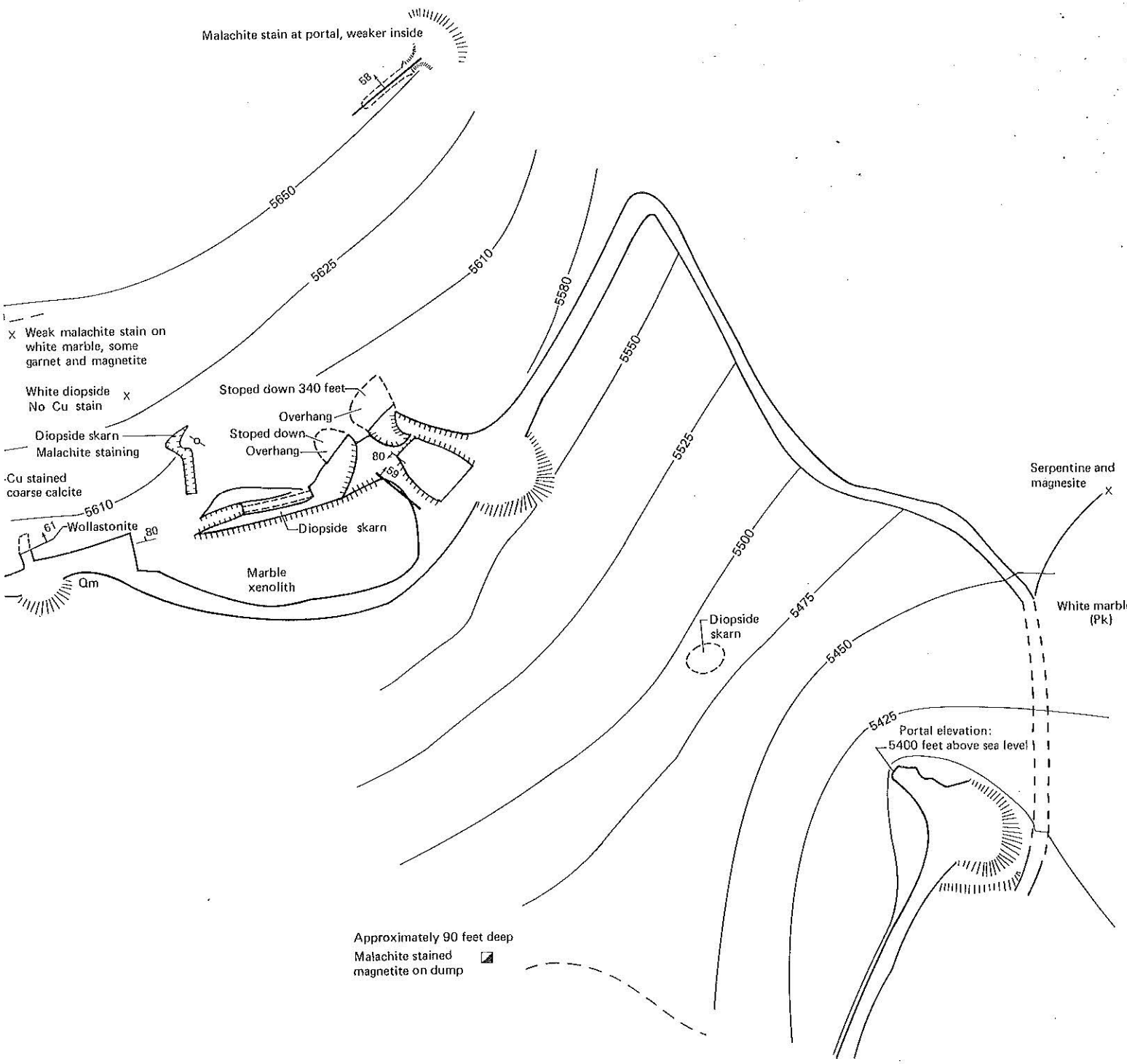
The ore body is, like the others described, a garnet-diopside-magnetite skarn in the metamorphosed Toroweap Formation. The gangue mineralogy is similar



EXPLANATION

Qm	Quartz monzonite		Underground workings
x	Test pit		Fault, dashed where inferred
	Shaft down		Contact, dashed where inferred
61	Strike and dip		Iron pipe (survey point)
70	Overturned bedding		
	Vertical bedding		

FIGURE 5a. Surface workings of the Niagra Tunnel, Montreal mine, Beaver County, Utah


Malachite stain at portal, weaker inside
58
5650
5625
5610
5580
5550
5525
5500
5475
5450
5425
Weak malachite stain on white marble, some garnet and magnetite
White diopside No Cu stain
Diopside skarn
Malachite staining
Cu stained coarse calcite
Stoped down 340 feet
Overhang
Stoped down
Overhang
80
59
Diopside skarn
61
Wollastonite
80
Qm
Marble xenolith
Diopside skarn
Serpentine and magnesite
White marble (Pk)
Portal elevation:
5400 feet above sea level
Approximately 90 feet deep
Malachite stained magnetite on dump

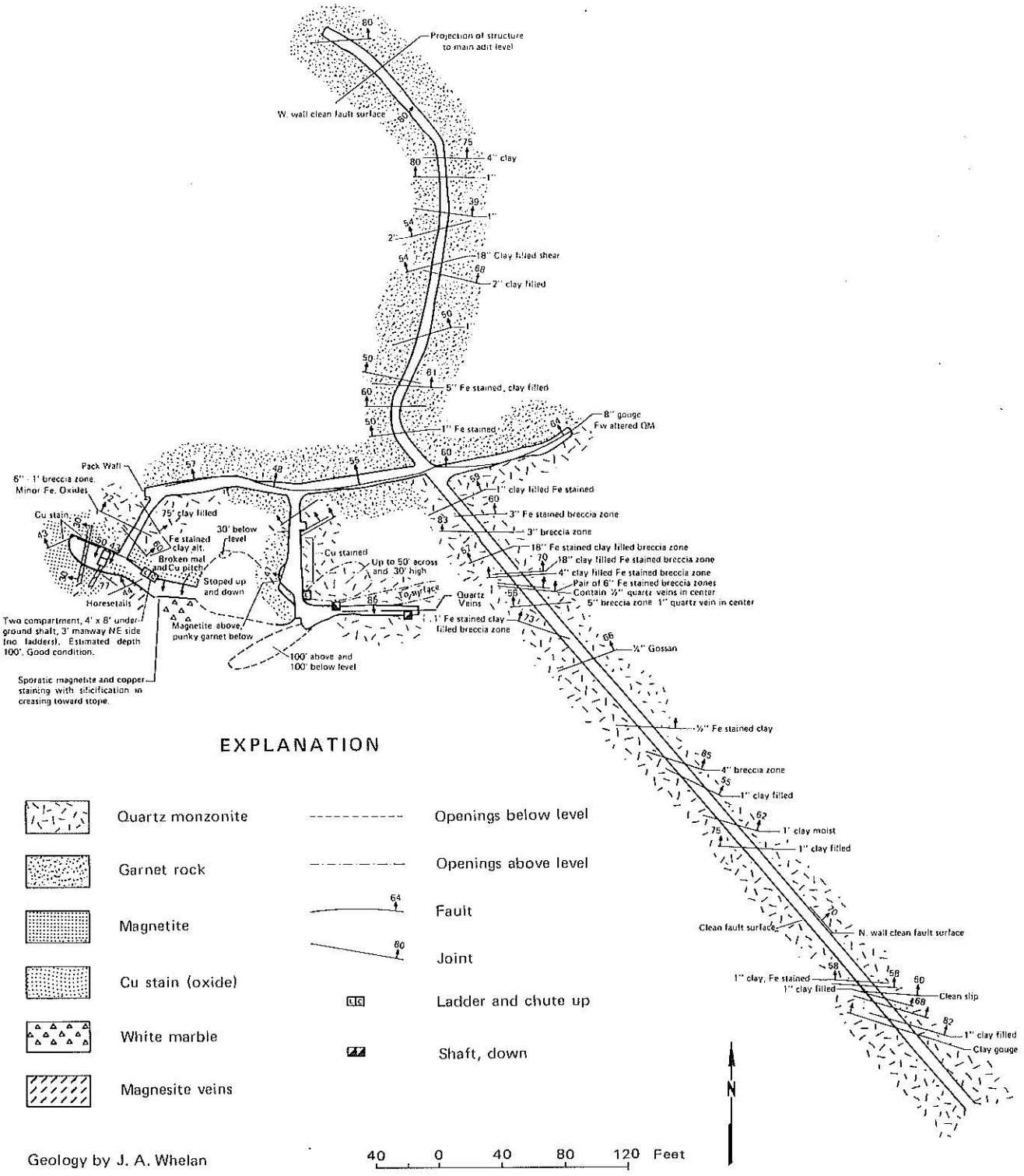


FIGURE 5b. Underground workings of the Niagra Tunnel, Montreal mine, Beaver County, Utah

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creating solutions for today's environment

March 3, 2014

Becky Bonebrake
BLM Wildlife Biologist
Cedar City Field Office
176 East DL Sargent Drive
Cedar City, UT 84721
Via E-Mail (bbonebra@blm.gov)

RE: CS Mining - 2014 Golden Eagle Survey #1 Results

Dear Becky,

During February 18 through 21, 2014 JBR biologists Seth Topham and Greg Sharp (surveyors) completed a survey for golden eagles and their nests in the pre-approved golden eagle survey area in support of CS Mining's Milford Operations Area Project. The surveyors looked at all golden eagle nesting habitat within the 5-mile buffer of the project, but focused their efforts on the golden eagle survey area identified in coordination with you. The surveyors checked all known eagle nest locations along with searching for new nests. The surveyors also searched for golden eagles and recorded all golden eagle sightings and behavior.

Weather throughout the 4-day survey event was optimal for golden eagle activity, day time high temperatures were around 55 degrees and winds were generally calm to lightly breezy. During the survey, 15 individual golden eagle sightings were made across 9 eagle sighting events (1 or more eagles). Of the eagles observed, 3 had juvenile plumage and the rest were adults.

Since it is impossible to determine which golden eagles were seen and recorded and which were repeats of golden eagles already seen and recorded the surveyors recorded all golden eagle sightings. Eagle observations included many behaviors such as soaring, courting, perched, chasing, nest building, defending, and incubating, indicating that golden eagles were still very much active and largely not incubating eggs during the survey event.

In addition, 22 known nest sites were visited. Of these, 15 nests were relocated; the other 7 were not found. In addition, JBR documented and mapped 3 newly discovered eagle nests. One of the newly discovered nests is currently active and had a golden eagle incubating on the nest. Of the 18 nests visited, 3 showed signs of repair (e.g., green vegetation on the nest), which does not include the active nest.

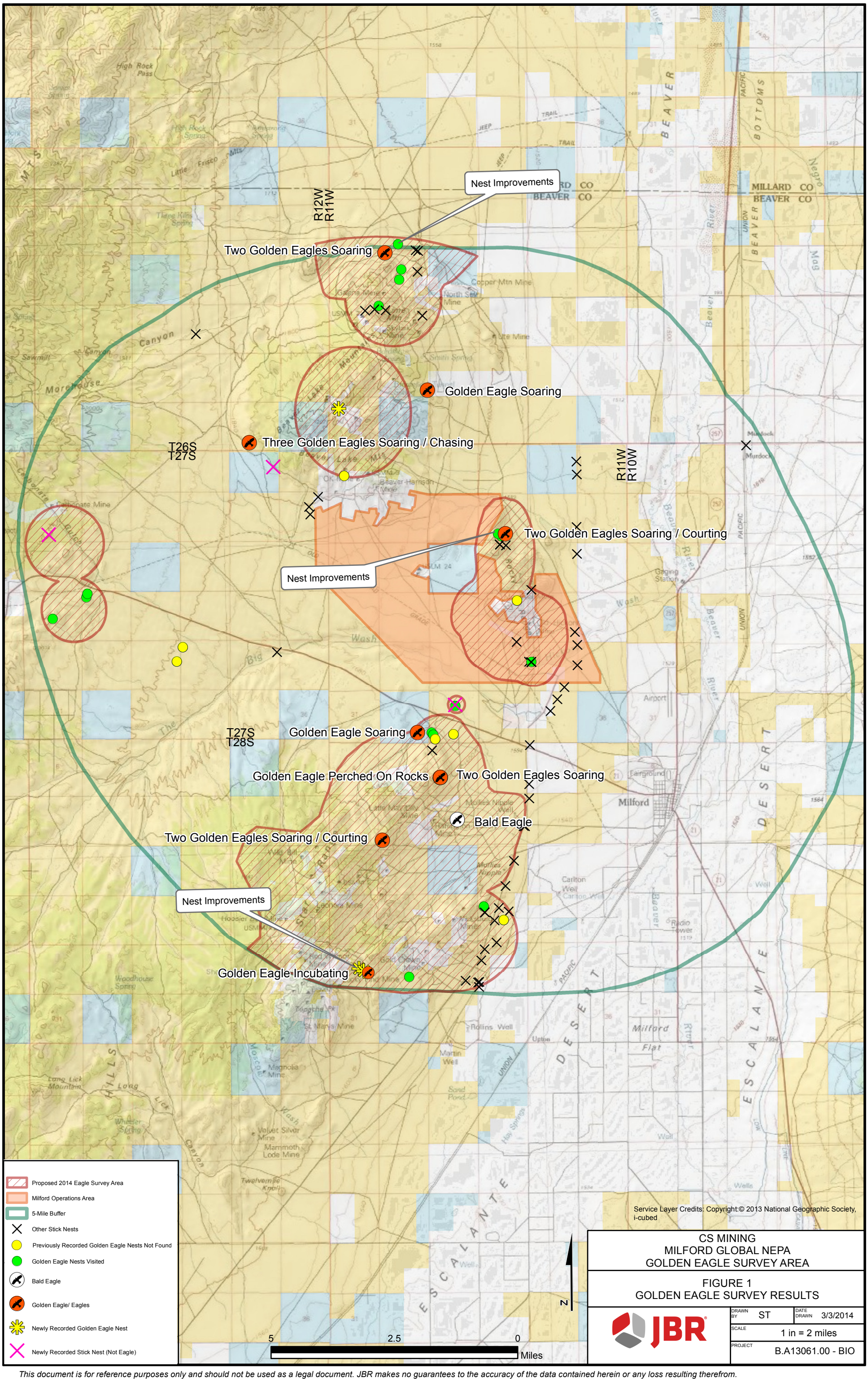
Photos were taken of all golden eagles and golden eagle nests. Photos will assist in monitoring changes to nests as golden eagles begin to become less visible during incubation and rearing. Data sheets were also filled out and all eagles and newly discovered nests were mapped using a global positioning system. Figure 1 is attached.

Best regards,



Seth Topham
Biologist

Path: X:\UT\Clients\CS_Mining\SunriseAmendment_BA1306100\MXDs\BIO_mxds\2014_Biology\2014_EagleSurvey\EagleSurveyResults_2014_V1.mxd



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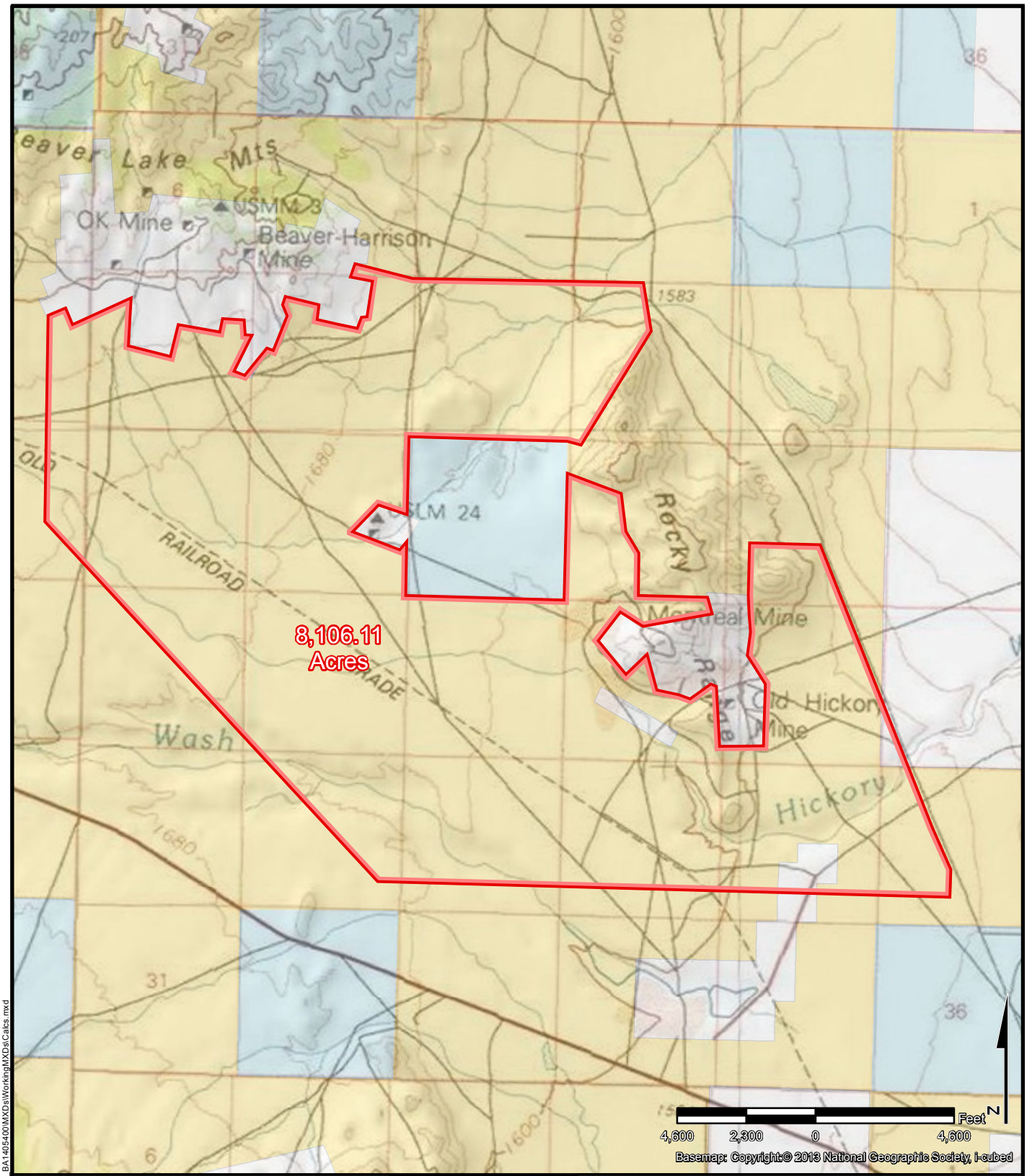


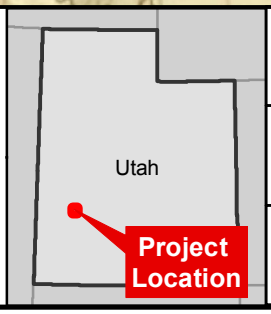
Legend

2014 NEPA Area

Land Status

- Bureau of Land Management (BLM)
- Private
- State

DRAFT



CS MINING
MILFORD OPERATIONS AREA

NEPA AREA

JBR

DRAWN BY	NF	DATE DRAWN	4/23/2014
SCALE	1 in = 4,600 feet		
PROJECT	B.A14054.00		

X:\UT\Clients\CS_Mining\MilfordOperationsAreaProject_BA14054.00\MXDs\WorkingMXDs\Calcs.mxd

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Fax: (435) 652-9558

July 1, 2015

Mace Crane
Bureau of Land Management
Fillmore, UT 84631
Via email (mcrane@blm.gov)

RE: Rare Plant Habitat Evaluation

Dear Mr. Crane,

On June 16, 2015 Stantec botanist Arnold Tiehm (resume attached) and biologist Seth Topham visited the CS Mining MOA to evaluate it for the presence of suitable habitat for the rare plants Frisco clover (*Trifolium friscanum*) and Frisco buckwheat (*Eriogonum soredium*).

According to the Utah Rare Plant Guide (UNPS 2003-2015) and A Utah Flora (Welsch et. al. 1993) *Trifolium friscanum* occurs on volcanic gravels and limestone in pinyon-juniper woodlands between 6,900 – 7,300 feet elevation and *Eriogonum soredium* occurs on white limestone outcrops in sagebrush and juniper communities between 6,600 – 7,300 feet elevation. The highest elevation within the MOA is 5,900 feet, with most of it below 5,700 feet (see attached figure).

Utah Native Plant Society (UNPS). 2003-2015 [Accessed July 1, 2015]. Utah rare plant guide. [Internet]. A.J. Frates editor/coordinator. Salt Lake City, UT: Utah Native Plant Society. Available from: http://www.utahrareplants.org.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins. (Eds.) 1993. A Utah Flora. 2nd edition. Brigham Young Univ., Provo, Utah. 986 pp.

Per Mr. Tiehm:

> The emphasis of this rare plant search was *Trifolium friscanum* and *Eriogonum soredium*. Both of these species occur at higher elevations than were found on the search area. As both are known from limestone substrates all rock outcrops in the search area were visited and explored. There is a small area of limestone which had *Petrophytum caespitosum* and *Cercocarpus intricatus*. This area was thoroughly searched and *Trifolium friscanum* and *Eriogonum soredium* were not found. All of the other rocky areas were of a different substrate, were at lower elevations, and were covered with a lot more vegetation than areas that support *Trifolium friscanum* and *Eriogonum soredium*.

Our conclusion is that the CS Mining MOA does not provide suitable habitat for either of these rare plants.

Best regards,

Eric A. Holt, Project Manager/Supervisor/Biologist

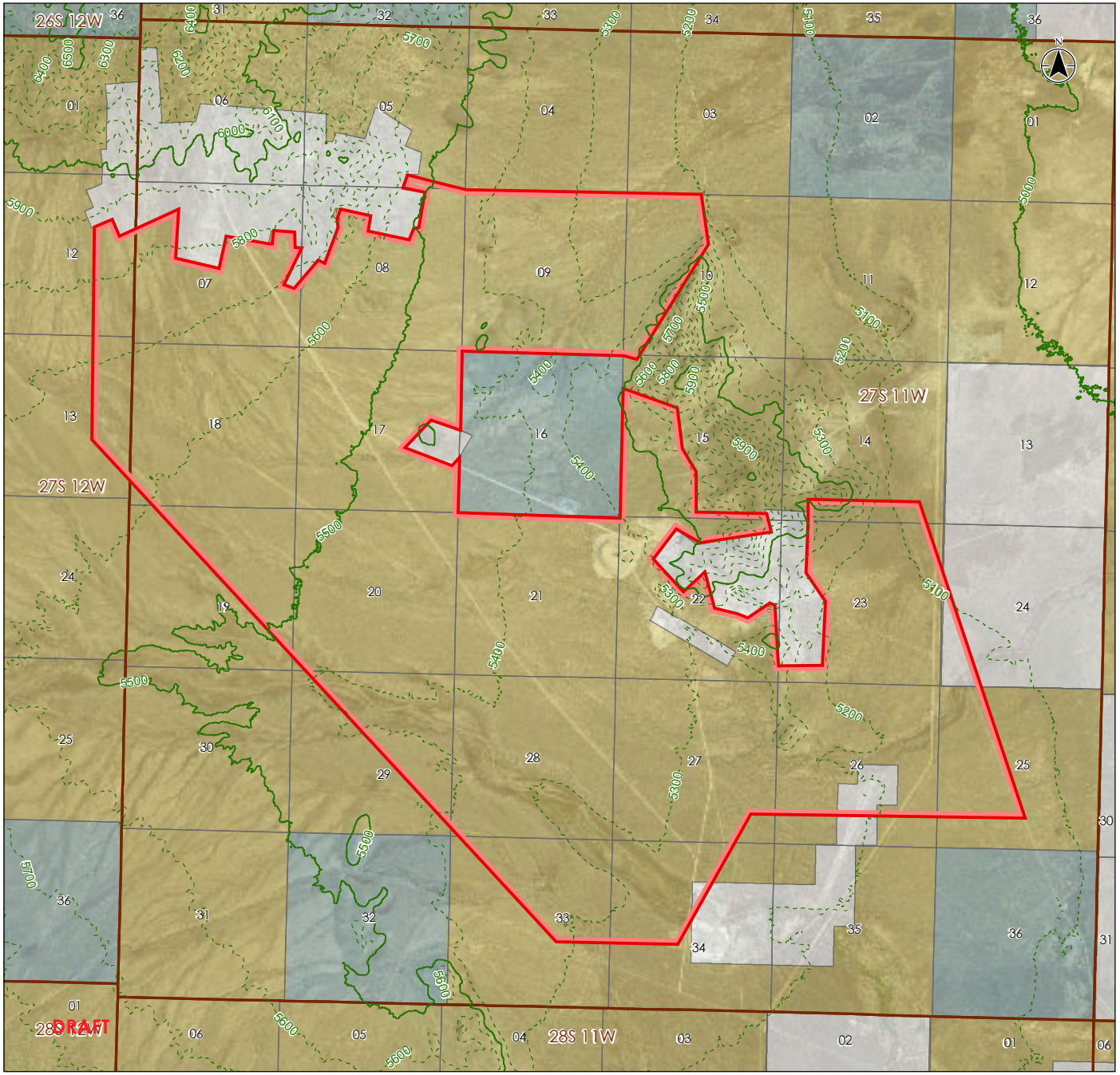
The following is a list of all plants encountered on the search area.

Trees and shrubs
Artemisia arbuscula
Artemisia nova
Artemisia tridentata var. wyomingensis
Atriplex canescens
Atriplex confertifolia
Brickellia californica
Brickellia microphylla
Cercocarpus intricatus
Chrysothamnus viscidiflorus var. puberulus
Ephedra nevadensis
Ephedra viridis
Ericameria nana
Ericameria nauseosa
Eriogonum microthecum
Glossopetalon spinescens var. aridum
Grayia spinosa
Gutierrezia sarothrae
Holodiscus dumosus
Juniperus osteosperma
Krascheninnikovia lanata
Petrophytum caespitosum
Purshia stansburyana
Tetradymia spinosa

Cacti
Echinocereus engelmanii
Echinocereus mohavensis
Opuntia polyacantha

Grasses
Achnatherum hymenoides
Achnatherum speciosa
Achnatherum thurberiana
Aristida purpurea
Bromus rubens
Bromus tectorum
Elymus elymoides
Hesperostipa comata
Hilaria jamesii
Poa secunda
Pseudoregneria spicata

Forbs
Astragalus calycosus
Astragalus humistratus var. humivagans
Astragalus lentiginosus
Astragalus purshii
Boechera pendulina
Camissonia walkeri
Castilleja chromosa
Chaetopappa ericoides
Cirsium neomexicanum
Cryptantha flavoculata
Cryptantha humilis
Cryptantha sp.
Cymopterus petraeus
Descurainia filipes
Draba cunifolia
Erigeron pumilus
Eriogonum deflexum
Eriogonum palmerianum
Eriogonum shockleyi
Erodium cicutarium
Gilia inconspicua
Halogeton glomeratus
Hymenopappus filifolius var. nanus
Hymenoxys acaulis
Lappula redowskii
Lepidium lasiocarpum
Marrubium vulgare
Mentzelia albicaulis
Oenothera caespitosa
Phacelia incana
Phlox sp.
Senecio multilobatus
Sisymbrium altissimum
Sphaeralcea grossularifolia
Stenotus acaulis
Stephanomeria exigua



Stantec

- Index Contour (500-foot interval)
- Supplemental Contour (100-foot interval)
- Milford Operations Area
- Township Boundary
- Section Boundary

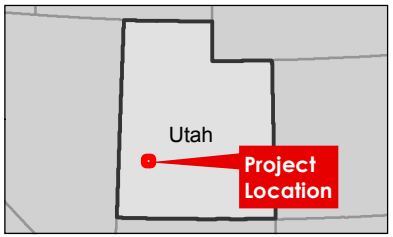
Land Status

- Bureau of Land Management (BLM)
- Private
- State

0 2,500 5,000 Feet

1:60,000 (At Original document size of 8.5x11)

Notes
1: Coordinate System: NAD 1983 UTM Zone 12N
2: Service Layer Credits:



Project Location
T27S, R11W; T27S, R12W
Beaver County, Utah

203706012
Prepared by NF on 2015-07-06
Technical Review by EH on 2015-07-06
Independent Review by CLG on 2015-07-06

Client/Project
CS Mining

Rare Plant Survey

Figure No.
DRAFT

Title
Project Area

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K:\UT\Clients\CS_Mining\CS_Mining_Support\203706012\MXDs\Figures\Figure 2.mxd Revised: 2015-07-06 By: mbust

Arnold Tiehm

Botanist

Mr. Tiehm has performed extensive fieldwork in the Great Basin and adjoining areas of Nevada, California, Oregon, Idaho, and Utah. Since 1974, he has collected more than 16,600 individual plant samples. He has identified at least 20 new species, 40 taxa new to Nevada, 4 new to California, 1 new to Utah, and 1 new to Oregon. Mr. Tiehm's experience includes categorizing the general vegetation community, surveying for threatened and endangered species, and performing vegetation monitoring. His experience as a botanist includes a 10-year range research project for the U.S. Department of Agriculture in Nevada and a study of the proposed MX Missile System Deployment Project in the western United States. He has prepared five status reports for the State of Nevada, Natural Heritage Program on rare and sensitive plant species.

EDUCATION

M.A., Botany, University of Nevada, Reno, Nevada, 1978

B.S., Wildlife Management, University of Nevada, Reno, Nevada, 1974

CERTIFICATIONS & TRAINING

MSHA Annual Refresher, Reno, Nevada, 2014

MEMBERSHIPS

Member, California Native Plant Society

Member, Nevada Native Plant Society

Member, New England Botanical Club

PROJECT EXPERIENCE

Vegetation Assessments

Nevada Copper Pumpkin Hollow Project* (Botanist)

Performed a field survey to assess and catalogue the vegetation within a 2,795-acre project area, near Yerington, NV. Reviewed the list of special status species known from the general area of the project and assessed their habitats, allowing for a thorough search of any similar habitats that were in the project area.

Aqua Trac Water Importation Project* (Botanist)

Performed field studies to assess and catalogue the vegetation along a 300-foot-wide, 60-mile pipeline corridor. Reviewed the list of special status species known from the general area of the project (Washoe, Pershing, and Churchill Counties, NV) and assessed their habitats. This allowed for a thorough search of any similar habitats that were in the project area.

Sugar Loaf Estates Baseline Surveys* (Botanist)

Performed field studies to assess and catalogue the vegetation of the project area in Plumas County, CA. He also reviewed the list of special status species known from the general area of the project and assessed their habitats. This allowed for a thorough search of any similar habitats that were in the project area. A complete list of all plant species found on the project was compiled and all special status plants were mapped using GPS technology.

Ely Energy Center and Transmission Line Projects* (Botanist)

Performed field studies to assess and catalogue the vegetation of the approximate 300-mile project alignment spanning White Pine, Lincoln, and Clark Counties, NV. Surveys assessed the potential for threatened, endangered, candidate, sensitive, and State-listed species. Compiled a complete list of all plant species found on the project, mapped the general vegetation community, and mapped all sensitive plant populations using a Trimble GPS.

Mt. Rose Ski Resort Baseline Surveys* (Botanist)

Performed intensive field surveys throughout the Mt. Rose Ski Resort, Washoe County, NV. Specifically surveyed for the Tahoe draba and Galena rockcrest, U.S. Forest Service (USFS) sensitive species.

Seismic Oil and Gas Exploration Project* (Botanist)

Performed field surveys on approximately 600 miles of seismic exploration alignments in eastern and central Nevada. Surveys were performed to identify threatened, endangered, candidate, BLM sensitive, and State-listed plant species. The locations of all sensitive plant populations were recorded using a Trimble GPS with sub-meter accuracy.

** denotes projects completed with other firms*

CS Mining, LLC

Milford Operations Area Biological Resources Survey Report



Prepared for:
CS Mining, LLC
1208 South 200 West
P.O. Box 608
Milford, Utah 84751

Prepared by:
Stantec Consulting
321 N. Mall Drive, Suite I-202
St. George, Utah 84890

October 29, 2014

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Appendices

Appendix A - Photos
Appendix B - Adit Information for the Old Hickory and Niagara Mines

List of Acronyms

BLM	Bureau of Land Management
CSM	CS Mining
ESD	Ecological Site Description
GPS	Global Positioning System

1.0 INTRODUCTION

CS Mining (CSM) is currently mining and processing copper ore near Milford, Utah. CSM is looking to expand operations over the course of several years with various developments in an area designated as the Milford Operations Area. The proposed expansions will occur on a mixture of Bureau of Land Management (BLM) administered and private land. These areas have been surveyed for special status species (Threatened, Endangered, Candidate, Proposed, and Sensitive) that might be impacted as a result of the proposed operations.

Surveys were completed during the spring, summer, and fall of 2014 following the "CS Mining, LLC, Milford Operations Area, 2014 Biological Survey Statement of Work." The survey effort started with an eagle survey performed by Stantec biologists (Surveyors) beginning February 18 and running through February 21, 2014. The survey was conducted to document eagles and eagle pairs throughout the survey area (5-mile buffer surrounding the Project Area) during peak eagle activity (courting and nest building). During the survey all known eagle nests were checked for recent (2014) sign of use, along with identifying and documenting new eagle nests. A general raptor survey was also conducted from March 26 to March 28, 2014. This survey focused on locating all nesting raptors within a 1-mile buffer of the Project Area, along with locating active eagle nests within the 5-mile buffer. Known nest locations, provided by the Cedar City BLM, were checked for 2014 activity along with surveyors searching for new nests. Utilizing AnaBats, spring and fall acoustical monitoring bat data was recorded at each of three mine shafts : Niagara (5/21/14 to 5/27/14 and 9/15/14 to 9/19/14), Old Hickory (5/27/14 to 5/30/14 and 9/15/14 to 9/19/14), and Sunrise (5/30/14 to 6/4/14 and 9/15/14 to 9/19/14). From May 26, 2014 to May 30, 2014 an eagle nest success, general raptor, and general biology survey was conducted. During this survey all active eagle and other raptor nests were checked for nest success/use. The general biological survey was conducted by focusing on higher quality habitat for sensitive species - along washes, around areas of topographic variation, and other patches of unique habitat in the Project Area boundary.

The survey area is located about 9 miles northwest of Milford and is accessible by Utah Highway 21 and a small, gravel, un-named county route (Figure 1). The project boundary covered portions of Sections 03-05, 07-10, and 12-29 Township 27 South, Range 11 West, Salt Lake Meridian. The northern part of the Rocky Range Mountains was also included in the survey area for raptors and golden eagles. The northern portion of the Star Range that was within a 5-mile buffer of the project boundary, as well as the southern portion of the Beaver Lake Mountains that was within a 5-mile buffer of the project boundary, were surveyed for the presence of golden eagles (Figure 2).

The survey area is located between 5,200 and 5,800 feet elevation above mean sea level in an area with flats dominated by big sagebrush (*Artemisia tridentata*) and the hills/mountains dominated by black sagebrush (*Artemisia nova*). Appendix A shows the typical landscape of the survey area.

1.1 SPECIAL STATUS SPECIES

Table 1 lists all special status animal species occurring in the Cedar City Field Office. Prior to conducting surveys, Stantec and the BLM identified 10 special status species that have a moderate to high probability of occurring within or adjacent to the Project Area: bald eagle, burrowing owl, ferruginous hawk, big free-tailed bat, fringed myotis, kit fox, pygmy rabbit, spotted bat, Townsend's big-eared bat, and Western red bat. Other species would not be found in the survey area due to lack of suitable habitat. Details about their habitat are listed in Table 1.

One special status plant species has recently been discovered near the Project Area; Frisco clover (*Trifolium friscanum*) a Federal candidate for listing, is known from a limited range in central Beaver and southwest Millard counties, Utah (i.e., San Francisco Mountains, Tunnel Spring Mountains, Blue Mountain and Beaver Lake Mountains). This plant has also been found near Lime Peak just northwest of the Project Area. Surveys for this plant were not conducted during 2014 biological surveys.

Table 1: Special Status Species Known or Potentially Occurring in the Milford Operations Area

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the Project Area	Status
FISH				
Bonneville cutthroat trout	*Oncorhynchus clarkii utah*	One of three subspecies of cutthroat native to Utah. It occurs in streams and lakes of the Bonneville Basin and a limited portion of the Virgin River Drainage (Bosworth 2003). In general, habitat is variable, ranging from high elevation streams with coniferous and deciduous riparian trees to low elevation streams in sage-steppe grasslands containing herbaceous riparian zones. Regardless of habitat, require a functional stream riparian zone that provides structure, cover, shade, and bank stability.	**None** - No suitable aquatic habitats within the Milford Operations Area.	BLM Sensitive, Conservation Agreement Species, Utah Species of Concern
Desert sucker	*Catostomus clarkii*	In Utah, the species occurs only in the Virgin River system in the southwestern corner of the state.	**None** - No suitable aquatic habitats within the Milford Operations Area.	BLM Sensitive, Utah Species of Concern

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the Project Area	Status
Southern leatherside chub	*Lepidomeda aliciae*	Endemic to streams in the southern and eastern Bonneville Basin. Require flowing water and do not persist in lakes or reservoirs. Occupied streams have a high variability of stream flow, annual precipitation, gradient, elevation, conductivity, and pH (Utah Division of Wildlife [UDWR] 2010).	**None** - No suitable aquatic habitats within the Milford Operations Area.	BLM Sensitive, Utah Species of Concern, Conservation Agreement Species
AMPHIBIANS				
Arizona toad	*Bufo microscaphus*	In Utah, found only in the southwestern portion of the state. This species inhabits streams, washes, irrigated crop lands, reservoirs, and uplands adjacent to water.	**None** - No suitable aquatic habitats within the Milford Operations Area.	SS
Western (boreal) toad	*Bufo boreas*	Primarily found in or near ponds, lakes, reservoirs, rivers, and streams within grasslands and mountain meadows (Stebbins 1985).	**None** - No suitable aquatic habitats within the Milford Operations Area.	CA
BIRDS				
American white pelican	*Pelecanus erythrorhynchus*	In Utah, the only known breeding colonies are located in the northern portions of Utah, Utah Lake and Great Salt Lake ecological complex. During spring migration, the breeding season, and fall staging and migration periods, can be observed at many reservoirs throughout the state.	**None** - No suitable aquatic habitats within the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
Bald eagle	*Haliaeetus leucocephalus*	Occur in Utah generally on a migratory or wintering basis, although a small population nests in Utah. Nests in tall trees and commonly near bodies of water where prey are available. Bald eagles will feed on fish, waterfowl, small mammal, and carrion. Will concentrate wherever food is available, roosting in large groups in forested stands that provide protection from weather. They may also winter in upland habitats, feeding on small mammals and deer carrion.	**Moderate** - No lakes or reservoirs occur within or near the Milford Operations Area. Potential foraging habitat.	BLM Sensitive, Utah Species of Concern

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the Project Area	Status
Black swift	*Cypseloides niger*	Use waterfalls for nesting; typically falls that are permanent but may be intermittent if they flow throughout the breeding season (June to early September). Nesting sites are typically coniferous forests, often mixed conifer or spruce-fir forests, but this varies depending on elevation and aspect. Nest sites may include mountain shrub, aspen, or even alpine components.	**None** - There are no waterfalls or bodies of water in or near the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
Burrowing owl	*Athene cunicularia*	Nests occur in shrub-dominated habitats, including sagebrush steppe and desert scrub, often in sparsely vegetated areas with a short grass herbaceous component (Bosworth 2003). Are obligate burrow nesters and may be largely dependent on prairie dog burrows in much of Utah, but also utilize burrows dug by badgers, ground squirrels, and other burrowing rodents.	**High** - Shrub dominated habitats present. Suitable burrows likely present. Known occurrences in the area.	BLM Sensitive, Utah Species of Concern
California condor	*Gymnogyps californianus*	Mountainous country especially rocky and brushy areas with cliffs; forage over large areas Species is concentrated in southern Utah, in the region of the Grand Canyon and Zion Canyon.	**Low** - Foraging habitat is present and birds have been documented in region. Milford Operations Area is about 70 miles from known condor roosting locations.	Federally Listed Endangered west of Interstate 15
Ferruginous hawk	*Buteo regalis*	Occupy grasslands, sagebrush, salt-desert, and other shrublands, and edges of pinyon-juniper woodlands; they may become locally abundant at shrubsteppe and pinyon-juniper ecotones. They may occur as breeding or year around populations in southwest Utah.	**High** - Suitable habitat present throughout most of the Milford Operations Area. Known occurrences in the area.	BLM Sensitive, Utah Species of Concern

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the Project Area	Status
Greater sage-grouse	*Centrocercus urophasianus*	Inhabit sagebrush plains, foothills, and mountain valleys. Sagebrush is the predominant plant of quality habitat. A good understory of grasses and forbs, and associated wet meadow areas, are essential for optimum habitat.	**None** - Milford Operations Area is located approximately 8.5 outside of UDWR mapped habitat.	Federal Candidate, BLM Sensitive
Lewis' woodpecker	*Melanerpes lewis*	Habitats are burned-over Douglas-fir, mixed conifer, pinyon-juniper, riparian, and oak woodlands, but is also the fringes of pine and juniper stands, and deciduous forests, especially riparian cottonwoods (ibid.). Areas with an under-story of grasses and shrubs to support insect prey populations are preferred. Dead trees and stumps are required for nesting.	**Low** - There are no deciduous forests located in or near the Milford Operations Area . May use Milford Operations Area during migration.	BLM Sensitive, Utah Species of Concern
Long-billed curlew	*Numenius americana*	Use expansive, open, level to gently sloping or rolling grasslands with short vegetation such as shortgrass or recently grazed mixed-grass prairie. They commonly nest in both wet and dry prairie and in pastures, but rarely nest in hayland, cropland, fallow, or stubble fields (Dechant et al. 2003).	**Low** - No known occurrences in the Milford Operations Area. The species has been documented as a breeder in region.	BLM Sensitive, Utah Species of Concern
Northern goshawk	*Accipiter gentiles*	Inhabit montane coniferous and deciduous woodland in the west, nesting in stands of intermediate to high canopy-closure with a thin understory, interspersed with small openings, fields, or wetlands. Important microhabitats in Utah include snags, multiple canopies, and down woody debris. In southern Utah, most often associated with mature to old growth stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), followed by aspen (*Populus tremuloides*; Graham et al. 1999).	**Low** - The Milford Operations Area provides forested habitats, but lacks multiple canopies and intermediate to high canopy-closure. No known occurrences.	BLM Sensitive, Conservation Agreement

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the Project Area	Status
Short-eared owl	*Asio flammeus*	Short-eared owls are ground nesters, generally in grasslands and tundra. Nesting habitat has been described in Utah as marshes; wet hummocks; agricultural croplands; arid grassland; sometimes cold desert shrub (including saltbush and greasewood), and sagebrush-rabbitbrush (Bosworth 2003).	**Low** - No known occurrences in the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
MAMMALS				
Big free-tailed bat	*Nyctinomops macrotis*	Prefers rocky and woodland habitats, where roosting occurs in caves, mines, old buildings, and rock crevices. In Utah the big free-tailed bat has been captured in the following habitats: lowland riparian, desert shrub, and montane forest (Oliver 2000).	**Moderate** - Woodland habitat present and known to occur in region.	BLM Sensitive, Utah Species of Concern
Dark kangaroo mouse	*Microdipodops megacephalus*	In Utah, the species occurs in the West Desert, typically in sagebrush areas with sandy soils.	**None** - Suitable, sandy soils not present in the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
Fringed myotis	*Myotis thysanodes*	Moderately wide range of habitats: lowland riparian, desert shrub, juniper–sagebrush, sagebrush–rabbitbrush, pinyon–juniper–sagebrush, pinyon–juniper, mountain meadow, ponderosa pine forest, and montane forest and woodland. Inhabits caves, mines, and buildings (Oliver 2000).	**Moderate** - Suitable habitat present in the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
Kit fox	*Vulpes macrotis*	Habitats include desert, grassland/herbaceous, playa/salt flat, savanna, shrubland; primarily in open desert, shrubby or shrub-grass habitat. In the Great Basin it is found in shadscale, greasewood, and sagebrush (NatureServe 2010).	**Moderate** - The Milford Operations Area contains sagebrush and open desert.	BLM Sensitive, Utah Species of Concern

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the Project Area	Status
Pygmy rabbit	*Brachylagus idahoensis*	Habitats are dominated by big sagebrush and on alluvial fans where sagebrush occurs in tall, dense clumps (Green and Flinders 1980). Burrows are usually located at the base of sagebrush plants. Diet consists primarily of big sagebrush species; however, grasses and forbs are utilized in the summer.	**Moderate** - The Milford Operations Area contains big sagebrush and soils suitable for creating burrows. No known occurrences.	BLM Sensitive, Utah Species of Concern
Spotted bat	*Euderma maculatum*	Inhabit a diversity of habitats: grass, desert, pinyon/juniper, sagebrush, and ponderosa up to high elevation coniferous forests, and also riparian and urban high-rise (cliff analog). Foraging occurs over sagebrush steppe, desert scrub, or montane meadow habitat. It is thought that spotted bats roost singly in steep cliff faces having cracks or crevices, but there is some indication that caves and mines may be used in winter (Altenbach et al. 2002).	**Moderate** - Roosting and foraging habitat present in the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
Townsend's big-eared bat	*Corynorhinus townsendii*	Dependent on deep caverns or mines for roost, maternity, and hibernation sites. Use variety of grassland/shrub and forested habitats, primarily pinyon-juniper-mahogany, white fir, blackbrush, sagebrush, salt desert scrub, and agricultural and urban habitats (Altenbach et al. 2002).	**High** - Adits and mine shafts present in the Milford Operations Area. Known occurrences in the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
Utah prairie dog	*Cynomys parvidens*	Burrowing mammals that require the presence of well-drained soils. Inhabit areas where vegetation can be maintained at a height level, which allows them to identify invading predators. Prefer areas where less than 10% of the vegetation is composed of tall plants greater than 12 inches (Collier 1975).	**None** - The Milford Operations Area is outside the known range and outside areas designated by US Fish and Wildlife Service (USFWS).	Federal Threatened
Western red bat	*Lasiurus blossevillii*	Found near water, often in wooded areas.	**High** - Suitable habitats and known occurrences in the Milford Operations Area.	BLM Sensitive, Utah Species of Concern

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the Project Area	Status
Plants				
Frisco buckwheat	*Eriogonum soredium*	Found only on soils derived from Ordovician limestone outcrops. These rare soils are home to other rare plant species including Ostler's pepperweed and Frisco clover. It is known from four populations in the San Francisco Mountains, Beaver County, Utah on sparsely populated slopes in pinion-juniper and sagebrush communities from 6,200 to 7,200 feet (Tilley 2012a). Flowers June – August.	**Low** - No known populations within the Milford Operations Area, but suitable habitat may be present.	Federal Candidate, Utah Rank G1
Ostler's pepperweed	*Lepidium ostleri*	Found only on soils derived from Ordovician limestone outcrops. These rare soils are home to other rare plant species including Frisco buckwheat and Frisco clover. It is known from four populations in the San Francisco Mountains, Beaver County, Utah on sparsely populated slopes in pinion-juniper and sagebrush communities from 6,200 to 7,200 feet. Flowering occurs from June to early July (Tilley 2012b).	**Low** - No known populations within the Milford Operations Area, but suitable habitat may be present.	Federal Candidate, Utah Rank G1
Frisco clover	*Trifolium friscanum*	Found only on soils derived from volcanic gravels, Ordovician limestone, and dolomite outcrops. These rare soils are home to other rare plant species including Frisco buckwheat and Ostler's pepperweed. Frisco clover is found on sparsely populated slopes in pinion-juniper and sagebrush communities from 5,600 to 8,400 feet elevation. Known to occur on the San Francisco Mountains, Beaver Lake Mountains, and Wah Wah Mountains in Beaver County, and on the Tunnel Springs Mountains in Millard County. Flowering occurs from late May to June (Tilley 2012c).	**Low** - Potential for habitat in northern portions of Beaver Mountains.	Federal Candidate, Utah Rank G1

2.0 FINDINGS

2.1 VEGETATION OR HABITAT SURVEY RESULTS

The survey area contains two main ecological communities and disturbed areas. These are the big sagebrush-dominated flats, black sagebrush-dominated hills/mountains, and disturbed land (roads, pits, and dumps; Figure 2).

The vegetation in the survey area is dominated by native plants common to the location, elevation, and underlying geology of the area. Cheatgrass (*Bromus tectorum*) was found in scattered patches throughout the Project Area. Table 2 contains a list of the plant species found and identified during the survey.

Table 2: Plant Species Noted during the Project Survey

Common Name	Scientific Name
Indian rice grass	*Achnatherum hymenoides*
Black sagebrush	*Artemisia nova*
Big sagebrush	*Artemisia tridentata*
Bud sage	*Picrothamnus desertorum*
Shadscale	*Atriplex confertifolia*
Fourwing salt brush	*Atriplex canescens*
Cheatgrass	*Bromus tectorum*
Mustard	*Chorispora* sp.
Yellow rabbitbrush	*Chrysothamnus viscidiflorus*
Squirrel tail	*Elymus elymoides*
Mormon tea	*Ephedra nevadensis*
Rabbit brush	*Ericameria nauseosa*
Oval-leaved buckwheat	*Eriogonum ovalifolium*
Hopsage	*Grayia spinosa*
Broom snakeweed	*Gutierrezia sarothrae*
Sticky snakeweed	*Gutierrezia microcephala*
Halogeton	*Halogeton glomeratus*
Marshelders	*Iva* sp.
Cactus	*Opuntia* sp.
Phlox	*Phlox* sp.
Bitter brush	*Purshia tridentata*
Tumbleweed	*Salsola tragus*
Globemallow	*Sphaeralcea coccinea*
Tamarisk	*Tamarix ramosissima*

Based on soils mapping, three NRCS Ecological Site Descriptions (ESDs) are represented in the survey area (NRCS 2003). These are:

- Semidesert Loam (Wyoming Big Sagebrush) (034XY212UT): Wyoming big sagebrush, Indian ricegrass.
- Semidesert Sandy Loam (Wyoming Big Sagebrush) (035XY216UT): Indian ricegrass, needleandthread, Wyoming big sagebrush, fourwing saltbrush.
- Semidesert Gravelly Loam (Wyoming Big Sagebrush) South (028AY214UT): Wyoming big sagebrush, Indian ricegrass.

These descriptions align with the communities identified in the survey area through data gathering.

Data was collected from walking meandering transects throughout the survey area.

2.2 GENERAL WILDLIFE FINDINGS

The following animals were observed within or directly adjacent to the survey area:

Table 3: Animals Observed During Survey

Common Name	Scientific Name
Black-tailed jackrabbit	*Lepus californicus*
Coachwhip	*Masticophis flagellum*
Common side-blotched lizard	*Uta stansburiana*
Desert cottontail	*Sylvilagus auduboni*
Desert horned lizard	*Phrynosoma platyrhinos*
Desert spiny lizard	*Sceloporus magister*
Gophersanke	*Pituophis catenifer*
Long-nosed leopard lizard	*Gambelia wislizenii*
Whiptail	*Aspidoscelis velox*
White-tailed antelope squirrel	*Ammospermophilus leucurus*

Two coyote (*Canis latrans*) dens were noted as active during a 2013 biological survey (JBR 2013), these dens were checked during the 2014 survey and found to be inactive.

2.2.1 Initial Golden Eagle Survey

On February 18 through 21, 2014 Surveyors completed a survey for golden eagles and their nests in the BLM-approved Golden Eagle Survey Area (Figure 2). The Surveyors looked at all golden eagle nesting habitat within the 5-mile buffer around the Project Area, but focused their efforts on the Eagle Survey Areas identified in conjunction with Becky Bonebrake (BLM Biologist). The Surveyors checked all known eagle nest locations along with searching for new nests. The Surveyors also searched for golden eagles and recorded all golden eagle sightings and behavior.

Weather throughout the four-day survey event was optimal for golden eagle activity; day time high temperatures were around 55 degrees and winds were generally calm to lightly breezy. During the survey, three previously unrecorded eagle nests were found. Of the nests visited, three showed signs of repair (e.g., green vegetation on the nest)

and one eagle, at the south end of the survey area, was incubating. A total of 15 individual golden eagle sightings were made. Of these sightings, three of the golden eagles had juvenile plumage and the rest were adults. Since it is impossible to determine which golden eagles were seen and recorded and which were repeats of golden eagles already seen and recorded, the Surveyors recorded all golden eagle sightings. Eagle observations included many behaviors such as soaring, courting, perching, chasing, nest building, defending, and incubating, indicating that golden eagles were still very much active and largely not incubating eggs during the survey event.

Photos were taken of all golden eagles and golden eagle nests checked. Data sheets were also filled out and all eagles and newly discovered nests were recorded using a global positioning system (GPS).

2.2.2 Raptor and Migratory Bird Findings

Sixty raptor nests were found/checked (Table 4) within the general raptor and golden eagle survey areas, which included the Rocky Range Mountains, the southern portion of the Beaver Lake Mountains, and the northern portion of the Star Range. Locations of the nests can be found on Figure 2. Numerous other nest locations provided by Cedar City BLM were also checked and found to no longer exist or were just bad data points. These nest locations were removed from the final nest data portrayed on Figure 2. Of the nests found/checked 10 were active. Four of the active nests were occupied by ravens, two active long eared owl nests were found which both fledged chicks, one ferruginous hawk nest (in a power structure next to the Marietta Mine crusher yard) was active and fledged chicks, and three were golden eagle nests.

Of three active golden eagle nests identified, two were successful and fledged chicks. Nest UT040002012 at the extreme north end of the survey area fledged two chicks. Nest UT040002020 at the extreme south end of the survey area fledged at least one chick and possibly two. Due to the nest location, extremely high on a rock face, and the depth of the nest, it was very difficult for Surveyors to achieve a vantage point to see into the nest. One nest UNK_012, near the center of the Survey Area, failed. Surveyors were able to get higher than the nest and utilizing a spotting scope see into the nest; there was no evidence of adult eagles or chicks in or near the nest. No deceased chicks were found in or under the nest, rather the nest was confirmed completely empty. The failed golden eagle nest was located very close to a common raven nest and during every previous visit to the nest ravens were observed harassing the nesting golden eagles.

Table 4: Summary of Raptor Nest Findings

Species Common Name	Species Code	WLRNEST_NO	2014Status	Nest Success
Common Raven	COCO	UNK_011	Active	Unknown
Golden Eagle	AQCH	UNK_012	Active	Fail
Undetermined Raptor	UNKN	1	Inactive	
Long-Eared Owl	ASOT	2	Active	Success
Undetermined Raptor	UNKN	3	Inactive	
Golden Eagle	AQCH	6	Inactive	
Golden Eagle	AQCH	UT040002013	Inactive	
Undetermined Raptor	UNKN	UT040002014	Inactive	
Golden Eagle	AQCH	UT040004183	Inactive	
Undetermined Raptor	UNKN	UT040004194	Inactive	
Common Raven	COCO	UT040004196	Inactive	
Common Raven	COCO	UT040004198	Inactive	
Common Raven	COCO	UT040004200	Active	Unknown
Ferruginous hawk	BURE	UT040004201	Active	Success
Ferruginous hawk	BURE	UT040000528	Inactive	
Golden Eagle	AQCH	UT040000668	Inactive	
Golden Eagle	AQCH	UT040000671	Inactive	
Undetermined Raptor	UNKN	UT040000672	Inactive	
Undetermined Raptor	UNKN	UT040000683	Inactive	
Golden Eagle	AQCH	UT040000690	Inactive	
Golden Eagle	AQCH	UT040000691	Inactive	
Golden Eagle	AQCH	UT040000692	Inactive	
American Kestrel	FASP	UT040000694	Inactive	
Golden Eagle	AQCH	UT040000695	Inactive	
Undetermined Raptor	UNKN	UT040000696	Inactive	
Golden Eagle	AQCH	UT040000798	Inactive	
Golden Eagle	AQCH	UT040000813	Inactive	
Golden Eagle	AQCH	UT040000816	Inactive	
Undetermined Raptor	UNKN	UT040002026	Inactive	
Undetermined Raptor	UNKN	UT040002027	Inactive	
Common Raven	COCO	UT040002028	Inactive	
Undetermined Raptor	UNKN	UT040002024	Inactive	
Common Raven	COCO	UT040002025	Inactive	
Ferruginous hawk	BURE	UT040002033	Inactive	
Long-Eared Owl	ASOT	UT040002029	Active	Success
Undetermined Raptor	UNKN	UT040002030	Inactive	
Undetermined Raptor	UNKN	UT040002031	Inactive	
Undetermined Raptor	UNKN	UT040002032	Inactive	
Golden Eagle	AQCH	UT040002012	Active	Success
Ferruginous hawk	BURE	UT040002005	Inactive	
Golden Eagle	AQCH	UT040002006	Inactive	
Undetermined Raptor	UNKN	UT040002007	Inactive	
Golden Eagle	AQCH	UT040002008	Inactive	
Golden Eagle	AQCH	UT040002011	Inactive	
Golden Eagle	AQCH	UT040002009	Inactive	

Species Common Name	Species Code	WLRNEST_NO	2014Status	Nest Success
Undetermined Raptor	UNKN	UT040002010	Inactive	
Golden Eagle	AQCH	UT040002022	Inactive	
Common Raven	COCO	UT040002021	Inactive	
Golden Eagle	AQCH	UT040002013	Inactive	
Golden Eagle	AQCH	UT040002014	Inactive	
Golden Eagle	AQCH	UT040002016	Inactive	
Golden Eagle	AQCH	UT040002015	Inactive	
Golden Eagle	AQCH	UT040002018	Inactive	
Golden Eagle	AQCH	UT040002020	Active	Success
Undetermined Raptor	UNKN	UT040002004	Inactive	
Undetermined Raptor	UNKN	UT040002017	Inactive	
Undetermined Raptor	UNKN	UT040002019	Inactive	
Prairie Falcon	FAME	UT040002023	Inactive	
Common Raven	COCO	UT040002025	Active	Unknown
Common Raven	COCO	UT040002034	Active	Unknown

Several raptor individuals (unassociated with nests) were seen during the general raptor survey event; two ferruginous hawks were seen courting and copulating near the edge of the 1-mile buffer survey area boundary but no nest was located in or near the survey area. Several American kestrels were also noted flying through the survey area but none were found to be nesting within the survey area. A complete list of birds noted during the survey is located in Table 5.

Table 5: Birds Observed During the Survey

Common Name	Scientific Name
American kestrel	*Falco sparverius*
Bald eagle	*Haliaeetus leucocephalus*
Black-throated sparrow	*Amphispiza bilineata*
Brewer's sparrow	*Spizella breweri*
Brown-headed cowbird	*Molothrus ater*
Chukar	*Alectoris chukar*
Common raven	*Corvus corax*
Ferruginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Horned lark	*Eremophila alpestris*
Lesser nighthawk	*Chordeiles acutipennis*
Loggerhead shrike	*Lanius ludovicianus*
Long-eared owl	*Asio otus*
Northern flicker	*Colaptes auratus*
Pinyon jay	*Gymnorhinus cyanocephalus*
Prairie falcon	*Falco mexicanus*
Rock wren	*Salpinctes obsoletus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Turkey vulture	*Cathartes aura*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*

2.2.3 AnaBat Findings

There were four locations noted in or near the Project Area that may contain bats. These locations were the old Sunrise adit, the Montreal adit, the Old Hickory 100 Level adit, and the Niagara adit. Once on site, it was noted that the Montreal adit had been covered, and no sign of activity was present. For the other three locations, Surveyors used an AnaBat Detector to passively survey for bat species (Figure 3). The AnaBat was placed in or near the adit entrances and was allowed to collect data for a period of 12+ continual hours. AnaBats were set out in the spring and again in the fall. Due to the requirement of escorts on active mining sites, Surveyors did not stay at the adit locations after dropping off the AnaBats.

The Sunrise adit consists of one main tunnel, which extends for 225 feet, and one small upper tunnel that extends for approximately 50 feet. The AnaBat was placed near the Sunrise adit opening around noon on May 30, 2014, and ran continually until approximately 9:00 AM on June 4, 2014 (spring); then was put out again on September 15, 2014 and ran until September 19, 2014 (fall), the AnaBat was thus recording during the most active bat period of one hour before sunset to one hour after sunrise. A total of 952 bat calls over 6 species were recorded during the spring monitoring period (Table 6) and 1,160 calls over 7 species were recorded for the fall period (Table 7). All calls recorded for this report were analyzed by a qualified individual, Trever Peterson, senior wildlife biologist.

The Old Hickory mine consists of a shaft 300-feet deep, an adit which cuts the orebody 100-feet downhill of the shaft entrance, and four sublevels (Whelan 1982, Appendix B). Around noon on May 27, 2014, the AnaBat was moved to the Old Hickory 100-foot level adit where it ran continually until approximately 9:00 AM on May 30, 2014 (spring); then the AnaBat was redeployed from September 15 to September 19, 2014 (fall), recording during the most active bat period of one hour before sunset to one hour after sunrise. A total of 116 calls were recorded over 7 species during the spring survey (Table 6). The fall survey produced 451 calls over 10 species (Table 7).

The Niagara adit is a northwest trending adit that continues into the mountainside for approximately 1,230 feet, where the adit has been pack-walled off (Appendix B). Around noon on May 20, 2014, an AnaBat was placed at the Niagara adit, where it ran nights until approximately 9:00 AM on May 27, 2014 (spring); it was also placed out on September 15 and ran nights until September 19, 2014 (fall), the AnaBat was thus recording during the most active bat period of one hour before sunset to one hour after sunrise. A total of 211 bat calls were recorded over 11 species during the spring survey (Table 6) and 411 calls over 6 species during the fall survey (Table 7).

Table 6: Bat Recordings Spring 2014

Frequency	Species/Category	Species Code	Niagara	Old Hickory	Sunrise
High	*Myotis* species (~40 kHz)	MYSP*	11	30	7
High	canyon bat	PAHE	17	4	4
High	western red bat	LABL	0	0	0
High	high-frequency unknown	HFUN	19	26	6
Medium	pallid bat	ANPA	7	5	0
Medium	Townsend's big-eared bat	COTO	0	0	0
Medium	long-eared Myotis	MYEV	1	0	0
Medium	fringed Myotis	MYTH	2	0	0
Medium	mid-frequency unknown	MDUN	5	2	1
Low	big brown bat	EPFU	1	0	0
Low	Mexican free-tailed bat	TABR	12	2	368
Low	silver-haired bat	LANO	0	0	0
Low	hoary bat	LACI	0	0	0
Low	big brown/free-tailed	EPFU/TABR	30	21	190
Low	silver-haired/free-tailed	LANO/TABR	4	4	20
Low	big brown/free-tailed/ silver-haired	EPFU/LANO/TABR	12	2	137
Low	hoary/free-tailed	LACI/TABR	8	0	4
Low	low-frequency unknown	LFUN	82	20	215
Extra Low	spotted bat	EUMA	-	-	-
Extra Low	western mastiff bat	EUPA	-	-	-
Total			**211**	**116**	**952**
Total Files			498	134	965

*MYSP includes several *Myotis* species whose calls are in the ~40 kHz range, including Yuma myotis, little brown bat, California myotis, western small-footed bat, and long-legged bat.

Table 7: Bat Recordings Fall 2014

Frequency	Species/Category	Code	Niagara	Old Hickory	Sunrise
High	*Myotis* species (~40 kHz)	MYSP*	167	38	22
High	canyon bat	PAHE	4	5	2
High	western red bat	LABL	0	0	0
High	high-frequency unknown	HFUN	176	54	15
Medium	pallid bat	ANPA	0	9	0
Medium	Townsend's big-eared bat	COTO	9	49	0
Medium	long-eared myotis	MYEV	3	0	0
Medium	fringed Myotis	MYTH	0	0	0
Medium	mid-frequency unknown	MDUN	0	80	3
Low	big brown bat	EPFU	1	0	0
Low	Mexican free-tailed bat	TABR	0	12	61
Low	silver-haired bat	LANO	0	0	0
Low	hoary bat	LACI	0	1	0
Low	big brown/free-tailed	EPFU/TABR	5	70	162
Low	silver-haired/free-tailed	LANO/TABR	0	27	31
Low	big brown/free-tailed/ silver-haired	EPFU/LANO/TABR	0	11	97
Low	hoary/free-tailed	LACI/TABR	0	3	42
Low	low-frequency unknown	LFUN	46	92	725
Extra Low	spotted bat	EUMA	-	-	-
Extra Low	western mastiff bat	EUPA	-	-	-
Total			**411**	**451**	**1,160**
Total Files			541	534	1,206

*MYSP includes several *Myotis* species whose calls are in the ~40 kHz range, including Yuma myotis, little brown bat, California myotis, western small-footed bat, and long-legged bat.

Each file was visually inspected using AnalookW 3.8s (© 2011, Chris Corben) for species identification. Bat call sequences were individually viewed and categorized by species or species category based on comparison to reference calls. Relatively accurate identification of bat species can be attained by visually comparing recorded call sequences of sufficient length to bat call reference libraries (O'Farrell et al. 1999; O'Farrell and Gannon 1999). Call sequences were classified to species whenever possible, based on criteria developed from review of reference calls collected by Chris Corben, the developer of the Anabat system, as well as other bat researchers. Call

sequences were assigned either to species or into categories of species with similar call structures. Call sequences with fewer than 5 pulses were categorized as one of three "unknown" categories based on minimum frequency (high, medium, or unknown). For these three sites in Utah, free-tailed bats have highly variable call structures and can resemble calls of hoary bats, silver-haired bats, and big brown bats. As such, several categories were established for calls that could be identified as either free-tailed bats or silver-haired, big brown, hoary, or a combination of these species. Other species, such as the Townsend's big-eared bats, and fringed Myotis produce very quiet echolocation calls which are often not rendered in great detail in acoustic recordings. However, particular effort was made to categorize calls of these species, even in cases with marginal or poor call quality, due to the conservation status of these species in Utah.

Of the bat species detected, only the Townsend's big-eared bat and the fringed myotis are considered special status species (sensitive). The Townsend's big-eared bat was detected on the recordings at both the Niagara and Old Hickory adits only during the fall acoustical monitoring while the fringed myotis was only detected at the Niagara adit, during the spring acoustical monitoring. Fringed Myotis are present based on only two call sequences identified to this species. It is possible these two sequences are a different species, but we wanted to err on the side of the species and include them based on their conservation status.

2.2.4 Sensitive Species Biology Survey

Surveyors looked at suitable or otherwise unique habitats within the Project Area for the occurrence of sensitive species. Biologists walked meandering transects through areas of varying topography, vegetation changes, rock outcrops, and along washes or where terrain otherwise allowed for unique habitats. No sensitive species or their sign were found during the survey event.

2.2.5 Noxious Species

In conjunction with the general biology and other surveys, surveyors looked for the presence of any Utah listed noxious species in the survey area. The only noxious species observed was tamarisk (Class C). However, as noted in Table 2, several weedy species including cheatgrass, halogeton, and tumbleweed are also present.

2.2.6 Wetlands and Waters of the US

No wetlands or waters of the US were found to occur within the Project Area.

3.0 REFERENCES:

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APPENDIX A: Photos



Nest number UT040002020, successful golden eagle nest.



Nest number UT040002012, successful golden eagle nest with 2 chicks pictured.



Nest number UNK_012, un-successful golden eagle nest.



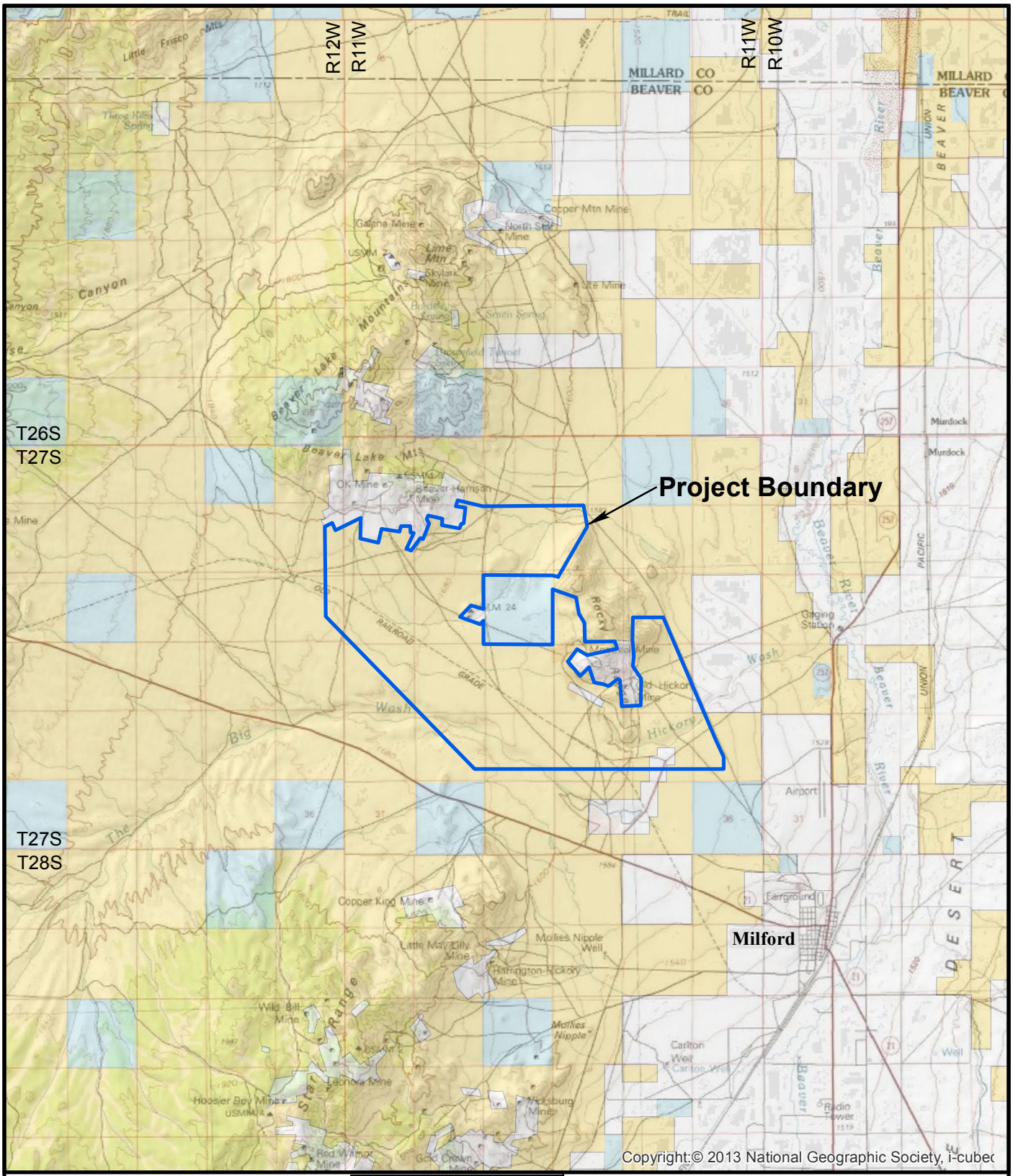
Nest number UT0400004201, successful ferruginous hawk nest.



Nest number 2, successful long eared owl nest with a portion of an owl visible.



Nest number UT040002029, successful long eared owl.



Legend

Project Area

Land Ownership

Federal

Private

State

2 1 0 2 Miles

N

Project Location

CS MINING
MILFORD OPERATIONS AREA

FIGURE 1
PROJECT LOCATION AND LAND STATUS

Stantec

DRAWN BY	CP
DATE DRAWN	10/30/2014
SCALE	1 in = 2 miles
PROJECT	B.A13061.00 - BIO

Path: X:\UT\Clients\CS_Mining\MilfordOperationsAreaProject_BA1405400\MXDs\WorkingMXDs\Biology2014_Report_MXDs\Figure 1 Project Location and Land Status.mxd

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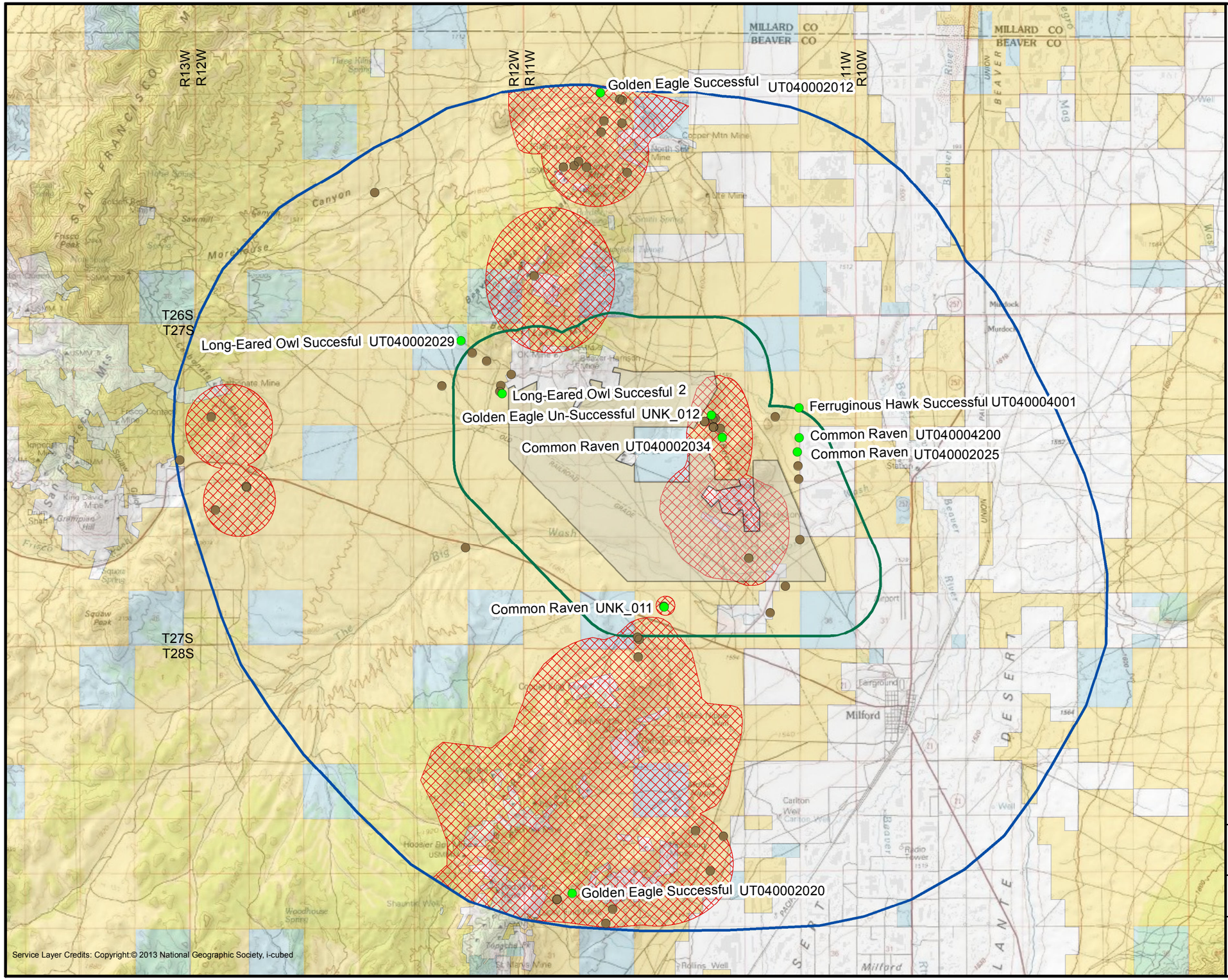
JBR makes no guarantees to the accuracy of the data contained herein or any loss resulting therefrom.



Legend

2014Status

- Active
- Inactive
- Project Area
- General Raptor - Project Area 1.0-Mile Buffer
- Golden Eagle - Project Area 5.0-Mile Buffer
- Golden Eagle Survey Area
- Federal
- Private
- State

N

1.5 0.75 0 1.5 Miles

CS MINING
MILFORD OPERATIONS AREA

FIGURE 2
RAPTOR SURVEY AREA AND NEST LOCATIONS

Stantec

DRAWN BY	CP
DATE DRAWN	10/30/2014
SCALE	1 in = 1.8 miles
PROJECT	B.A13061.00 - BIO

Path: X:\UT\Clients\CS_Mining\MilfordOperationsAreaProject_BA1405400\MXDs\WorkingMXDs\Biology2014_Report_MXDs\Figure 2 Golden Eagle\GeneralRaptor_ Survey AreaAndResults.mxd

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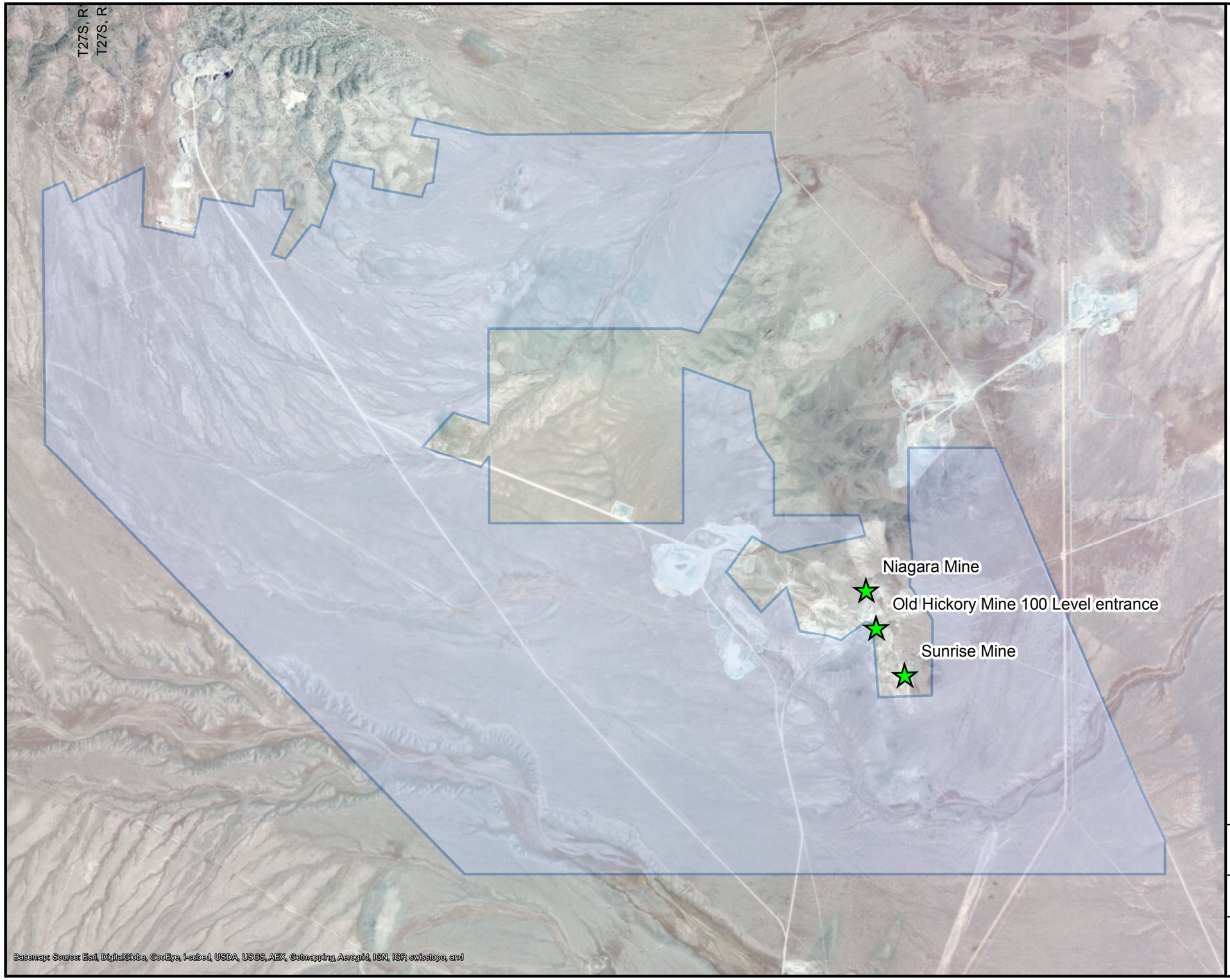

Legend

- Anabat Locations
- Project Area

N

2,500 1,250 0 2,500

Feet

CS MINING
MILFORD OPERATIONS AREA

FIGURE 3
BAT SURVEY AREA

Stantec

DRAWN BY	CP
DATE DRAWN	10/30/2014
SCALE	1 in = 2,640 feet
PROJECT	B.A13061.00 - BIO

Path: X:\UT\Clients\CS_Mining\MilfordOperationsAreaProject_BA1405400\MXDs\WorkingMXDs\Biology2014_Report_MXDs\Figure 3 Anabat_Locations.mxd

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APPENDIX H

Soils

USU ANALYTICAL LABORATORIES

Soil Test Report
and
Fertilizer Recommendation

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)
www.usual.usu.edu

Date Received: 10/20/2014
Date Completed: 11/3/2014

PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2268
Identification: 1 SUNRISE ALLUVIAL
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		7.8	Normal	
Salinity - ECe	dS/m	5.62		
Phosphorus - P	mg/kg	7.2		
Potassium - K	mg/kg	182		
Nitrate-Nitrogen - N	mg/kg	17.7		
Zinc - Zn	mg/kg	0.17		
Iron - Fe	mg/kg	1.97	Very Low	
Copper - Cu	mg/kg	2.83	Adequate	
Manganese - Mn	mg/kg	2.40	Adequate	
Sulfate-Sulfur - S	mg/kg	84.2	Adequate	
Organic Matter	%	<1.0		
SAR				

Notes
FOR INTERPRETATIONS / RECOMMENDATIONS, PLEASE CONTACT THE LAB WITH INFORMATION ON WHAT YOU WILL BE GROWING (NOT INDICATED ON INFORMATION SHEET RECEIVED), OR CONSULT TABLES IN "UNDERSTANDING YOUR SOIL TEST RESULTS" (FOUND ON OUR WEBSITE "AFTER RESULTS")

For further assistance, please see your County Agent -- Mark Nelson - 438-6451
For further information and publications of interest, see the
USU Analytical Lab webpage or Utah State University Extension

Methods Used by USUAL: pH + EC (salinity) + SAR by saturated paste; P + K by Olsen sodium bicarbonate extract – K by AA, P by ascorbic acid/molybdate blue colorimetric; NO3-N by CaOH extract + cadmium reduction; Zn, Fe, Cu, Mn by DTPA + ICP; SO4-S by CaHPO4 + ICP; OM by Walkley-Black
Results only reflect the sample received and may not be indicative of actual field conditions.

11/3

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www.usual.usu.edu

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Date Completed: 11/3/2014

PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2269
Identification: 2 ALLUVIAL UNDER HT TOP
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		8.0	Normal	
Salinity - ECe	dS/m	1.48		
Phosphorus - P	mg/kg	5.8		
Potassium - K	mg/kg	139		
Nitrate-Nitrogen - N	mg/kg	2.45		
Zinc - Zn	mg/kg	0.10		
Iron - Fe	mg/kg	1.22	Very Low	
Copper - Cu	mg/kg	1.44	Adequate	
Manganese - Mn	mg/kg	1.56	Adequate	
Sulfate-Sulfur - S	mg/kg	63.7	Adequate	
Organic Matter	%	<1.0		
SAR				

Notes
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Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2270
Identification: 3 MARIA ALLUVIUM
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		8.7	Very High	
Salinity - ECe	dS/m	1.25		
Phosphorus - P	mg/kg	6.3		
Potassium - K	mg/kg	179		
Nitrate-Nitrogen - N	mg/kg	2.03		
Zinc - Zn	mg/kg	0.15		
Iron - Fe	mg/kg	1.71	Very Low	
Copper - Cu	mg/kg	7.20	Adequate	
Manganese - Mn	mg/kg	1.13	Adequate	
Sulfate-Sulfur - S	mg/kg	21.1	Adequate	
Organic Matter	%	<1.0		
SAR				

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Date Completed: 11/3/2014

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Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2271
Identification: 4 HIDDEN TREASURE TOP
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		7.6	Normal	
Salinity - ECe	dS/m	3.80		
Phosphorus - P	mg/kg	11.3		
Potassium - K	mg/kg	268		
Nitrate-Nitrogen - N	mg/kg	9.88		
Zinc - Zn	mg/kg	0.44		
Iron - Fe	mg/kg	1.65	Very Low	
Copper - Cu	mg/kg	11.3	Adequate	
Manganese - Mn	mg/kg	5.36	Adequate	
Sulfate-Sulfur - S	mg/kg	34.2	Adequate	
Organic Matter	%	1.4		
SAR				

Notes
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Date Completed: 11/3/2014

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Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2272
Identification: 5 "PRE-ACT" SOIL STOCKPI
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Loamy Sand		
pH		8.2	Normal	
Salinity - ECe	dS/m	1.27		
Phosphorus - P	mg/kg	12.0		
Potassium - K	mg/kg	532		
Nitrate-Nitrogen - N	mg/kg	15.7		
Zinc - Zn	mg/kg	0.23		
Iron - Fe	mg/kg	1.37	Very Low	
Copper - Cu	mg/kg	7.22	Adequate	
Manganese - Mn	mg/kg	2.54	Adequate	
Sulfate-Sulfur - S	mg/kg	6.2	Low	
Organic Matter	%	<1.0		
SAR				

Notes

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Methods Used by USUAL: pH + EC (salinity) + SAR by saturated paste; P + K by Olsen sodium bicarbonate extract – K by AA, P by ascorbic acid/molybdate blue colorimetric; NO3-N by CaOH extract + cadmium reduction; Zn, Fe, Cu, Mn by DTPA + ICP; SO4-S by CaHPO4 + ICP; OM by Walkley-Black
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Date Received: 10/20/2014
Date Completed: 11/3/2014

PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2273
Identification: HIDDEN TREASURE ALLUVI
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Loamy Sand		
pH		7.7	Normal	
Salinity - ECe	dS/m	5.34		
Phosphorus - P	mg/kg	5.5		
Potassium - K	mg/kg	99.3		
Nitrate-Nitrogen - N	mg/kg	3.97		
Zinc - Zn	mg/kg	0.11		
Iron - Fe	mg/kg	1.68	Very Low	
Copper - Cu	mg/kg	1.55	Adequate	
Manganese - Mn	mg/kg	2.29	Adequate	
Sulfate-Sulfur - S	mg/kg	6.2	Low	
Organic Matter	%	<1.0		
SAR				

Notes

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Results only reflect the sample received and may not be indicative of actual field conditions

UtahStateUniversity
USU ANALYTICAL LABORATORIES

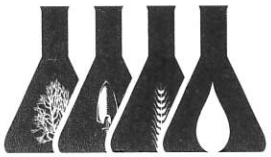
Physical Address: 1541 North 800 East, North Logan
Mailing Address: 9400 Old Main Hill, Logan, UT 84322 – 9400
Phone: (435) 797– 2217 • Fax: (435) 797 – 2117
Web: usual.usu.edu

10/5/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg					%
2320	SR_soil	1	1	Sandy Loam	8.1	0.72	7.5	478	1.94	0.37	2.78	5.58	4.20	3.3	1.1
2321	SR_soil	1	2	Sandy Clay Loam	8.0	3.06	5.1	425	1.46	0.20	2.82	2.59	4.55	11.1	<1.0
2322	SR_soil	2	1	Sandy Loam	7.7	0.37	5.1	190	1.39	0.33	2.50	2.84	3.18	2.0	1.0
2323	SR_soil	2	2	Sandy Clay Loam	7.7	0.32	2.2	176	1.25	0.15	2.61	1.82	3.49	1.0	<1.0
2324	SR_soil	2	3	Sandy Clay Loam	7.6	0.31	2.5	173	0.77	0.12	2.51	1.47	3.95	1.0	<1.0
2325	SR_soil	3	1	Sandy Loam	7.4	0.30	5.5	252	1.05	0.48	3.39	5.26	4.50	0.8	1.0
2326	SR_soil	3	2	Sandy Loam	7.7	0.33	3.0	251	0.71	0.19	2.90	2.03	4.16	1.1	<1.0
2327	SR_soil	3	3	Sandy Clay Loam	7.7	0.36	2.8	203	0.74	0.22	2.86	2.62	4.52	1.3	<1.0
2328	SR_soil	4	1	Sandy Loam	8.0	0.52	6.7	456	1.58	0.29	2.61	3.78	3.65	2.9	1.3
2329	SR_soil	4	2	Sandy Clay Loam	8.1	1.86	3.0	305	1.06	0.15	2.80	1.48	4.24	3.9	<1.0
2330	SR_soil	5	1	Sandy Loam	7.6	0.39	6.9	377	1.26	0.57	3.34	9.32	4.78	1.2	1.0
2331	SR_soil	5	2	Sandy Clay Loam	7.8	0.56	3.7	378	0.75	0.35	3.39	5.58	4.47	1.3	<1.0
2332	SR_soil	5	3	Sandy Clay Loam	7.9	1.21	3.8	317	1.71	0.43	3.59	6.77	4.98	2.3	<1.0
2333	SR_soil	6	1	Sandy Loam	7.8	0.37	4.5	281	1.34	0.37	3.14	3.96	4.04	1.7	<1.0
2334	SR_soil	6	2	Sandy Clay Loam	7.8	0.37	3.0	293	0.81	0.17	3.33	1.76	3.46	1.9	<1.0
2335	SR_soil	7	1	Sandy Loam	8.0	0.45	6.6	316	1.32	0.56	2.75	8.09	3.20	1.9	1.0
2336	SR_soil	7	2	Sandy Clay Loam	8.1	1.01	4.8	287	0.73	0.34	3.32	4.80	4.70	2.1	<1.0
2337	SR_soil	8	1	Sandy Clay Loam	7.8	0.38	7.0	327	1.13	0.48	2.55	8.49	3.37	2.4	1.2
2338	SR_soil	8	2	Sandy Clay Loam	7.8	0.38	3.1	346	0.85	0.15	2.65	2.62	4.27	2.4	1.0
2339	SR_soil	8	3	Sandy Clay Loam	7.6	0.41	4.2	315	0.78	0.16	2.50	2.21	3.62	5.4	<1.0
2340	SR_soil	9	1	Sandy Loam	7.9	0.48	5.5	410	0.79	0.43	2.67	6.05	4.51	2.7	1.3
2341	SR_soil	9	2	Sandy Clay Loam	8.1	0.70	2.4	370	0.73	0.20	2.98	2.42	3.71	1.9	<1.0
2342	SR_soil	10	1	Sandy Loam	7.9	0.45	12.4	250	2.10	1.00	2.68	16.9	4.35	2.9	1.4
2343	SR_soil	10	2	Loam	7.8	0.43	5.1	303	1.08	0.24	2.51	2.93	3.87	1.8	<1.0
2344	SR_soil	10	3	Sandy Clay Loam	7.8	0.39	7.2	346	1.32	0.33	2.93	6.04	4.73	1.8	<1.0
2345	SR_soil	11	1	Sandy Clay Loam	7.7	0.41	4.9	132	0.75	0.31	3.09	3.79	3.42	2.3	1.0
2346	SR_soil	11	2	Sandy Clay Loam	7.7	0.35	2.5	125	0.76	0.16	2.98	1.64	4.51	1.6	1.0
2347	SR_soil	11	3	Sandy Clay Loam	7.7	0.42	1.8	122	0.73	0.15	3.48	1.86	4.80	1.8	1.0
2348	SR_soil	11	4	Sandy Clay Loam	7.8	0.33	1.1	107	0.60	0.13	3.75	2.44	4.70	2.5	<1.0
2349	SR_soil	12	1	Sandy Clay Loam	7.8	0.43	6.3	180	1.19	0.42	2.96	5.38	4.04	1.9	1.2
2350	SR_soil	12	2	Sandy Clay Loam	7.7	0.41	3.0	171	0.80	0.25	3.02	3.04	4.78	1.9	1.0
2351	SR_soil	12	3	Sandy Clay Loam	7.7	0.44	2.7	194	1.05	0.17	3.21	2.75	4.07	2.3	<1.0
2352	SR_soil	12	4	Sandy Clay Loam	7.8	0.40	1.5	148	1.38	0.17	3.60	2.52	4.07	2.2	<1.0



Plant Analysis Lab
Soil Testing Lab
Feed Anaysis Lab
Irrigation Water Analysis Lab
Manure Analysis Lab

UtahStateUniversity
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9/24/2015

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Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg				mg/kg	%
2208	HT_soil	1	1	Sandy Loam	8.1	0.32	9.5	292	1.32	0.13	2.19	0.83	2.60	1.6	1.2
2209	HT_soil	1	2	Sandy Loam	8.0	0.33	5.8	342	1.36	0.14	2.20	0.71	3.54	1.7	1.2
2210	HT_soil	1	3	Sandy Loam	8.1	0.41	2.9	310	0.94	0.44	1.65	0.48	3.63	2.5	1.0
2211	HT_soil	2	1	Sandy Clay Loam	7.4	0.25	12.0	225	0.75	0.22	4.04	1.31	4.09	1.1	<1.0
2212	HT_soil	2	2	Sandy Clay Loam	7.6	0.25	5.8	139	0.54	0.19	3.95	1.39	5.16	1.2	<1.0
2213	HT_soil	2	3	Sandy Clay Loam	7.9	0.28	3.2	108	0.54	0.13	3.59	1.07	3.54	1.3	<1.0
2214	HT_soil	2	4	Sandy Clay Loam	8.0	0.69	2.7	83.0	0.51	0.07	3.34	0.73	4.33	1.5	<1.0
2215	HT_soil	3	1	Sandy Loam	8.1	0.24	6.3	225	0.64	0.12	2.10	0.67	1.96	1.2	1.0
2216	HT_soil	3	2	Sandy Loam	8.1	0.26	3.5	175	0.92	0.12	2.43	0.77	2.98	1.3	1.0
2217	HT_soil	3	3	Sandy Loam	8.1	0.25	1.7	60.8	0.52	0.08	2.37	0.54	3.98	1.7	<1.0
2218	HT_soil	3	4	Sandy Loam	8.2	0.33	1.1	71.0	0.67	0.04	2.45	0.40	3.60	1.6	<1.0
2219	HT_soil	3	5	Sandy Loam	8.3	0.73	0.9	63.6	<0.5	0.04	2.60	0.41	3.20	1.9	<1.0
2220	HT_soil	3	6	Sandy Clay Loam	8.2	1.51	2.1	89.7	<0.5	0.06	2.48	0.47	2.96	1.6	<1.0
2221	HT_soil	4	1	Sandy Loam	8.0	0.27	6.5	275	<0.5	0.13	2.30	0.84	2.86	1.5	1.0
2222	HT_soil	4	2	Sandy Loam	8.1	0.25	4.4	226	<0.5	0.09	1.98	0.70	3.22	1.4	<1.0
2223	HT_soil	4	3	Sandy Loam	8.0	0.24	2.1	184	<0.5	0.06	1.98	0.53	3.26	1.4	<1.0
2224	HT_soil	4	4	Sandy Loam	8.0	0.25	1.4	179	<0.5	0.05	1.78	0.43	3.02	1.5	<1.0
2225	HT_soil	4	5	Loamy Sand	8.0	0.28	1.3	205	<0.5	0.07	1.63	0.42	3.35	1.7	<1.0
2226	HT_soil	5	1	Sandy Loam	7.8	0.26	8.5	293	<0.5	0.19	3.29	0.98	4.11	1.6	<1.0
2227	HT_soil	5	2	Sandy Loam	7.8	0.32	6.5	246	1.00	0.16	3.14	0.99	3.79	1.7	1.0
2228	HT_soil	5	3	Sandy Loam	7.9	0.34	2.4	149	0.67	0.08	2.06	0.62	3.96	1.5	1.0
2229	HT_soil	5	4	Sandy Loam	7.9	0.32	1.6	153	<0.5	0.05	2.14	0.54	2.90	1.5	<1.0
2230	HT_soil	5	5	Sandy Clay Loam	8.0	0.40	1.4	186	<0.5	0.04	1.99	0.51	3.25	1.5	1.0
2231	HT_soil	5	6	Sandy Clay Loam	8.2	0.43	1.3	217	0.92	0.04	2.03	0.54	2.59	1.4	<1.0
2232	HT_soil	5	7	Sandy Clay Loam	8.4	0.55	1.7	234	<0.5	0.04	2.00	0.53	3.00	1.6	1.0
2233	HT_soil	5	8	Sandy Clay Loam	8.6	0.63	2.1	223	0.58	0.04	2.02	0.54	2.88	2.0	<1.0
2234	HT_soil	5	9	Sandy Clay Loam	8.6	0.92	2.7	245	0.55	0.05	2.16	0.59	2.69	2.7	<1.0
2235	HT_soil	6	1	Sandy Loam	8.1	1.21	5.4	254	0.56	0.12	2.94	0.71	3.61	2.8	1.4
2236	HT_soil	6	2	Sandy Clay Loam	8.0	3.55	4.9	171	0.74	0.11	5.49	0.84	3.04	6.5	1.1
2237	HT_soil	6	3	Sandy Clay Loam	7.8	6.64	4.3	112	0.54	0.15	4.92	0.72	2.62	15.6	1.0
2238	HT_soil	6	4	Sandy Clay Loam	7.8	8.92	6.0	117	<0.5	0.13	5.12	0.85	3.46	37.2	1.2
2239	HT_soil	6	5	Sandy Clay Loam	7.8	10.4	7.6	149	<0.5	0.16	3.61	0.83	4.21	53.0	1.2
2240	HT_soil	7	1	Sandy Clay Loam	7.4	0.28	11.1	374	0.87	0.25	4.90	1.20	5.33	1.4	1.0
2241	HT_soil	7	2	Sandy Clay Loam	7.5	0.33	7.7	305	0.80	0.21	4.95	1.20	5.81	1.4	<1.0
2242	HT_soil	7	3	Sandy Clay Loam	7.8	0.35	5.3	188	0.50	0.11	3.79	0.82	4.10	1.5	1.2
2243	HT_soil	7	4	Sandy Clay Loam	7.8	0.85	2.7	106	<0.5	0.06	2.97	0.55	5.43	2.0	<1.0
2244	HT_soil	8	1	Sandy Clay Loam	7.7	0.34	6.9	187	1.08	0.21	3.62	0.97	3.88	1.8	1.1
2245	HT_soil	8	2	Clay Loam	7.6	0.35	4.4	103	0.52	0.12	3.29	0.82	4.99	2.2	1.6
2246	HT_soil	8	3	Clay Loam	7.5	0.43	4.7	66.5	<0.5	0.11	2.41	0.53	5.42	2.6	1.6
2247	HT_soil	9	1	Clay Loam	8.0	0.36	14.6	409	0.55	0.28	2.52	0.87	3.45	1.7	1.3
2248	HT_soil	9	2	Sandy Clay	7.8	0.36	6.1	309	0.55	0.16	2.39	0.86	2.95	2.0	1.2
2249	HT_soil	9	3	Loamy Sand	7.9	0.35	8.8	224	<0.5	0.14	3.07	0.65	2.93	2.4	<1.0
2250	HT_soil	9	4	Sand	8.0	0.31	6.7	175	1.05	0.12	2.09	0.42	1.68	2.3	<1.0
2251	HT_soil	9	5	Sand	8.0	0.31	5.8	148	1.53	0.11	2.22	0.43	1.84	2.8	<1.0
2252	HT_soil	9	6	Sand	8.0	0.31	5.5	147	1.35	0.12	2.15	0.38	1.90	2.9	<1.0
2253	HT_soil	10	1	Loamy Sand	7.7	0.33	6.0	204	0.56	0.18	3.42	0.76	4.12	1.8	1.1
2254	HT_soil	10	2	Sandy Loam	7.8	0.50	5.0	247	0.84	0.13	3.22	0.74	5.29	1.8	1.2
2255	HT_soil	10	3	Clay Loam	8.1	1.40	3.6	259	0.56	0.10	2.68	0.62	6.57	12.2	1.4
2256	HT_soil	11	1	Loamy Sand	7.2	0.42	9.7	345	2.01	0.28	5.29	1.13	5.45	2.7	1.6
2257	HT_soil	11	2	Sandy Loam	7.6	0.44	9.1	341	1.94	0.27	4.98	1.03	5.55	2.0	1.4
2258	HT_soil	11	3	Sandy Clay Loam	7.8	0.50	6.1	366	1.46	0.19	4.40	0.76	5.39	2.0	1.3
2259	HT_soil	11	4	Sandy Clay Loam	8.0	0.66	4.7	388	1.12	0.14	4.38	0.69	4.21	3.2	1.0
2260	HT_soil	12	1	Sandy Loam	7.9	0.40	9.1	335	3.18	0.25	3.35	1.00	3.68	2.2	1.4
2261	HT_soil	12	2	Loam	7.8	0.37	7.8	295	1.18	0.19	3.67	1.15	4.44	1.5	1.4
2262	HT_soil	12	3	Loam	7.8	0.35	5.0	233	1.12	0.11	2.64	0.98	4.95	1.4	1.1
2263	HT_soil	12	4	Sandy Clay Loam	7.8	0.36	3.3	161	0.84	0.11	2.69	0.84	4.31	1.4	1.0
2264	HT_soil	12	5	Sandy Clay Loam	8.0	0.73	4.8	195	1.33	0.12	2.55	0.77	5.06	1.5	<1.0
2265	HT_soil	12	6	Sandy Clay Loam	7.9	1.69	4.0	223	4.88	0.09	2.92	0.86	4.71	2.0	<1.0
2266	HT_soil	12	7	Sandy Loam	7.9	2.87	4.0	246	5.27	0.10	2.75	0.87	4.49	4.1	<1.0
2267	HT_soil	12	8	Sandy Loam	7.8	5.57	3.2	233	6.44	0.08	2.43	0.81	3.30	23.6	<1.0
2268	HT_soil	13	1	Clay Loam	8.0	0.54	20.4	>900	2.74	0.28	2.38	1.36	5.50	2.6	2.0
2269	HT_soil	13	2	Clay Loam	8.2	0.66	10.0	886	4.54	0.18	1.86	1.06	4.79	3.2	1.9
2270	HT_soil	13	3	Clay Loam	8.0	0.89	10.0	542	9.74	0.16	2.00	0.96	4.40	5.4	1.4
2271	HT_soil	13	4	Clay Loam	8.0	1.28	8.0	161	18.0	0.17	2.31	0.95	4.18	6.5	1.6
2272	HT_soil	13	5	Clay Loam	7.9	2.04	8.0	154	14.0	0.13	1.73	0.85	3.60	6.7	1.3
2273	HT_soil	13	6	Clay Loam	7.9	3.64	4.9	127	13.9	0.12	1.43	0.75	3.21	9.7	1.3

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						dS/m	mg/kg		mg/kg	mg/kg					%
2274	HT_soil	13	7	Sandy Loam	7.7	6.85	6.8	113	18.5	0.12	1.16	0.63	2.68	22.9	<1.0
2275	HT_soil	13	8	Clay Loam	7.6	11.7	6.9	97.3	31.8	0.09	1.20	0.62	2.47	50.8	1.0
2276	HT_soil	13	9	Sandy Loam	7.5	16.1	7.1	92.4	46.4	0.10	1.15	0.61	1.93	66.4	<1.0
2277	HT_soil	13	10	Sandy Loam	7.7	17.5	8.3	93.5	48.3	0.11	1.28	0.47	1.73	89.2	<1.0
2278	HT_soil	13	11	Sandy Loam	7.6	18.9	9.8	117	59.1	0.15	1.55	0.56	2.86	67.2	<1.0
2279	HT_soil	14	1	Loam	7.9	0.60	25.4	473	1.56	0.39	3.80	1.61	6.55	2.9	2.1
2280	HT_soil	14	2	Sandy Clay Loam	7.9	0.41	7.7	512	1.01	0.15	2.24	1.01	4.67	1.7	1.6
2281	HT_soil	14	3	Sandy Clay Loam	8.0	0.37	3.2	463	0.71	0.09	1.99	0.8	4.50	1.7	1.0
2282	HT_soil	14	4	Sandy Clay Loam	8.0	0.34	4.4	292	1.37	0.08	1.72	0.55	4.53	1.8	<1.0
2283	HT_soil	14	5	Sandy Clay Loam	8.1	0.37	8.5	168	<0.5	0.06	1.43	0.51	3.91	2.6	<1.0
2284	HT_soil	14	6	Sandy Loam	8.2	0.33	5.1	95.5	<0.5	0.05	1.27	0.47	2.37	2.2	<1.0
2285	HT_soil	14	7	Sandy Loam	8.2	0.42	4.7	96.6	0.66	0.05	1.54	0.47	2.87	2.2	<1.0
2286	HT_soil	15	1	Loamy Sand	7.6	0.33	12.2	188	0.91	0.27	4.04	0.63	4.62	1.0	<1.0
2287	HT_soil	15	2	Sandy Loam	7.7	0.35	6.0	188	1.25	0.19	3.77	0.77	4.40	1.2	1.0
2288	HT_soil	15	3	Sandy Clay Loam	7.8	0.36	5.7	151	1.60	0.13	3.04	0.62	4.69	1.3	1.0
2289	HT_soil	15	4	Sandy Clay Loam	8.0	0.34	4.6	107	1.29	0.09	2.42	0.42	3.83	1.2	<1.0
2290	HT_soil	16	1	Loam	7.9	0.88	29.7	>900	2.39	0.35	2.95	1.73	10.4	3.2	2.4
2291	HT_soil	16	2	Sandy Loam	8.1	0.86	11.6	837	1.51	0.15	2.11	1.09	5.26	2.7	1.1
2292	HT_soil	16	3	Sandy Loam	8.1	0.53	5.1	516	1.43	0.09	1.82	0.71	3.75	2.3	<1.0
2293	HT_soil	16	4	Sandy Loam	8.0	0.46	3.4	197	0.99	0.08	1.62	0.49	2.88	1.7	<1.0
2294	HT_soil	16	5	Sandy Loam	8.1	0.56	4.2	76.9	1.04	0.07	1.42	0.52	3.51	3.0	<1.0
2295	HT_soil	16	6	Sandy Clay Loam	8.3	0.65	4.5	48.1	1.10	0.06	1.47	0.58	3.29	3.9	<1.0
2296	HT_soil	16	7	Sandy Clay Loam	8.3	0.76	4.7	55.9	1.19	0.09	1.49	0.61	2.88	4.0	1.0
2297	HT_soil	16	8	Clay Loam	8.4	0.83	5.6	53.7	1.13	0.08	1.55	0.66	2.99	3.8	1.1
2298	HT_soil	16	9	Silty Clay Loam	8.5	0.88	5.9	61.9	0.96	0.10	2.01	0.81	3.22	3.8	1.3
2299	HT_soil	16	10	Silty Clay Loam	8.5	0.99	6.9	60.1	1.05	0.12	1.93	0.79	3.55	4.9	<1.0
2300	HT_soil	16	11	Silty Clay Loam	8.3	1.46	8.5	72.8	1.14	0.11	2.46	1.10	3.62	11.6	1.1
2301	HT_soil	17	1	Sandy Loam	7.9	0.49	13.0	238	2.10	0.20	3.63	0.99	5.04	1.4	1.6
2302	HT_soil	17	2	Sandy Clay Loam	7.9	1.03	6.9	245	1.76	0.18	3.29	0.90	5.50	2.2	1.1
2303	HT_soil	17	3	Clay Loam	7.6	1.50	3.5	240	1.22	0.08	2.11	0.62	7.95	61.1	1.0
2304	HT_soil	18	1	Clay Loam	8.5	1.89	28.1	>900	7.54	0.37	2.17	1.77	8.89	5.9	1.5
2305	HT_soil	18	2	Silt Loam	8.1	6.78	10.1	>900	6.68	0.15	1.71	1.18	5.05	6.4	1.3
2306	HT_soil	18	3	Silt Loam	8.0	1.66	8.0	635	3.72	0.16	1.57	0.92	4.43	2.7	1.2
2307	HT_soil	18	4	Silt Loam	8.1	0.96	5.8	218	3.96	0.13	1.48	0.85	4.11	4.5	1.0
2308	HT_soil	18	5	Sandy Clay Loam	8.1	0.84	5.9	59.9	2.82	0.12	1.72	0.79	3.47	6.2	<1.0
2309	HT_soil	18	6	Clay Loam	8.1	0.84	8.5	89.1	3.60	0.13	1.73	0.81	4.28	4.7	<1.0
2310	HT_soil	18	7	Silt Loam	8.1	0.73	8.4	66.5	3.77	0.13	1.89	0.97	3.61	5.5	<1.0
2311	HT_soil	18	8	Silt Loam	7.9	1.02	8.8	86.1	8.07	0.17	1.90	0.95	3.61	4.4	<1.0
2312	HT_soil	18	9	Sandy Clay Loam	7.6	2.95	8.4	99.2	24.9	0.16	1.73	0.74	2.96	12.0	<1.0
2313	HT_soil	18	10	Sandy Clay Loam	7.4	7.56	9.6	98.8	95.8	0.16	1.77	0.78	2.83	57.2	<1.0
2314	HT_soil	19	1	Sandy Loam	7.6	0.45	7.5	260	2.01	0.24	3.52	1.33	5.92	0.8	<1.0
2315	HT_soil	19	2	Sandy Clay	7.7	1.71	3.2	182	1.36	0.16	4.10	0.96	5.05	1.65	<1.0
2316	HT_soil	19	3	Sandy Clay	7.7	6.12	2.2	101	1.11	0.13	3.83	0.71	3.48	16.1	<1.0
2317	HT_soil	19	4	Clay Loam	7.8	8.79	3.1	83.6	1.24	0.11	3.57	0.77	4.19	64.7	<1.0
2318	HT_soil	19	5	Clay Loam	7.9	11.6	8.0	84.6	1.44	0.10	3.16	0.75	3.40	128	<1.0
2319	HT_soil	19	6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
2390	HT_soil	9	7	Not Enough Soil	8.0	0.38	4.4	175	1.73	0.11	2.26	0.36	2.58	3.5	<1.0

UtahStateUniversity
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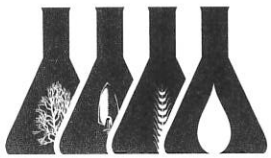
10/7/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg				mg/kg	%
2353	XRDS_soil	1	1	Sandy Clay Loam	7.7	0.35	3.8	134	5.37	0.16	4.05	3.30	3.73	1.9	1.1
2354	XRDS_soil	1	2	Sandy Clay Loam	7.7	0.33	2.8	108	1.47	0.11	5.36	3.55	4.50	1.6	1.0
2355	XRDS_soil	1	3	Sandy Clay Loam	7.7	0.36	1.3	73.2	1.39	0.07	7.10	3.00	3.51	1.6	<1.0
2356	XRDS_soil	1	4	Loamy Sand	8.0	0.59	0.7	67.3	0.80	0.06	5.57	1.93	1.81	2.1	<1.0
2357	XRDS_soil	1	5	Sandy Loam	8.0	1.34	3.0	110	0.91	0.10	5.15	2.97	3.24	9.5	<1.0
2358	XRDS_soil	2	1	Sandy Clay Loam	7.6	0.38	4.6	126	1.48	0.10	2.73	4.91	3.77	1.8	1.4
2359	XRDS_soil	2	2	Sandy Loam	7.8	0.32	6.9	118	1.49	0.22	2.89	3.76	3.32	1.3	1.1
2360	XRDS_soil	2	3	Sandy Loam	7.8	0.32	6.5	124	1.10	0.17	2.85	3.60	2.85	1.5	1.2
2361	XRDS_soil	2	4	Sandy Loam	7.8	0.32	6.6	125	1.31	0.11	2.82	3.16	2.65	1.9	1.3
2362	XRDS_soil	3	1	Loamy Sand	8.0	0.27	4.6	117	1.11	0.17	2.85	8.19	2.92	2.9	<1.0
2363	XRDS_soil	3	2	Sand	7.6	0.47	2.3	108	1.12	0.16	2.90	8.16	4.94	3.0	<1.0
2364	XRDS_soil	3	3	Sand	7.7	0.31	1.4	94.0	0.48	0.09	2.79	4.50	3.27	1.9	<1.0
2365	XRDS_soil	3	4	Sand	7.8	0.27	1.3	90.2	0.54	0.09	2.88	4.38	2.58	2.3	<1.0
2366	XRDS_soil	4	1	Loamy Sand	7.8	0.35	9.0	175	1.05	0.10	2.42	1.49	3.92	1.2	1.1
2367	XRDS_soil	4	2	Sandy Loam	7.7	0.36	5.3	122	0.99	0.08	2.34	1.69	4.52	1.4	1.2
2368	XRDS_soil	4	3	Sandy Clay Loam	7.7	0.33	8.0	146	1.36	0.10	2.63	2.19	5.06	2.1	1.4
2369	XRDS_soil	5	1	Sandy Clay Loam	7.8	0.34	3.7	179	0.69	0.13	2.54	2.36	3.42	1.1	<1.0
2370	XRDS_soil	5	2	Sandy Loam	7.7	0.34	1.6	105	0.58	0.07	2.25	2.50	4.23	0.9	<1.0
2371	XRDS_soil	5	3	Sandy Loam	7.8	0.33	1.3	66.4	0.64	0.06	1.92	2.52	3.63	1.3	<1.0
2372	XRDS_soil	5	4	Sandy Loam	7.8	0.33	1.7	62.4	0.54	0.05	1.96	2.23	3.26	2.5	<1.0
2373	XRDS_soil	5	5	Sandy Loam	7.9	0.36	1.7	58.5	0.58	0.05	1.92	2.07	3.50	2.2	<1.0
2374	XRDS_soil	5	6	Loamy Sand	8.1	1.55	2.0	82.9	0.72	0.06	1.59	1.61	2.59	9.3	<1.0
2375	XRDS_soil	6	1	Sandy Clay Loam	7.7	0.35	4.1	144	1.05	0.11	2.40	4.45	3.06	0.9	1.2
2376	XRDS_soil	6	2	Sandy Loam	7.7	0.36	4.0	136	0.84	0.13	2.82	4.82	4.19	1.0	1.1
2377	XRDS_soil	6	3	Sandy Clay Loam	7.7	0.34	2.4	77.8	0.69	0.05	2.17	4.71	3.53	1.3	<1.0
2378	XRDS_soil	6	4	Sandy Clay Loam	7.8	0.29	1.4	79.3	0.50	0.04	1.85	3.93	2.66	1.4	<1.0
2379	XRDS_soil	6	5	Sandy Clay Loam	7.8	0.36	2.4	90.0	0.62	0.07	1.91	3.82	2.56	1.4	<1.0
2380	XRDS_soil	7	1	Sandy Clay Loam	7.8	0.35	9.4	148	1.21	0.13	3.56	7.09	3.44	1.1	1.3
2381	XRDS_soil	7	2	Sandy Clay Loam	7.7	0.39	5.9	95.7	1.11	0.10	3.47	5.84	3.04	1.5	1.3
2382	XRDS_soil	7	3	Sandy Clay Loam	7.7	0.47	4.4	68.1	0.98	0.09	4.49	8.50	1.81	1.4	1.1
2383	XRDS_soil	7	4	Sandy Clay Loam	7.7	0.44	2.8	64.9	1.06	0.09	4.57	6.17	0.56	1.8	<1.0
2384	XRDS_soil	8	1	Loamy Sand	7.9	0.29	6.3	118	0.95	0.18	2.56	2.40	2.70	1.4	1.0
2385	XRDS_soil	8	2	Sandy Clay Loam	7.8	0.42	6.1	117	1.04	0.12	2.59	3.60	4.02	1.7	1.3



Plant Analysis Lab
Soil Testing Lab
Feed Anaysis Lab
Irrigation Water Analysis Lab
Manure Analysis Lab

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10/7/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg				mg/kg	%
2386	XRDS_soil	8	3	Sandy Clay Loam	7.8	0.38	3.1	83.0	1.09	0.09	2.36	4.46	3.64	1.6	1.6
2387	XRDS_soil	8	4	Sandy Clay Loam	7.7	0.38	2.1	65.9	0.80	0.08	2.37	6.94	4.57	2.0	1.2
2388	XRDS_soil	8	5	Sandy Clay Loam	7.7	0.47	2.3	68.3	0.82	0.10	2.45	6.40	5.82	1.8	1.0
2389	XRDS_soil	8	6	Sandy Clay Loam	7.8	0.38	3.7	94.5	1.07	0.12	2.67	5.17	5.19	1.7	1.3
2391	XRDS_soil	9	1	Loamy Sand	7.8	0.50	4.4	183	1.54	0.12	2.31	2.30	4.95	2.1	1.1
2392	XRDS_soil	9	2	Loamy Sand	7.8	0.44	2.5	125	1.29	0.10	1.86	2.33	4.23	1.9	1.0
2393	XRDS_soil	9	3	Sandy Loam	7.7	0.47	2.5	98.7	1.24	0.11	2.44	4.07	5.42	2.1	1.0
2394	XRDS_soil	9	4	Sandy Loam	7.8	0.38	2.0	68.2	1.06	0.05	2.24	3.93	4.17	2.6	<1.0
2395	XRDS_soil	9	5	Sandy Loam	7.8	0.38	1.8	68.7	1.00	0.02	2.31	3.40	4.10	2.7	<1.0
2396	XRDS_soil	10	1	Sandy Loam	7.7	0.56	4.2	165	1.42	0.16	3.09	2.64	4.76	1.5	1.0
2397	XRDS_soil	10	2	Sandy Loam	7.7	0.37	3.0	111	1.12	0.09	2.76	3.90	5.63	1.6	1.2
2398	XRDS_soil	10	3	Sandy Loam	7.7	0.36	2.8	72.4	1.17	0.05	2.19	3.85	4.58	1.7	1.3
2399	XRDS_soil	10	4	Sandy Loam	7.9	0.36	2.0	46.8	1.13	0.05	1.93	3.04	3.68	3.2	<1.0
2400	XRDS_soil	10	5	Loamy Sand	8.1	0.55	2.4	52.3	0.76	0.03	1.89	2.09	3.32	6.2	<1.0

Appendix D
Hidden Treasure Area Soils Data



QA CONSULTING AND TESTING

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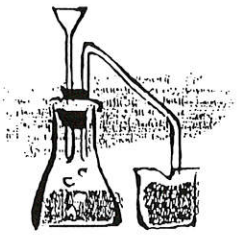

INVOICE

DUE ON RECEIPT

ATTENTION: EARL/MARK

To: Western Utah Copper Company
1208 S 200 W
Milford UT 84751

January 9, 2003

Project: Copper Mine
PO: verbal

phone 435 387 5053 **FAX** 5088, 5263

Description	**$ Unit**	**$**
6 topsoil tests for soil characterization* (pH, EC, SAR, %OM, % Sand, % Silt, %Clay, Texture Class., Coarse Fragments)	57.50	345.00
Labor 25.75 hrs	37.00	952.75
Extreme sample preparation**		
Document review and notes (DOGM notice)		
Report preparation (soil collection/results)		
1 portal to portal sample collection (13.5 hrs on December 18, 2002)		
Milage: 334 miles Salem/Milford/Salem	0.32	106.88
Photographs	12.00	12.00
	Total	1,416.63

Make check payable to:
QA CONSULTING AND TESTING, LLC
EIN 87-0629746

* North Pile, South Pile, Mill Site Pile, Mill Site Native Area, Sagebrush Area South of Mill Site Road, Disturbed Flat Area South of Drainage

** For soil samples exceeding one gallon in volume &/or rocky

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ROYVON@AOL.COM

Mark Dotson, Earl Harrison
Western Utah Copper Co.
1208 S 200 W
Milford, UT 84751

435 387 5053, fx 5088, 5263

December 27, 2002
Project No.: not given
Project: Copper Mine
Sampling date: 18 Dec, 2002

PO: verbal

SOIL BASELINE INFORMATION

Sample Name	pH*	Soluble Salts* dS/m or mmho/cm	Sodium Absorption Ratio* (SAR)	Organic Matter %*	Sand %*	Silt %*	Clay %*	Texture Class*
North Pile	8.6	0.3	3.1	1.7	74	15	11	Sandy Loam
S[illegible]h Pile	7.9	1.4	4.0	0.5	70	17	13	Sandy Loam
[illegible] Site Pile	8.5	0.2	1.8	0.4	78	13	9	Sandy Loam
Mill Site Area	8.1	0.2	0.9	1.6	62	25	13	Sandy Loam
S of Mill Site	8.1	0.2	0.8	1.2	62	25	13	Sandy Loam
Drainage Area	8.6	0.3	4.5	1.3	42	39	19	Loam

SOIL BASELINE INFORMATION (cont)

Sample Name	% Coarse Fragments* (Rocks) >2mm	≥1.5" (3.8 cm) in diameter*
North Pile	17.6	Present
South Pile	19.7	Present
Mill Site Pile	18.1	Present
Mill Site Area	14.9	Present
S of Mill Site	13.3	Present
Drainage Area	1.4	Present

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Baseline Interpretation:

Soils North Pile, South Pile, Mill Site Pile, Mill Site Area, and South of Mill Site are Normal Soils** with a coarse fraction present (>5.0%). The Drainage Area soil is a Normal Soil lacking a distinct coarse fraction (≤ 5.0%).

Normal Soils are characterized as having a pH of about 8.5 or less, soluble salt level of 4.0 or less and a SAR of 13 or less. Normal Soils are considered suitable for vegetation establishment.

The extent of the topsoil or suitable plant growth material from the six areas sampled will be provided by WUCC. U.S. Soil Conservation Service soil types will be provided by WUCC.

* *Topsoil Quality Guidelines for Landscaping*, June 2002, AG/SO-02, Rich Koenig, Utah State University Cooperative Extension Soil Specialist, and **Von Isaman, QA Consulting and Testing, LLC.**
** *The Nature and Properties of Soils*, 12th Edition, Brady and Weil, 1999.

Sampling locations and depths.

Sampling areas were designated on a topographic map by Mr. Dotson.

For North Pile, South Pile and Mill Site Pile, a trench was excavated from the top to the bottom of the pile. The trench depth was six inches (15 cm) and the width of the trench was that of a standard size round nose shovel. Soil was collected along the bottom of the trench and the entire length of the trench. The sampling depth was about one inch (2.5 cm). Any rocks encountered during the actual sampling were collected and counted in the coarse fragment determination. For each of these three areas, about 7.5 gallons (28 liters) of sample was collected and placed in clean buckets.

North Pile. Three trenches as described above were excavated on the west, north and east sides of the pile. Respective trench lengths were: 20 feet (6 meters), 19 feet (5.7 meters) and 15 feet (4.5 meters). These three sampling locations were composited into one sample for analyses.

South Pile. One trench as described above was excavated on the south side of the pile 45 feet (13.5 meters) long. The northeast corner of the pile, sometime in the past, had a portion removed. The portion removed was about 90 feet (27 meters) by 35 feet (10.5 meters).

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Sampling locations and depths (cont).

South Pile (cont). This removal resulted in a vertical face about 70 inches (1.8 meters) high. This face was back excavated 6 inches (15 cm) and a sample was collected. These two sampling locations were composited into one sample for analyses. Note that the South Pile consists of a West and East pile. The East pile was sampled and the results are designated as South Pile, as it is several meters to the south of the North Pile. The West pile was not sampled as it was determined that it was too rocky to afford any appreciable rooting/plant growth media.

Mill Site Pile. Two trenches as described above were excavated on the west lower tier of the pile and the west upper tier of the pile. Respective trench lengths were: 21 feet (6.3 meters) and 65 feet (19.5 meters). These two sampling locations were composited into one sample for analyses.

Mill Site Area, South of Mill Site and Drainage Area. A hole was dug using the round nose shovel approximately 8 inches (20.3 cm) deep. With a common garden type hand trawl, an approximate one inch (2.5 cm) slice was excavated into the face of the hole to a depth of 6 inches (15 cm). The soil was allowed to fall on the awaiting shovel blade. Any rocks encountered during the sampling were collected and counted in the coarse fragment determination. For each of these three areas, about 2.5 gallons (9.5 liters), 5 gallons (18.9 liters), and 2 gallons (7.5 liters), respectively, of soil was collected and placed in clean buckets. For the respective areas, 18, 36, and 15 subsamples were collected.

Comment:

On December 18, 2002, Von Isaman of QA Consulting and Testing, LLC., met with Mark Dotson and Earl Harrison, both of Western Utah Copper Company. In Mr. Dotson's office, he indicated to Mr. Harrison the areas to be soil sampled on a topographic map. Mr. Harrison and Mr. Isaman proceeded to the site and collected samples as described in this report. Mr. Isaman transported the soil samples to his laboratory in Salem, Utah where he conducted the above reported baseline analyses.

In order to obtain a representative soil sample from the topsoil piles, a trench technique was used. The trench technique is based upon the premise that the pile soil was deposited in layers using scrapers, dump trucks and bulldozer, or other similar methods. The entire length of the

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Comment (cont):

trench that traverses the side of the pile from top to bottom is sampled. This is graphically illustrated in the South Pile where the northeast section of the pile was previously removed leaving a vertical profile. The vertical profile revealed a distinct soil layer. The north side trench revealed a distinct soil layer as illustrated in the image of Earl Harrison indicating the layer presence. This trench technique for soil collection is validated by the vertical profile. By sampling more than one location (trench) on the pile, variation in soil deposition is minimized and subsample representation is optimized. A similar scenario is also afforded on the Mill Site pile.

Six inches (15 cm) of soil depth was collected from the Mill Site Area, South of Mill Site and Drainage Area in response to WUCC's statement on Page 5, Second Review, M/001/059, December 6, 2002 that states *"the operator says they intend to salvage the first six inches of material..."*.

In the six areas sampled and tested, no sodic horizons or cemented hardpans were observed. Other materials, such as some bedrock, were not observed in the six areas sampled.

Visual observation of the vegetation growing on the three topsoil piles indicates there does not appear to be any significant adverse soil conditions that prohibit vegetation establishment.

The Mill Site area and South of Mill Site area (south of access road) appears to have a stable sagebrush plant community.

The Drainage Area (adjacent to South of Mill Site area and bordered by two drainages/washes) has received significant disturbance recently. Except for some pockets of sagebrush, the area is void of vegetation.

Digital images and photographs are available upon request.

APPROVED
JUN 0 8 2007
DIV. OIL GAS & MINING
WesternUtahCopperRpt.D27

APPENDIX I

Cultural & Archeological

CONFIDENTIAL

APPENDIX J

Tailings Storage

SPENCER J. COX
Governor
DEIDRE M. HENDERSON
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES
JOEL FERRY
Executive Director
Division of Water Rights
TERESA WILHELMSEN
State Engineer/Division Director

ORDER OF THE STATE ENGINEER

ORDER GRANTING PERMIT TO CONSTRUCT, ENLARGE, REPAIR, ALTER, REMOVE OR ABANDON A DAM

Submission of plans, in the name of Milford Mining Company Utah LLC, applicant, to enlarge East Intermediate Tailings Facility / UT53781 located in Beaver County, Utah, are hereby **Approved**, contingent upon the conditions outlined in this **Order**. The applicant is hereby authorized to conduct the work detailed in the plans, as described in this **Order**. Any modification may require additional authorization and/or plan resubmittal. The plans addressed in this Order consists of the design report(s), drawings, and specifications submitted to the State Engineer for design review.

This dam has been classified as a low hazard structure.

The applicant is ORDERED to abide by the terms and conditions of this Order as follows:

1. Prior to construction, one (1) complete, printed copies of the construction drawings and specifications, including the Engineer and Owner's signatures, must be submitted to our office. An electronic copy of the same would be appreciated.

Prior to the initiation of construction, the following information must be submitted to and approved by the State Engineer:

1. A detailed construction observation/quality assurance plan including:
    a. The names of key individuals with documentation of their qualifications and assignments.
    b. Testing type and frequency requirements.

2. The name of the contractor and the contractor's representative responsible for the project.

3. The estimated starting and completion dates for the project.

4. The applicant shall assure that any other necessary permits or approvals for use and operation of the dam have been formally acquired, including, but not limited to, applications necessary to establish water rights for the diversion, impoundment, or use of water.

During the construction phase of the project, compliance with the following conditions is required:

1. Written documentation of all construction activities must be maintained by the Engineer and submitted to the State Engineer weekly, including:

    a. Material test results and certifications.
    b. Daily inspection reports including any field notes and photographs.

2. Any conditions that differ appreciably from those considered during design must be reported to the State Engineer before work continues.

3. All construction changes that differ significantly from the approved drawings and specifications must be submitted to and approved by the State Engineer prior to implementing such changes.

4. No fill material shall be placed on the foundation without prior inspection and approval by the State Engineer. The geotechnical engineer for the project shall be present at the inspection. Arrangements shall be made sufficiently in advance to avoid construction delays.

Before the reservoir basin can be used to impound tailings and the dam placed into operation, the following conditions must be met:

1. The Engineer shall schedule and conduct a final inspection of the project that shall include designated personnel from the Dam Safety Section of the State Engineer's office.

2. A Standard Operating Plan, as required at UTAH ADMIN. CODE R. 655-12-4, 4A, 4B and 4C, must be prepared or updated to reflect changes to the dam and approved by the State Engineer.

3. The Engineer shall provide a letter to the State Engineer indicating the project has been completed according to the approved plans and recommending the project be placed into or returned to operation in accordance with the initial filling plan.

4. Written approval of the project from the State Engineer authorizing operation of the dam.

Within 60 days of the project's completion, the applicant or engineer must supply the State Engineer with a final set of "as-constructed" drawings. These drawings shall be marked as "Record Drawings" indicating the final status of these documents. The Record Drawings may be submitted electronically in a .pdf format. Alternatively, the Record Drawings may be submitted on mylar, or other reproducible media of equivalent durability, approved by the State Engineer.

Approval will be voided if construction has not begun within 1 year from the date of this Order.

The statutory process and criteria for evaluation of these plans are described at UTAH CODE ANN. § 73-5a-202 through 205 and Administrative Rules R655-10 and R655-11. The State Engineer has determined that these plans meet the necessary legal criteria for approval based upon the following Findings of Fact and reasoning set forth in the Discussion.

FINDINGS OF FACTS

1. The plans submitted to our office on January 11, 2024, for approval for this project consist of the following documents:

    - "Milford Mining Company Utah East Intermediate Tailings Disposal Facility (ITDF) 5840 Raise Technical Report for Permit Application", prepared by Picacho Associates, LLC, dated November 24, 2023.
    - "Milford Mining Company East ITDF 5840 Dam Raise & Impoundment", prepared by Picacho Associates, LLC, dated January 8, 2024.
    - "Technical Specifications East ITDF 5840 Raise Milford Mining Company Utah, LLC, prepared by Picacho Associates, LLC, dated January 8, 2024.

2. The review processes of these documents, including comments from Dam Safety and other Division of Water Rights personnel, as well as responses and modifications by the designer, are included in the Dam Safety correspondence files for this dam.

DISCUSSION

1. In accordance with criteria established at UTAH CODE ANN. § 73-5a-106, this dam has been assigned a low hazard rating.

2. Based on a detailed review, it is the opinion of the State Engineer that the *design report* for this dam meets the requirements of UTAH ADMIN. CODE R. 655-10-6B.E. Further, the *proposed design* meets the pertinent design standards set forth in UTAH ADMIN. CODE R. 655-11.

3. Based on a detailed review, it is the opinion of the State Engineer that the *construction drawings* for this dam meet the pertinent requirements of UTAH ADMIN. CODE R. 655-10-6B. A through C.

4. Based on a detailed review and as documented in the State Engineer's files pertaining to this dam, it is the opinion of the State Engineer that the *project specifications* meet the pertinent requirements of UTAH ADMIN. CODE R. 655-10-6B.D.

Your contact with this office is Everett Taylor who can be reached at telephone number 801-538-7376.

This **Order** is subject to the provisions of UTAH ADMIN. CODE R. 655-6-17 of the Division of Water Rights and to UTAH CODE ANN. §§ 63G-4-302 and 73-3-14, which provide for filing either a Request for Reconsideration with the State Engineer or an appeal with the appropriate District Court. A Request for Reconsideration must be filed with the State Engineer within 20 days of the date of this **Order**. However, a Request for Reconsideration is not a prerequisite to filing a court appeal. A court appeal must be filed within 30 days after the date of this **Order**, or if a Request for Reconsideration has been filed, within 30 days after the date the Request for Reconsideration is denied. A Request for Reconsideration is considered denied when no action is taken within 20 days after the Request is filed.

Dated this 21st day of February, 2024.

E.W. Taylor

Everett W. Taylor, P.E. / Assistant State Engineer

Mailed a copy of the foregoing **Order** this 21st day of February 2024, to:

MILFORD MINING COMPANY UTAH, LLC
BRENDAN MOSELEY
P.O. BOX 827
MILFORD, UT 84751

Nathan Moses - Regional Engineer, nathanmoses@utah.gov
Woodrow Campbell - Division of Water Quality, wwcampbell@utah.gov
Stephen Taylor - Picacho Associates, LLC, Stephen, StephenJTaylor@cox.net
Brendan Moseley, brendan.moseley@milfordmining.com

By: Tiffany Gonzales

Tiffany Gonzales, Executive Secretary

MILFORD MINING COMPANY UTAH
1208 SOUTH 200 WEST
MILFORD, UTAH 84751

January 11, 2024

Mr. Everett Taylor
Utah Division of Water Rights
1594 W. North Temple Suite 220
Salt Lake City, Utah 84114-6300
Permit Application for East ITDF 5840 Raise

Dear Mr. Taylor,

Further to Milford Mine's permit application submitted to the Utah Division of Water quality on November 27, 2023, our engineers, Picacho Associates, LLC, have revised the East ITDF 5840 drawings and specifications submitted as "For Permitting" to "For Construction" needed to move into the construction phase. The revisions were made based on constructability input from our contractors and additional engineering review. These revisions are limited to changes in drawing details and do not affect any of the criteria or calculations submitted in our November 27, 2023, permit application. No changes were made to the "For Permitting" specifications.

We believe these changes recommended by Picacho are important and are typical in moving from permitting to construction level.

For completeness, we have attached the "For Construction" drawings and specifications to the entire permit submittal package submitted on November 27, 2023. The changes, and the reasoning behind them are detailed below and are all based on Picacho recommendations.

Impoundment Grading

Grading of the impoundment and dams has been refined. This refinement uses more recent areal mapping and results in a small relocation of the Saddle Dam, smoothing of the impoundment finish grade contours, and the addition of a bench within the impoundment at the 5,840-foot elevation (above mean seal level) to assist with liner installation. These changes do not affect any embankment stabilities.

Liner System

As recommend by Picacho, we added a slip joint between the new 60-mil HDPE liner and the existing 40-mil HDPE liner at the 5,840-foot elevation (See Details D-8 and D-9 Drawing 13). The slip joint will allow the existing 40-mil liner to freely move downwards with a preserved seal as the existing tailings may continue to settle over time and create a down drag on this liner. This reduces the likelihood of tearing of this liner and eliminates a difficult weld between the 60-mil and 40-mil liners made more difficult by the long exposure of the upper edge of the 40-mil liner to ultraviolet radiation. This joint detail was developed in conjunction with Dr. Ed Kavazanjian, a world expert in liners and potential down drag forces on liners.

We also added a low permeability liner under 60-mil HDPE along upstream face of main embankment and north wing of main embankment. The low permeability face liner adds robustness against leaks

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MILFORD, UTAH 84751

and potential tears or gashes in the 60 mil HDPE liner and allowed us to remove the face drain, which is not as robust as either of the low permeability liners specified.

Blanket and Under Dam Drains

As recommended by Picacho, we removed the Blanket and Under Dam Drains from the Saddle Dam, the north wing of main embankment, and from main embankment itself, in addition, for the main embankment we removed the face drains from under the 60-mil liner and replaced these with a low permeability liner that extends through the north wing of the main embankment.

In the case of the Saddle Dam this a low structure with a high factor of safety that will be needed for less than 5 years until the West ITDF impoundment is built downstream of the Saddle Dam. The West ITDF tailings will eventually pond against the Saddle Dam eliminating its current purpose.

The north wing of the main embankment is also a low structure with a high factor of safety to which we have added a low permeability liner under the 60-mil which we believe mitigates the need for drains.

For the main embankment we added a low permeability liner under the 60-mil geomembrane (See Drawing 5 and Detail D-11 on Drawing 13) and a “herringbone” arrangement (See Drawing 7) of drains in lieu of the blanket and underdrains. These 2-foot-wide drains within the herringbone are easier to construct, remove a potential failure plane created by the geotextile over the entire downstream face, and using perforated polyethylene drainpipes wrapped in geotextile provide a more robust defence against fines migration which could lead to piping within the embankment.

Piezometers and Existing Well

As recommended by Picacho, we added details for two piezometer locations within the main embankment (See Drawing 14). These piezometers will allow monitoring of pore pressures within the embankment and will provide early warning of potential problems.

We added a note to extend existing well to ground level so that this well remains functional during and after construction (See Drawing 5).

Please let me know if you have any concerns and if Milford Mining can assist the permitting process in any way.

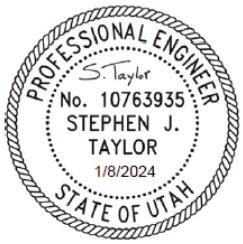
As mentioned, you are welcome to visit the mine, or question us, or our engineers, during the permit approval process at any time before or during the planned construction.

Yours Faithfully

Brendan Moseley

Chief Executive Officer

PICACHO ASSOCIATES



TECHNICAL SPECIFICATIONS

Revision	Issue/ Rev Description	Date
A	For Bid	11/1/23
B	For Permitting	11/24/23
0	For Construction	1/11/2024
1	For Construction. Added specifications for GCL and Corrugated, Perforated, Polyethylene Piping	1/26/2024

East ITDF 5840 Raise
Milford Mining Company Utah, LLC

Division 1 - General Requirements

SECTION	01000	Work Restrictions
	01011	Summary of Project
	01039	Project Coordination and Meetings
	01300	Submittals
	01500	Temporary Controls
	01600	Materials, Labor, and Equipment
	01700	Contract Closeout

Division 2 - Site Work

SECTION	02200	Site Preparation
	02300	Earthwork
	02400	Subgrade Preparations
	02714	Geotextile
	02771	Geomembrane
	02773	Geosynthetic Clay Liner
	02711	Polyethylene Pipe

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01000

WORK RESTRICTIONS

PART 1 -GENERAL

1.1 WORK INCLUDED

A. The work under this contract consists of one Bid Schedule.

B. Restrictions and other requirements that need to be followed by the CONTRACTOR during the course of construction.

1.2 SUBMITTALS

A. NOT USED

B. NOT USED

1.3 CONTRACTS

A. Work shall be done under a single contract. Actual installed quantities may vary from those shown in the Bid Schedule. Payments will be made based on actual drawing neat line quantities installed multiplied by the unit prices bid. See Schedule of Quantities.

1.4 WORKING HOURS AND TIME RESTRICTIONS

A. Work hours shall not be restricted for this project. Time is of the essence and the contractor is free to work around the clock if necessary. The contractor shall provide a proposed work schedule and coordinate inspections and testing with the Engineer and OWNER.

1.5 NOT USED.

1.6 REFERENCE SPECIFICATIONS AND STANDARDS

1.7 Reference specifications, such as ASTM, and ANSI used in this project manual typically do not show effective dates. Unless explicitly noted all references, specifications and standards

shall be the latest published version.

1.8 PROJECT COORDINATION

A. It is important for the CONTRACTOR to coordinate his work and site access requirements with the OWNER. It is also important that the CONTRACTOR keep good relations with all affected parties.

B. All material which may come in contact with drinking water, including paints, coatings, pipes, gaskets, lubricants, and O-rings shall be ANSI certified as meeting the requirements of NSF Standard 61, Drinking Water System Components B Health Effects. All such components shall be appropriately stamped with the NSF logo.

PART 2-PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

PICACHO ASSOCIATES

SECTION 01011

SUMMARY OF PROJECT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included.

B. Summary of Work

C. Definitions

1.2 RELATED SECTIONS

A. Section 01039 - Project Coordination and Meetings

B. Section 01300- Submittals

C. Section 01500-Temporary Controls

D. Section 01600- Materials, Labor, and Equipment

E. Section 01700 - Contract Closeout

1.3 WORK INCLUDED

A. Construction of East ITDF 5840 Raise and lining of impoundment. Work includes clearing, grubbing and stockpiling of topsoil, excavation and grading of side slopes, fill placement, anchor trench construction, placement of double textured 60 mil High Density Polyethylene (HDPE) geomembrane, and construction of access road and adjoining diversion ditch. Installation of piping and barge pumpback system to be performed by others.

Work includes excavation, importation (from onsite sources), and placement of soil, drain rock, and waste rock. Final subgrade preparation and certification of base soil for placement of HDPE geomembrane, and placement of drain systems.

Furnish and install double textured 60 mil HDPE geomembrane.

1.4 SUMMARY OF WORK

A. The construction of the East 5840 Raise is the next stage of the systematic ITDF facility

development. Subsequent expansion will include building the West ITDF Starter Dam and a series of sequentially constructed raises.

B. CONTRACTOR to perform the following work:

- Submit Health and Safety Plan to OWNER or approved representative for review and approval
- Submit Construction Schedule to OWNER or approved representative for review and approval
- Submit Earthmoving Plan to OWNER or approved representative for review and approval

C. Clear and grub vegetation and approximately 4 inches of topsoil from beneath the starter dam footprint and throughout the basin where liner will be constructed to the maximum anticipated tailings impoundment level.

D. Prepare dam foundation area by over-excavating, replacement and compaction of up to uppermost 15 feet of foundation soil. Excavate, haul, place, moisture condition and compact fill materials from within the impoundment in order to raise the existing East IDTF to an elevation of 5840 feet..

E. Perform final subgrade preparation for placement of geomembrane. Preparation of subgrade includes mass excavation and mass fill operations including compaction of fill soil. CONTRACTOR is required to certify, in writing (subgrade acceptance form), that the subgrade soil is adequate for the installation of liner materials prior to placement of geomembrane.

F. Manage and coordinate the installation (by others) of double textured 60 mil HDPE geomembrane (procured by Milford Mine) as detailed on the construction drawings. Drawings included with the bid package are for bidding purposes only. Final locations and final details will be confirmed with the issue of construction drawings prior to work commencing. Quantities are not expected to change more than twenty percent (20%) per line item from bidding documents to construction documents.

G. All products are to be installed or placed in accordance with standards required by respective manufacturer.

H. Anchor geomembrane securely in place to prevent the movement of installed materials. Anchoring of all materials shall be performed with sandbags, anchor trenches or other ENGINEER approved methods.

I. Sequence installation to ensure that all operations are achieved in an orderly and expeditious manner.

1. Touch-up minor damaged surfaces caused during delivery, storage, handling and installation. Replace damaged components as necessary.

J. Installation will not be considered complete until the liner and other materials are completely inspected by the Construction Quality Assurance (QA) Inspector.

1.5 DEFINITIONS

A. CONTRACTOR, the term " CONTRACTOR " shall be used to describe the various work activities of both the prime CONTRACTOR and all of the subcontractors for which the CONTRACTOR retains responsibility.

B. ENGINEER, the term "ENGINEER" shall be used to describe the design engineer responsible for the structural design of the starter dam, site preparation and subgrade recommendations , liner system , and the specifications therein.

C. OWNER, the term "OWNER" shall be used in the specifications herein to describe Milford Mining and its affiliates or its designated representative.

D. QUALITY CONTROL, the quality control " QC" testing will be performed by an independent third party qualified testing agency satisfactory to both the OWNER and ENGINEER for the performance of testing, documentation and reporting on the quality of the construction and conformance with the requirements set forth in the project plans and specifications. Cost of QC testing will be paid by the CONTRACTOR. All testing reports and documentation will be submitted to the ENGINEER.

E. QUALITY ASSURANCE, periodic quality assurance "QA" testing will be performed by the ENGINEER, or third-party QA Company to document the quality of the construction and as a means to validate the QC test results.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

PICACHO ASSOCIATES

SECTION 01039

PROJECT COORDINATION AND MEETINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prime CONTRACTOR Responsibilities

B. Preconstruction Meeting

C. Daily Meetings

D. Weekly Meetings

E. Work Deficiency Meetings

1.2 RELATED SECTIONS

A. Section 01011 - Summary of Project

B. Section 01300 - Submittals

C. Section 01500-Temporary Controls

D. Section 01600 - Materials, Labor and Equipment

E. Section 01700 - Contract Closeout

1.3 PRIME CONTRACTOR RESPONSIBILITY

A. Coordination

1. The prime CONTRACTOR shall properly coordinate all work. Expediting the work of the various trades as necessary so that the different elements are built and installed in proper sequence and so that the parts fit together in a neat, tight, and professional manner and function properly and as intended at completion of the work without interruption of continued operation of the tailings impoundment operations.

2. The CONTRACTOR shall see to it that orders for manufactured items, which he is to furnish as called for under this contract and specifications and under his direction, are ordered by the various trades involved and are delivered to the site at the proper time.

3. The CONTRACTOR and the various trades working under his leadership and direction shall coordinate their work with adjacent work and with other trades so as to facilitate the general progress of the work. Each trade shall afford other trades every reasonable opportunity for the installation of their work and for the storage of their material.

B. Conformity with Plans

I. The CONTRACTOR shall perform all work in conformity with the drawings, specifications, QA Plan and instructions from the ENGINEER.

2. All minor details of the work, which are not specifically mentioned in the specifications or Schedule of Quantities, but are obviously incidental, shall be considered a part of the work for which prices are given in the proposal, and no extra compensation shall be allowed the CONTRACTOR for the performance thereof.

C. Errors and Omissions

I. If the CONTRACTOR, in the course of the work, finds any errors or omissions in plans or in the layout as given by survey points and instruct ions, or if he finds any discrepancy between the plans and the physical conditions of the locality, he shall promptly verify the same and notify the OWNER. Any work done after such discovery, until authorized, will be done at the CONTRACTOR's risk.

D. Notice to OWNER

1. The CONTRACTOR shall give forty-eight hours' notice when he will need the services of the OWNER for staking out any portion of the work.

E. Lines and Grades

I. All work shall be done to the true line and grade, as indicated by the Drawings.

2. The OWNER will furnish initial survey control points and the CONTRACTOR must protect them and will be held responsible for any defective work caused by his negligence in this respect.

3. If the survey control points are destroyed or if additional points are needed, the OWNER will furnish them to the CONTRACTOR, and the CONTRACTOR shall reimburse the OWNER for the additional expense of reestablishing the survey control points.

F. Supervisory Personnel

1. It is the intent of these specifications to provide a completed project, which will in every way reflect the work of competent journeymen in the various trades represented.

2. The CONTRACTOR shall insure that each portion of the work is supervised by a qualified person, well versed in the operation of the various tools required for the trade, the method in which the work is to be done, and knowledge of the general requirements of the construction work.

3. All work is to be done in accordance with the latest methods devised for such work to insure a professional appearance of the completed project.

1.4 MEETINGS

A. A Preconstruction Meeting will be held with OWNER, ENGINEER, QA Personnel, and all CONTRACTORS and their QC Personnel, and other stakeholders as requested by the OWNER to facilitate project schedule and coordination. CONTRACTOR shall submit preliminary schedule at Preconstruction meeting and provide weekly updates as work progresses. The State of Utah Division of Water Quality (DWQ) personnel may attend the Preconstruction meeting at their option. The meeting will be documented by the QA Inspector or ENGINEER on a Meeting Documentation form.

B. A Daily Progress Meeting will be held with attendance required by the CONTRACTOR, the QC Inspector, and the QA Inspector. The meeting will be documented by the QA Inspector on a Meeting Documentation form. The purpose of the meeting will be to:

- Review the previous day ' s work
- Review the work location and activities
- Discuss any problems

C. A Weekly Progress meeting will be held with attendance required by the CONTRACTOR, the QC Inspector, the QA Inspector, and OWNER. The ENGINEER and State of Utah DWQ personnel may attend at their option. The meeting will be documented by the QA Inspector on a Meeting Documentation form. The purpose of the meeting will be to:

- Review minutes of previous meetings.
- Review of Work progress and updated schedule.
- Field observations, problems, and decisions.
- Identification of problems that impede planned progress.
- Review of submittals schedule and status of submittals.
- Review of off-site fabrication and delivery schedules.
- Maintenance of progress schedule.
- Corrective measures to regain projected schedules.
- Planned progress during succeeding work period.
- Coordination of projected progress.
- Maintenance of quality and work standards.

- Effect of proposed changes on progress schedule and coordination.
- Other business relating to Work.

A Work Deficiency Meeting will be held if or when any work items are identified to be deficient. Attendance will be required by the CONTRACTOR, the QC Inspector, the QA Inspector, ENGINEER, and OWNER. The meeting will be documented by the QA Inspector on a Meeting Documentation form. The State of Utah DWQ personnel may attend at their option. The purpose of the meeting will be to:

- Review the Problem Identification/Corrective Measures Reports
- Review the Corrective Action Items
- Discuss any problems

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

PICACHO ASSOCIATES

SECTION 01300

SUBMITTALS

PART 1- GENERAL

1.1 SECTION INCLUDES

A. Submittal Procedures

B. Proposed Products List

C. Product Data

D. Certificates

E. Manufacturer' s Instructions

1.2 RELATED SECTIONS

A. Section 01011 - Summary of Project

B. Section 01039-Project Coordination and Meetings

C. Section 01500 -Temporary Controls

D. Section 01600 - Materials , Labor and Equipment

E. Section 01700 - Contract Closeout

1.3 SUBMITTAL PROCEDURES

A. Collect submittals from all manufacturers or suppliers to CONTRACTOR and provide to ENGINEER for written approval of products.

B. Identify manufacturer or supplier and reference appropriate drawing and/or specification location.

C. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

D. Obtain written approval of materials from ENGINEER prior to ordering from vendor.

E. When revised for resubmission, identify all changes made since previous submission.

F. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability

to comply with requirements.

1.4 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name and model number of each product. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

A. Product Data for Review:

1. Submitted to ENGINEER for review for the limited purpose of checking for conformance with Plans and Specifications

B. Submit one copy to OWNER.

C. Mark copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this project.

1.6 CERTIFICATES

A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, to the ENGINEER.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may include recent or previous test results on material or Product, but must be acceptable to ENGINEER.

1.7 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, installation and maintenance to CONTRACTOR and ENGINEER. ENGINEER will forward instructions to QA personnel.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

PART2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

PICACHO ASSOCIATES

SECTION 01500

TEMPORARY CONTROLS

PART I -GENERAL

1.1 SECTION INCLUDES

A. Site Safety

1.2 RELATED SECTIONS

A. Section 01011 - Summary of Project

B. Section 01039 -Project Coordination and Meetings

C. Section O1300 - Submittals

D. Section 01600- Materials, Labor and Equipment

E. Section 01700 - Contract Closeout

1.3 SITE SAFETY

A. The CONTRACTOR shall ensure that proper care is exercised to make the work safe at all times.

1. Materials, equipment or other obstructions shall not be strung or placed on or in any traveled roadways in a manner that will be hazardous to vehicles or personnel and shall provide and maintain at all times, and as directed by the OWNER for the protection of all traffic operating in work areas.

2. If in the operation of equipment, it becomes necessary to encroach upon the above mentioned traveled roadway or at any point that may be construed by the OWNER as dangerous to traffic or personnel, the CONTRACTOR shall place guards, at his expense, to direct and inform site persons of existing danger.

B. The CONTRACTOR shall be held responsible for any costs or schedule impacts through mishaps or accidents caused by his neglect or the neglect of any of his employees or agents in the performance of the work involved in the handling of this project work. No additional costs will be allowed by the OWNER for this added protection.

PART 2-PRODUCTS

Not Used

PART 3-EXECUTION

Not Used

END OF SECTION

PICACHO ASSOCIATES

SECTION 01600

MATERIALS, LABOR, AND EQUIPMENT

PART I-GENERAL

1.1 SECTION INCLUDES

A. CONTRACTOR Provided Materials, Labor, and Equipment

1.2 RELATED SECTIONS

A. Section 01011 - Summary of Project

B. Section 01039 - Project Coordination and Meetings

C. Section 01300- Submittals

D. Section 01500-Temporary Controls

E. Section 01700 - Contract Closeout

1.3 CONTRACTOR PROVIDED MATERIALS, LABOR, AND EQUIPMENT

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, supervision, etc., and all costs involved, necessary to complete the work required under this contract as specified, including all power required to power all tools and equipment used, such as gasoline, fuel, oil, electricity, etc.

B. All equipment, tools, machinery, etc. used shall be in good repair and shall be maintained in a good workable and safe condition necessary to continuously carry on the work involved in this project in a professional, expeditious and safe manner, without serious or costly delays in the performance of all phases of the work involved.

C. Use of any and all equipment and machinery on this project shall be in accordance with all applicable MSHA standards.

D. The CONTRACTOR shall provide all safety equipment at the CONTRACTOR' s expense.

E. No equipment or machinery shall be operated in or over paved streets or prepared roadway shoulders, in getting to, from or in working on this project that is equipped with treads or cleats that, in the opinion of the OWNER, may damage pavement or shoulder surfaces.

F. Any damage done under these circumstances shall be immediately repaired by the CONTRACTOR at CONTRACTOR' s expense.

G. If requested by the OWNER or the ENGINEER, the CONTRACTOR shall furnish a list of all equipment and machinery that he has of his own or that he has access to, which he proposes to use for this project. The CONTRACTOR shall state the present condition of equipment as to its fitness and safety on this type of work, together with a written statement as to the past experiences of those who will operate the various machines to be used, their qualifications and the previous experiences the CONTRACTOR has had in performing similar work as that required under this contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

PICACHO ASSOCIATES

SECTION 01700

CONTRACT CLOSEOUT

PART I-GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Project record documents.

D. Warranties and bonds.

1.2 RELATED SECTIONS

A. Section 01011 - Summary of Project

B. Section 01039 - Project Coordination and Meetings

C. Section 01300- Submittals

D. Section 01500 -Temporary Controls

E. Section 016 00 - Materials, Labor and Equipment

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for OWNER and ENGINEER' s review.

B. Provide to OWNER all Project Record Documents.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 5 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents ; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Product Data, and Samples.
   6. Manufacturer's instruction for installation, and repairing.
   7. All documents specified in the project QA/QC Plan.

B. Ensure entries are complete and accurate, enabling future reference by OWNER.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section, a description of actual Products installed, including the following:
   1. . Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings [and Shop Drawings]: Legibly mark each item to record actual construction including:
   I. Measured horizontal and vertical locations of underground installations, referenced to permanent surface improvements.
   2. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

G. Submit documents to OWNER with claim for final Application for Payment

1.6 WARRANTIES AND BONDS

A. Provide notarized copies.

B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers. Provide Table of Contents and assemble in ring binder with durable cover.

C. Submit prior to final Application for Payment.

D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

DIVISION 2 - SITE WORK

SECTION 02200

SITE PREPARATION

PART 1 - GENERAL

1.1 1 SECTION INCLUDES

A. Definitions

B. Quality Assurance

C. Project Conditions

D. Sequencing and Scheduling

1.2 RELATED SECTIONS

A. Section 02300 - Earthwork

B. Section 02400 - Subgrade Preparation

C. Section 02714 - Geotextile Fabric

D. Section 02771- 60-mil HDPE

1.3 DEFINITIONS

A. Clearing: Consists of removal of natural obstructions and existing foundations, buildings, fences, lumber-walls, stumps, brush, weeds, rubbish, trees, boulders, utility lines, and any other items which interferes with construction operations or are designated for removal.

B. Grubbing: Consists of the removal and disposal of wood or root matter below the ground surface remaining after clearing and includes stumps, trunks, roots, or root systems greater than l inch in diameter or thickness to a depth of 6 inches below the ground surface.

C. Stripping: Includes the removal and disposal of all organic sod, topsoil, grass and

grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. The depth of stripping is estimated to be 6 - 12 inches, but the required depth of stripping will be determined by the ENGINEER. All stripped topsoil materials shall be delivered and stored in a stockpile area designated by the OWNER for future use in reclamation.

1.4 QUALITY ASSURANCE

A. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.

B. Meetings: Attend meetings with all parties as described in Specification 010039 Section 1.4.

1.5 PROJECT CONDITIONS

A. Existing conditions:
   1. Verify character and amount of clay, sand, gravel, quicksand, water, rock, hardpan, and other material involved and work to be performed.

1.6 SEQUENCING AND SCHEDULING

A. Clearing and grubbing: Perform clearing and grubbing in advance of grading operations.

PART 2-PRODUCTS

Not Used.

PART 3-EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine site and verify existing conditions before beginning work.

3.2 PREPARATION

A. Protect existing improvements from damage by site preparation work.

3.3 INSTALLATION

A. Clearing:
   1. Clear areas where construction is to be performed, including borrow areas and other areas as indicated on the Drawings, or specified in this Section, of topsoil,

stumps, brush , roots, weeds, trees , shrubs , rubbish, and other objectionable material of any kind which , if left in place, would interfere with proper performance or completion of the work , would impair its subsequent us e, or form obstructions. Borrow area topsoil shall be stockpiled in an area designated by the OWNER.

2. It is the CONTRACTOR' s responsibility to determine the effort needed to remove shrubs, brush, rocks, and objectionable materials required for construction activities.
3. Do not incorporate organic material from clearing and grubbing operations infills and backfills.
4. CONTRACTOR's construction facilities: Fill or remove pits, fill, and other earthwork required for erection of facilities, upon completion of the work, and level to meet existing contours of adjacent ground.

B. Grubbing:

1. From ITDF basin area:

a. Grub stumps, roots, and other obstructions 1 inch to 3-inches in diameter or thickness to 6 inches below grade.

b. Grub stumps or roots 3 inches or over in diameter to depth of not less than 18 inches below finish grade.

c. Sharp rocks or other deleterious materials that could perforate the liner shall not be in contact with the liner material. Remove material or grade area such that deleterious material is covered by 6 inches of compacted site soils, or place bedding in areas as directed by ENGINEER.

2. In embankment areas or other areas to be cleared outside construction area: Do not leave stumps, roots, and other obstructions higher than the following requirements:

Height of Embankment over Stump	Depth of Clearing and Grubbing
0 feet to 2 feet	Grub stumps or roots 3 inches or over in diameter to 18 inches below original grade. Cut others flush with ground.
2 feet to 3 feet	Grub stumps 1foot and over in diameter to l8 inches below original grade. Cut others flush with ground.
Over 3 feet	Leave no stumps higher than stump top diameter, and in no case more than 18 inches.

3. Backfill and compact cavities left below subgrade elevation by removal of stumps or roots to density of adjacent undisturbed soil.

C. Stripping:

1. Remove soil material containing sod, grass, or other vegetation to depth of 6 - 12 inches from both borrow areas and areas to receive fill.

1. Deposit stripped material at locations as directed by OWNER.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 — General

Description of Work

The Contractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary to perform all Earthwork. The work shall be carried out as specified herein and in accordance with the Drawings.

The Work shall include, but not be limited to excavating, loading, hauling, placing, moisture conditioning, backfilling, compacting, grading, and preparing subgrade.

Earthwork shall conform to the dimensions, lines, grades and sections shown on the Drawings or as directed by the Engineer.

RELATED SECTIONS

Section 02200 – Site Clearing

Section 02714 – Geotextiles

Section 02771 – Geomembranes

Section 02711 – Piping

REFERENCES

The publications listed below form part of this Section. Each publication shall be the latest revision or addendum in effect at the date of the contract award, unless otherwise noted. Except as specifically modified by the requirements specified herein or the details on the DRAWINGS, the Work included under this Section shall conform to the applicable provisions of these publications.

Design of the work is based upon the ASTM International (ASTM), American Association of State Highway and Transportation Officials (AASHTO) and United States Army Corps of Engineers (USACE) standards.

ASTM International (ASTM), latest versions:

ASTM C33 – Standard Specification for Concrete Aggregates

ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C117 – Standard Test Method for Materials Finer than 75-□m (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C127 – Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

ASTM C131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C535 – Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM D75 – Standard Practice for Sampling Aggregates

ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

ASTM D1140 – Standard Test Methods for Determining the Amount of Material Finer than 75-□m (No. 200) Sieve in Soils by Washing

ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D4221 – Standard Test Method for Dispersive Characteristics of Clay Soil by Double Hydrometer

ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM D4555 – Standard Test Method for Determining Deformability and Strength of Weak Rock by an In Situ Uniaxial Compressive Test

ASTM D4647 – Standard Test Methods for Identification and Classification of Dispersive Clay Soils by the Pinhole Test

ASTM D5030 – Standard Test Methods for Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit

ASTM D5080 – Standard Test Method for Rapid Determination of Percent Compaction

ASTM D5519 – Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials

ASTM D5731 – Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications

ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

American Association of State Highway and Transportation Officials (AASHTO), latest version:

AASHTO T96 – Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

U.S. Army Corps of Engineers (USACE):

EM 1110-2-2301 – Engineering and Design Test Quarries and Test Fills

Design DRAWINGS.

Construction Quality Assurance (CQA) Plan.

DEFINITIONS

Borrow: Material excavated on the site or taken from designated borrow areas.

Coverage: One coverage is defined as the result of successive passes by a piece of compaction equipment, which by means of sufficient overlap, to ensure that all areas of the layer or lift being compacted have been subjected to one pass of the compaction equipment.

Embankment: All portions of the dam embankments.

Fines: Material passing the 0.075 mm (No. 200) sieve.

Lift: An individual layer of embankment materials placed on the prepared embankment surface (or prepared foundation surface in the case of the first lift) at the specified thickness and compacted in the specified manner or to the specified end product before placing the next layer (lift).

Lift Thickness: The thickness that embankment materials are to be placed before being compacted with specified compaction effort.

Maximum Dry Density: The maximum dry unit weight of a soil by a given compactive effort.

Optimum Moisture Content: The water (moisture) content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.

Percent Compaction: The ratio, expressed as a percentage, of the dry unit weight of a soil, to the maximum dry unit weight obtained in a laboratory compaction test at optimum moisture content.

Suitable Material: Imported material or material excavated from cut areas that meet the SPECIFICATION requirements for use in constructing fills and has been approved by the ENGINEER.

Unsuitable Material: Material that contains waste, debris, roots, organic matter, frozen matter, or any other materials determined by the ENGINEER to not meet the SPECIFICATIONS for any embankment zone or required fill, or any material not approved by the ENGINEER. Unsuitable material includes all material containing unbroken masses of earth materials which might arch or bridge and leave pockets or voids.

Well-Graded: A mixture of particle sizes that has no specific concentration, or lack thereof, of one or more sizes. A material type that, when compacted, produces a strong and relatively incompressible soil mass with a minimum of voids.

PRE-CONSTRUCTION SUBMITTALS

The Contractor shall submit a detailed construction plan for each earthwork activity at least fourteen (14) days in advance of the start of each earthwork activity covered in this Section. The plan shall be approved by the ENGINEER prior to commencing any earthwork activities. The construction plan shall, at a minimum, include the following:

Proposed borrow source(s) and proposed method(s) of sampling borrow source(s) for acceptance.

Proposed methods of loading and transporting (conveying or hauling) material from stockpile areas, including proposed haul routes.

Proposed soil processing, placement, compaction, and moisture control equipment, including:

Equipment schedule with weight, dimensions and operating data.

Proposed work schedule.

Proposed methods of protecting work (to include temporary pumping, drainage, irrigating, and moisture conditioning measures).

Transport of on-site and off-site materials.

The interrelationships among operations, including preparation of the embankment foundation; filter and drain construction; geomembrane subgrade preparation; geomembrane placement; embankment construction; and excavation dewatering (if needed); among others.

The equipment types and number of pieces of each type.

The use of and location(s) of stockpiles.

If the work of this Section is interrupted for reasons other than inclement weather, the CONTRACTOR shall notify the ENGINEER, OWNER, and CQA MONITOR(S) a minimum of 24 hours prior to the resumption of work.

TOLERANCES

Limits of excavation, Embankment Fill, Filter Material, Drain Gravel, Riprap, Anchor Trench Fill, and Pipe Bedding Material for site construction are defined by the lines and elevations shown on the DRAWINGS. All fill shall be placed to the minimum thicknesses shown on the DRAWINGS.

Finished grades shown on the DRAWINGS are given in feet and shall slope uniformly between given spot and contour elevations, without sags or humps. All grades shall provide for natural runoff.

Embankment fill zones shall be maintained at approximately the same level, both parallel and perpendicular to the dam embankment axis, except as indicated in the DRAWINGS.

Correction of over-excavation and backfilling shall be to CONTRACTOR's account.

The elevations and widths of the crest of the embankments shall not be less than the dimensions and elevations indicated on the DRAWINGS.

The CONTRACTOR shall ensure that subsurface drainage, toe drains and surface water channels maintain positive drainage without sags or humps.

SEQUENCING AND SCHEDULING

CONTRACTOR shall provide at least 24 hours of advance notice to the OWNER prior to sampling materials for potential use in Work.

CONTRACTOR shall provide at least 24 hours of advance notice to the OWNER when ready for testing and inspection.

CONSTRUCTION QUALITY ASSURANCE

All Work shall be monitored and tested in compliance with the requirements of the Earthworks CQA Plan.

CONTRACTOR shall be aware of all testing activities outlined in the CQA Plan and shall account for these activities in the construction schedule.

All CQA soils testing (both field and laboratory testing) will be the responsibility of the ENGINEER and the CQA MONITOR(S), as identified in the Earthworks CQA Plan. CONTRACTOR shall be responsible for cooperating with CQA MONITOR(S) during all testing activities. CONTRACTOR shall provide equipment and labor to assist CQA MONITOR(S) in sampling, if requested, and shall also provide access to all areas requiring testing activities. Quality Control testing shall be the responsibility of the CONTRACTOR, unless otherwise indicated.

Excavation, backfill and grading operations shall be carried out under the observation of the ENGINEER or CQA MONITOR(S).

Any work found unsatisfactory, or any work disturbed by subsequent operations before acceptance is granted shall be corrected by the CONTRACTOR, at its sole cost.

FIELD TESTING

Construction Quality Control (CQC) testing is the responsibility of the CONTRACTOR. The CONTRACTOR shall arrange an approved independent laboratory for the tests. Corrective action required due to failing tests and the cost to retest work shall be performed at no additional cost to the OWNER. CQC testing may be performed at the stockpile prior to use as fill, or at the placement location.

Construction Quality Assurance (CQA) field testing will be performed by the ENGINEER at the placement location. Where any non-conformance is revealed, further testing will be performed to delineate the limits of non-conformance and required corrective measures. Corrective measures, to the extent of complete replacement of material, shall be made by the CONTRACTOR until conformance is achieved, at no cost to the OWNER.

PRODUCTS

GENERAL

Fill materials comprise soils, gravels, or rockfill approved by OWNER and ENGINEER. Considerable variability in the nature of the borrow materials exists, and the CONTRACTOR assumes all responsibility for becoming familiar with the nature, moisture content, texture and percentage of oversize materials; the difficulties of excavation, of breaking down or removing the oversize materials; and of obtaining satisfactory moisture content.

EMBANKMENT FILL

Embankment Fill shall consist of inorganic structural rockfill used in the construction of embankments.

Materials used for Embankment Fill shall be obtained from the OWNER and subject to the approval of the ENGINEER. Planned sources of Embankment Fill include mine rock obtained from mining of the open pit, processed overburden soils, or other suitable borrow sources on site, as approved by OWNER and ENGINEER.

The CONTRACTOR will be responsible for excavating, sorting suitable from unsuitable materials, and loading, transporting, placing, moisture conditioning (where required) and compacting Embankment Fill material.

Embankment fill shall meet the following gradation and plasticity criteria:

Size	Percent Passing
12-inch	100
8-inch	65 – 100
2-inch	0 – 30
No. 200 Sieve (0.075 mm)	0 - 15

Plasticity Index: Non-plastic

Embankment Fill material shall have a maximum particle size of 21 inches or sixty-seven (67) percent of the approved lift height, whichever is smaller, unless otherwise approved by ENGINEER.

Rockfill material shall be inert, hard and durable with a minimum uniaxial compressive strength of 5,000 psi and no more than 45 percent loss during the Los Angeles Abrasion test.

FILTER MATERIAL

Filter Material shall consist of processed material conforming to these SPECIFICATIONS to be used as an interface material between the Drain Gravel and geomembrane, and elsewhere as shown on the DRAWINGS. Material used shall be subject to the approval of the ENGINEER.

The Filter Material shall be angular, durable, crushed, processed and screened, and shall conform to the following gradation requirements:

Sieve Size	Percent Passing
9.5 mm	100
No. 4 (4.75 mm)	90 – 100
No. 8 (2.36 mm)	70 – 100
No. 16 (1.18 mm)	50 – 85
No. 30 (0.6 mm)	25 – 60
No. 50 (0.3 mm)	5 – 40
No. 100 (0.15 mm)	0 – 20
No. 200 (0.075 mm)	0 – 5

Plasticity Index: Non-plastic

The CONTRACTOR will be responsible for manufacturing, loading, transporting, placing, processing and compacting Filter Material.

Filter material shall conform with ASTM C33 requirements for Abrasion and Magnesium Sulfate Soundness.

The fraction of the Filter Material finer than the 0.075 mm (U.S. Standard No. 200) sieve shall be classified as non-plastic based on Atterberg limits (ASTM D4318).

DRAIN GRAVEL

Drain Gravel material shall consist of free-draining, processed rock material conforming to these SPECIFICATIONS to be used as an interface material between the Embankment Fill and Filter Drain, and elsewhere as shown on the DRAWINGS. The CONTRACTOR will be responsible for manufacturing/ sourcing, processing, loading, transporting, placing and compacting Drain Gravel material.

Drain Gravel material shall be well-graded, angular, durable, crushed, processed and screened, and shall conform to the following gradation requirements:

Drain Rock Type 1	
Sieve Size	Percent Passing
8 inch	100
2 inches mm	60 – 95
No. 4 (4.75 mm)	15 – 40
No. 200 (0.075 mm)	0 – 10

Plasticity Index: Non-plastic

Drain Rock Type 2	
Sieve Size	Percent Passing
1/2 inch	100
No. 4 (4.75 mm)	15 – 40
No. 200 (0.075 mm)	0 – 10

A. Drain Gravel material shall conform with ASTM C33 requirements for Abrasion and Magnesium Sulfate Soundness.

The fraction of the Drain Gravel material finer than the 0.075 mm (U.S. Standard No. 200) sieve shall be classified as non-plastic based on Atterberg limits (ASTM D4318).

ANCHOR TRENCH FILL

Anchor Trench Fill material shall generally consist of the materials excavated from the geomembrane anchor trenches. CONTRACTOR shall remove rocks greater than 2 inches from the Anchor Trench Fill prior to placement of the material as backfill in the anchor trench.

PIPE and Liner BEDDING MATERIAL

Pipe/Liner Bedding Material shall consist of material from a borrow source approved by the ENGINEER and shall be used to backfill around pipes and under HDPE geomembrane liner as indicated in the DRAWINGS. Pipe/Liner bedding will be produced by others.

Pipe/Liner Bedding Material shall conform to the following minimum SPECIFICATIONS:

Sieve Size	Percent Passing
.5 in	100
No. 4 (4.75 mm)	30 – 100
No. 200 (0.075 mm)	5 – 20

Plasticity Index: 15 maximum.

EQUIPMENT

All equipment and tools used in the performance of the Work are subject to review by the ENGINEER and OWNER before the Work is started.

The CONTRACTOR may use any type of earthmoving or excavating equipment unless otherwise noted in the SPECIFICATIONS, provided the equipment is in a satisfactory condition, complies with applicable rules and regulations, is of such capacity that the construction schedule can be maintained as planned by CONTRACTOR, and is approved by OWNER.

The CONTRACTOR shall provide equipment for mixing, aerating and moisture-conditioning the fill materials.

The CONTRACTOR shall provide equipment for applying water of a type and quality adequate for the Work, free of leaks and equipped with a distributor bar or other approved device to ensure uniform application.

Compaction equipment shall conform to the MANUFACTURER's specifications and shall be maintained in good working conditions at all times. Equipment shall operate at speeds needed to achieve the minimum specified density and to create a stable, compacted mass.

EXECUTION

GENERAL

Prior to implementing any of the Work in this Section, the CONTRACTOR shall become thoroughly familiar with the site, the site conditions, and all portions of the Work falling within this and other related Sections.

Schedule Work to minimize impact to ongoing OWNER operations, traffic, utilities and other Contract Work being completed. Coordinate all necessary interruptions with OWNER.

Obtain OWNER approval for all temporary facilities and temporary construction access/haul road layouts prior to the start of construction.

Maintain roadways, ditches and channels in a well-drained condition at all times. Provide adequate drainage ditches, berms and culverts to direct runoff to natural drainage channels and limit ponding. Performing blading or leveling operations when placing fill and during the process of excavation except if the excavation is in rock or areas where leveling is not practical or necessary.

Control and conduct all operations including, but not limited to, transporting, stockpiling and placing materials to minimize contamination, segregation and particle breakdown.

Excavate and place fill to the lines, grades and cross-sections shown on the DRAWINGS and written field clarifications by the ENGINEER to within tolerances shown on the DRAWINGS or stated within this Section.

Finish the surface of all excavations, subgrades and fills to a smooth surface free from irregularities, with uniform transitions made to adjacent areas. Grading shall direct any surface runoff away from the Work area and toward approved drainage systems or impoundments.

All excavation, backfill and grading operations shall be carried out under the observation of ENGINEER or CQA MONITOR.

EXCAVATION

CONTRACTOR shall perform excavation to the lines and grades shown on the DRAWING, or as directed by the ENGINEER. No excavation shall begin until the CONTRACTOR has provided construction staking for the proposed Work.

CONTRACTOR shall prevent the disturbance of surrounding areas during excavation. Where selective excavations are required to obtain materials for fill, the material removed from the excavations shall be taken directly to the fill areas or, if required, stockpiled by material types. The stockpiles shall be approved by the OWNER and ENGINEER.

CONTRACTOR shall grade all excavations to ensure grades are maintained to provide adequate drainage at all times. Work shall be suspended by CONTRACTOR when, in the opinion of the ENGINEER, the site is overly wet, muddy or otherwise unsuitable for proper maintenance, until directed otherwise by the ENGINEER, at no cost to OWNER. CONTRACTOR may elect to stabilize overly wet, muddy or otherwise unsuitable areas to allow Work to continue, at no expense to the OWNER.

The CONTRACTOR will be responsible for the safety of temporary construction slopes.

CONTRACTOR shall inspect all temporary and permanent open-cut excavations on a regular basis for signs of instability. Should signs of instability be noted, CONTRACTOR shall immediately undertake remedial measures and shall notify OWNER. Permanent cut slopes shall be left in smooth, safe, and stable condition at the end of the workday.

All excavated materials not used for fill shall be stockpiled in accordance with Article 3.3 of this Section.

STOCKPILING

Soil shall be stockpiled in areas designated by the OWNER and shall be free of incompatible soil, clearing debris, or other objectionable materials.

Stockpiles shall be no steeper than 3H:1V (horizontal: vertical) or other slope approved by the ENGINEER, graded to drain, sealed by tracking parallel to the slope with a dozer or other means approved by the CQA MONITOR, and dressed daily during periods when fill is taken from the stockpile.

The CONTRACTOR shall employ temporary erosion and sediment control measures

SUBGRADE PREPARATION AND FOUNDATION ACCEPTANCE

Fill materials shall not be placed on any portion of the foundation until the foundation has been inspected and accepted by the CQA MONITOR(S) and/or ENGINEER. The CQA MONITOR(S) and/or OWNER shall be provided with advanced notice of the CONTRACTOR's intended foundation cleaning and placement of all embankment materials to permit inspection.

The OWNER and/or CQA MONITOR(S) will inspect and approve the exposed subgrade prior to any fill or geosynthetics being placed to confirm that the surface of the subgrade is smooth and free of debris, grade stakes, large rocks, roots, branches, vegetation, mud or cracks larger than one half inch in width.

CONTRACTOR is responsible for maintaining subgrades in a condition satisfactory to ENGINEER. CONTRACTOR shall protect prepared subgrades, including previously-approved subgrade, from weather, construction equipment, or other factors. Subgrade surfaces, including previously-approved subgrade, that become softened or otherwise unsuitable for placement of fill, shall be repaired to the satisfaction of ENGINEER and OWNER, at no cost to OWNER.

Prior to placement of fill materials, CONTRACTOR shall scarify all in-situ materials to a depth of 6-inches, unless otherwise noted, moisture condition, and recompact the subgrade. Compactive effort shall be adequate to obtain a minimum of ninety-five (95) percent of the maximum dry density as determined by the Standard Proctor test (ASTM D698) for the particular fill material. Moisture conditioning shall be adequate to achieve a uniform moisture and density. If rock is encountered, the CONTRACTOR shall prepare the subgrade by removing loose rock fragments until competent foundation material is encountered, as approved by ENGINEER.

If the underlying material is unsuitable to permit proper compaction of the subgrade, CONTRACTOR shall loosen, aerate (or excavate and remove), and recompact the subgrade until the top layer can be compacted as required. The recompacted surface shall then be scarified, as needed, to provide a good bond between the foundation and overlying fill or geosynthetic materials.

FILL PLACEMENT AND COMPACTION

General:

No fill materials shall be placed until the foundation and subgrade preparations have been completed as specified herein, in Article 3.4 of this Section. The procedures for fill placement shall be approved by the OWNER and ENGINEER prior to the start of fill placement.

No organic soil, brush, roots, sod or other deleterious or unsuitable materials shall be incorporated in the fills. The suitability of all materials intended for use as fill shall be subject to approval by the OWNER and ENGINEER. Fill placement shall be temporarily stopped by CONTRACTOR due to weather conditions or if materials and installation do not meet the SPECIFICATIONS at no cost to OWNER.

The distribution of materials shall be such that the fill is free from voids, lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. The composition of a fill shall be as described in Part 2 of this Section.

If the surface of the prepared foundation or the surface of any layer where fill materials will be placed is too dry or too smooth to bond properly with the layer of material to be placed thereon, the surface shall be moisture-conditioned and/or worked with a harrow, scarifier, disc or other suitable equipment to provide a satisfactory bonding surface before fill material is placed thereon.

If the surface of the prepared foundation or the rolled surface of any layer is excessively wet for fill materials to be placed thereon, it shall be removed and allowed to dry or worked with a harrow, scarifier, disc or other suitable equipment to reduce the moisture content to an acceptable level, or stabilized by other approved means, to meet project SPECIFICATIONS as determined by the OWNER and ENGINEER. It shall then be compacted before the next layer of fill material is placed. Determination of such dry or wet conditions shall be made by the ENGINEER.

When fill materials are too dry for proper compaction, CONTRACTOR shall spray water on each layer of the fill and shall work the moisture into the fill by harrowing or other approved means, until a uniform distribution of moisture is obtained. Material that is too wet for proper compaction, as determined by the ENGINEER, shall be removed from the fill and/or spread out and permitted to dry, assisted by disking and harrowing or mixing in dry material when permitted by the ENGINEER, if necessary, until the moisture content is reduced to an amount suitable for obtaining the specified degree of compaction, at no cost to OWNER.

CONTRACTOR shall apply water required for moisture conditioning on the fill or in the borrow areas.

Prior to mixing of wet and dry material on the fill to obtain the proper moisture content, approval shall be obtained from the ENGINEER. Mixed material shall have a uniform distribution of the moisture content prior to placement on the subsequent lift.

CONTRACTOR shall maintain fill materials within the moisture content range required to permit proper compaction to the specified density with the equipment being used. The moisture content of the fill materials, prior to and during compaction, shall be uniform throughout each layer of the material.

After each layer of fill has been placed, spread and moisture-conditioned, the layer shall be compacted by passing compaction equipment over the entire surface of the layer a sufficient number of times to obtain the required density, as specified herein.

Compaction shall be accomplished with equipment and by methods approved by OWNER or ENGINEER. If such equipment or methods are found unsatisfactory for the intended use, CONTRACTOR shall replace the unsatisfactory equipment with other types or adjust methods until proper compaction is achieved.

Placement, spreading and compaction for embankment construction shall be performed parallel to the embankment axis, unless otherwise specified by the ENGINEER. Materials shall be placed and spread over the surface of the underlying compacted fill.

Coverage of the compaction equipment shall be carried out so that the compactive effort is uniformly distributed in a systematic manner over the entire lift. Compaction of individual lanes of a lift shall be completed before beginning compaction of adjacent portions of the lift. When using rollers that have drums laterally separated, the uncompacted center portion of the roller path shall not be compacted until the outer portions of the path have been fully compacted. Individual lanes shall be overalapped by at least 1 foot.

It is the CONTRACTOR's responsibility to prevent materials from adjacent zones from being tracked or otherwise deposited onto the filters or drains.

Equipment crossings shall be limited to no more than two downstream and any given level of the embankment to reduce the number of areas affected by particle breakdown and contamination. At equipment crossings, place a protective covering to prevent damage to, or displacement of, underlying materials. Prior to placing materials at equipment crossings, the protective covering (including the fill material) and all contaminated, crushed or otherwise damaged materials shall be removed and replaced in the crossing areas using acceptable materials at no cost to the OWNER. All removed material shall be hauled to and placed in designated disposal areas. Equipment crossings shall be staggered or distributed to avoid being aligned vertically.

When test results indicate that compaction, water content or relative compaction is not in conformance with specified limits, the CONTRACTOR shall make immediate adjustments in procedures as necessary to conform to the specified limits. Re-working to attain the specified limits may include removal, re-handling, reconditioning, re-rolling, or a combination of these procedures. The CONTRACTOR shall perform all re-work required to achieve the specified compaction water content and relative compaction at no cost to the OWNER.

EMBANKMENT FILL

CONTRACTOR shall condition, place and compact Embankment Fill by a method specification technique with placement in controlled engineered lifts and compaction effort applied by construction traffic or by drum-drive smooth-drum vibratory compactors. The specifics of the method specification, including the lift thickness, will be dependent on test fill(s) constructed by the CONTRACTOR and on the available construction equipment. The test fill(s) shall be conducted in general accordance with the U.S. Army Corps of Engineers EM 110-2-2301.

It is recommended that the minimum size of compaction equipment consist of a minimum 15 ton (static drum weight) vibratory smooth-drum compactor. The number of passes and loose lift thickness shall be subject to the size of compaction equipment used and to the approval of the ENGINEER. The method specifications may be changed at any time, at the discretion of the ENGINEER, based upon changes in material characteristics, field conditions, and/or compaction equipment, at no additional cost to OWNER.

It is expected that Embankment Fill rockfill material compaction will consist of haul truck traffic and a minimum of four (4) passes of an approved smooth drum vibratory roller of adequate weight and size to achieve the specified degree of compaction. The number of passes may be modified based on the results of the test fill(s), as approved by the ENGINEER. The moisture content of rockfill material shall be reasonably uniform throughout each layer of material placed prior to and during compaction. Water in an amount equal to 20 percent of the volume of the fill shall be added to the material at the fill area prior to compaction by uniform spraying from a water truck. The required amount of water may be modified based on results of the test fill, as approved by the ENGINEER.

The CONTRACTOR shall handle and place Embankment Fill material in such a manner as to avoid segregation and particle contact between large particles (>150 mm) within the fill.

During Embankment Fill material placement, the CONTRACTOR shall trim the face to remove spoil and loose rock from contaminating or creating a coarse rock zone at the contacts with the adjacent zones.

FILTER MATERIAL

Prior to initiation of placement of Filter Material in the drainage zones, CONTRACTOR shall submit their proposed placement procedures and methodology to OWNER and ENGINEER as specified in Article 1.5 of this Section.

CONTRACTOR shall control and conduct all operations including, but not limited to, transporting, stockpiling, excavating, producing and placing the materials to minimize contamination, segregation, and particle breakdown.

CONTRACTOR shall place Filter Material according to a method specification subject to the approval of ENGINEER. The preliminary method specification shall be as follows:

Place Filter Material in continuous lifts no more than 300 mm in compacted thickness.

The material as placed and compacted shall be free from segregation and free of unsuitable materials. Moisture condition the Filter Material prior to compaction, as appropriate, maintaining the moisture content required to achieve satisfactory compaction. Use

moisture addition procedures during compaction as approved by the ENGINEER.

Compact Filter Material with a minimum of two (2) passes of an approved smooth-drum vibratory roller with a static drum weight between 8 and 12 tons to achieve a target relative density between 70 and 80%. The number of passes may be modified based on the results of a test fill completed at the start of the embankment construction and/or as approved by the ENGINEER. Excessive compaction of the Filter Material that could result in particle breakdown is prohibited.

CONTRACTOR shall minimize the amount of traffic over the Filter Material and prevent soils from adjacent zones from being tracked onto the Filter Material. Remove and replace Filter Material containing unsuitable material.

CONTRACTOR shall rework materials that have not been placed in accordance with these SPECIFICATIONS. Reworking may include removal, re-handling, re-compaction, or a combination of these procedures, as required by the ENGINEER.

Stop Filter Material placement temporarily during unsuitable weather conditions, as directed by the OWNER or ENGINEER.

DRAIN GRAVEL

Prior to initiation of placement of Drain Gravel, CONTRACTOR shall submit their proposed placement procedures and methodology to OWNER and ENGINEER as specified in Article 1.5 of this Section.

CONTRACTOR shall control and conduct all operations including, but not limited to, transporting, stockpiling, excavating, producing, and placing the materials to minimize contamination, segregation, and particle breakdown.

CONTRACTOR shall place Drain Gravel according to a method specification subject to the approval of ENGINEER. The preliminary method specification shall be as follows:

Place Drain Gravel in continuous lifts no more than 2-feet in compacted thickness.

The materials as placed and compacted shall be free from segregation and free of unsuitable materials. Use moisture addition procedures during compaction as approved by the ENGINEER.

Compact Drain Gravel with two (2) passes of an approved smooth-drum vibratory roller with a static drum weight between 8 and 12 tons. The number of passes may be modified based on the results of a test fill completed at the start of the embankment construction and/or as approved by the ENGINEER. Excessive compaction of the Drain Gravel that could result in particle breakdown is prohibited.

CONTRACTOR shall minimize the amount of traffic over Drain Gravel and prevent soils from adjacent zones from being tracked onto the Drain Gravel. Remove and replace Drain Gravel containing unsuitable material.

CONTRACTOR shall rework materials that have not been placed in accordance with these SPECIFICATIONS. Reworking may include removal, re-handling, re-compacting, or a combination of these procedures, as required by the ENGINEER.

Stop Drain Gravel placement temporarily during unsuitable weather conditions, as directed by the OWNER or ENGINEER.

ANCHOR TRENCH FILL

CONTRACTOR shall supervise the anchor trench excavation for conformance to the lines, grades, and width shown on the DRAWINGS, prior to liner system placement. The CQA MONITOR shall verify that the anchor trench has been constructed according to the DRAWINGS. Anchor trenches will not be excavated more than seven (7) days ahead of geosynthetics installation and will be backfilled within two (2) days of geosynthetics deployment. Seams within limits of the anchor trench do not require CQC/CQA testing, and backfilling of anchor trenches should not be delayed for CQC or CQA activities.

Rounded corners shall be provided in the trench where the geosynthetic materials adjoin the trench so as to avoid sharp bends in the geosynthetics materials.

The anchor trench shall be backfilled and compacted with a method specification as approved by the ENGINEER. Anchor Trench Fill material shall be placed in 8 to 12-inch thick loose lifts and compacted by wheel rolling with light, rubber-tired or other light compaction equipment. Anchor Trench Fill material shall be compacted to ninety-two (92) percent of the maximum dry density (as determined by the Standard Proctor tests) at plus or minus two (2) percent of optimum moisture content (ASTM D698), unless specifically approved otherwise by the ENGINEER.

Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. At no time shall construction equipment come into direct contact with the geomembrane. If damage occurs, it shall be repaired by the CONTRACTOR prior to the completion of backfilling.

PIPE BEDDING MATERIAL

Prior to initiation of placement of Pipe Bedding Material, CONTRACTOR shall submit their proposed placement procedures and methodology to OWNER and ENGINEER as specified in Article 1.5 of this Section.

CONTRACTOR shall control and conduct all operations including, but not limited to, transporting, stockpiling, excavating, producing, and placing the materials to minimize contamination, segregation, and particle breakdown.

CONTRACTOR shall place Pipe Bedding Material according to a method specification subject to the approval of ENGINEER. The preliminary method specification shall be as follows:

Place Pipe Bedding Material in maximum 6-inch loose lifts.

Pipe Bedding Material shall be hand-placed under the haunches of high density polyethylene (HDPE) piping. All HDPE drain pipes shall be protected from lateral displacement and

possible damage resulting from superimposed backfill loads, impact, or unbalanced loading during fill placement operations.

Compact Pipe Bedding Material using special compaction equipment as approved by the ENGINEER. No equipment shall be used which by its weight or movement will damage, move or tilt out of alignment any part of the pipe or structure above, adjacent, or below the ground surface.

CONTRACTOR shall minimize the amount of traffic over Pipe Bedding Material and prevent soils from adjacent zones from being tracked onto the Pipe Bedding Material. Remove and replace Pipe Bedding Material containing unsuitable material.

Stop Pipe Bedding Material placement temporarily during unsuitable weather conditions, as directed by the Owner or ENGINEER.

When Pipe Bedding Material is placed in drains, the CONTRACTOR will not be permitted to drop the material out of the loader bucket to fall onto the piping. All Pipe Bedding Material will be placed into the drains either by hand or from a maximum height of 2-feet.

LINER BEDDING MATERIAL

Prior to initiation of placement of Liner Bedding Material, CONTRACTOR shall submit their proposed placement procedures and methodology to OWNER and ENGINEER as specified in Article 1.5 of this Section.

CONTRACTOR shall control and conduct all operations including, but not limited to, transporting, stockpiling, excavating, producing, and placing the materials to minimize contamination, segregation, and particle breakdown.

CONTRACTOR shall place Liner Bedding Material according to a method specification subject to the approval of ENGINEER. The preliminary method specification shall be as follows:

Place Liner Bedding Material in maximum 6-inch loose lifts.

Compact Liner Bedding Material using special compaction equipment as approved by the ENGINEER. No equipment shall be used which by its weight or movement will damage, move or tilt out of alignment any part of the pipe or structure above, adjacent, or below the ground surface.

CONTRACTOR shall minimize the amount of traffic over Liner Bedding Material and prevent soils from adjacent zones from being tracked onto the Pipe Bedding Material. Remove and replace Pipe Bedding Material containing unsuitable material.

Stop Liner Bedding Material placement temporarily during unsuitable weather conditions, as directed by the Owner or ENGINEER.

TEST FILL PROGRAM

The purpose of the test fill program is to determine the optimal number of compaction passes, lift thickness, moisture conditioning and equipment required to construct a stable mass. The test

fill shall be constructed using material in which a moisture-density relationship cannot be determined using ASTM D698. Construct the test fill using the following procedures:

Clear and grub foundation area in accordance with SPECIFICATION Section 311000 (Site Clearing).

Prepare and compact foundation area in accordance with this SPECIFICATION.

Construct the test fill using the same placement, moisture conditioning, compaction methods and equipment in which the CONTRACTOR proposes to use to construct the permanent fills.

Mark and survey a minimum of five locations along each side of the top surface of each lift to be performed as part of the test fill program after spreading and before compaction starts.

Survey the elevation of each marked location after each pass of the tested compaction equipment to the nearest 1/8 inch.

Provide the survey data to the ENGINEER within the same day that each test fill layer is completed. The ENGINEER will enter the elevation difference between each pass into a spreadsheet and plot the average settlement versus compactor coverages on a graph. The CONTRACTOR's test fill documentation shall include lift thickness, type of compactor, compactor width, dynamic force, roller vibrations per minute and estimated travel speed.

The ENGINEER will visually evaluate particle breakdown during surveying.

The CONTRACTOR shall provide equipment for the ENGINEER to evaluate the compaction and moisture conditioning through the lift thickness at the end of each lift tested.

Additional combinations of lift thicknesses, applied water and compaction equipment types shall be tested on multiple lifts at the discretion of the CONTRACTOR.

The ENGINEER will identify acceptable combinations of the maximum lift thickness, applied water content, and number of coverages for approved compaction equipment tested as part of the test fill program.

Material placed and observed using acceptable combinations of maximum lift thickness, applied water content, and number of coverages of approved compaction equipment may remain in place. Material compacted using unacceptable combinations shall be removed and replaced with acceptable combinations.

SPECIAL COMPACTION

Special compaction of embankment materials is required within 2-feet of buried structures, within 2-feet of piezometer cables in trenches, within 2-feet of drain pipes and other pipes, within 2-feet of the geomembrane, and as otherwise shown on the DRAWINGS.

Place specially-compacted embankment material in accordance with the above SPECIFICATION for that material type, except for the following:

Only vibratory place or walk-behind compaction equipment shall be allowed.

The maximum loose lift thickness shall be 6-inches.

The maximum particle size shall be 3-inches.

Special compaction shall only be performed during daylight hours.

END OF SECTION

PICACHO ASSOCIATES

SECTION 02400

SUBGRADE PREPARATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Final subgrade preparation.

B. Certification of subgrade soil.

1.2 RELATED SECTIONS

A. Section 02200 - Site Preparation

B. Section 02300 - Earthwork

C. Section 02714-Geotextile Fabric

D. Section 02771- 60-mil HDPE

E. Section 02773 - Geosynthetic Clay Liner

1.3 PROJECT RECORD DOCUMENTS

A. Submit subgrade certification reports to QA Inspector to countersign prior to covering the area with geosynthetic liner. Liner installation work cannot proceed without written certification reports and approval from QA Inspector.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Only limited offsite soil material will be required for this portion of the project. Portions of the subgrade preparation may require excavation. Suitable excavated materials may be used as compacted fill with ENGINEERS prior approval.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions are in a condition suitable for initiating final grading procedures.

3.2 FINAL GRADING

A. Prepare subgrade soils to receive double textured 60 mil HDPE geomembrane by means of grading, rolling and/or track walking.
B. Subgrade will be free from rocks or other sharp objects, mounds, depressions, ridges or any anomaly that may cause concentrated stress or puncture to the geomembrane.
C. Where subgrade is deemed unsuitable by ENGINEER for placing liner, 6-inches of LINER BEDDING shall be placed in accordance with the Earthwork Specification, 02300.

3.3 SUBGRADE APPROVAL AND CERTIFICATION

A. CONTRACTOR will certify subgrade prior to material placement.

B. CONTRACTOR (QC Inspector) will provide QA Inspector with daily, written certification of subgrade approval for the QA Inspector' s countersignature prior to geomembrane placement.

END OF SECTION

PICACHO ASSOCIATES

SECTION 02714

GEOTEXTILE

PART 1-GENERAL

1.1 SECTION INCLUDES

A. Geotextile

1.2 RELATED SECTIONS

A. Section 02200 - Site Preparation

B. Section 02300 - Earthwork

C. Section 02400 - Subgrade Preparation

D. Section 02771- Geomembrane

E. Section 02773 – Geosynthetic Clay Liner

1.3 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) Standards:

B. Latest Version of the Geosynthetic Research Institute (GRI) Standards:

1.4 DEFINITIONS

A. Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.

C. Typical Roll Value: Property value calculated from average or mean obtained from test data.

1.5 SUBMITTALS

A. The OWNER, who will supply the material, shall provide the ENGINEER a certificate stating the name of the geotextile manufacturer, product name, style, chemical compositions of filaments or yarns and other pertinent information to fully describe the geotextile. ENGINEER will forward material approval to

both the QA and QC personnel.

B. ENGINEER will provide written approval of geotextile prior to ordering material.

C. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification.
D. Manufacturing Quality Control (MQC) test results shall be provided upon request.

1.6 DELIVERIES, STORAGE, AND HANDLING

A. Geotextile labeling, shipment and storage shall follow ASTM D 4873. All geotextile shall be stored, handled and installed in accordance with manufacturer' s referenced UV exposure time.

C. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number.

D. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

E. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sun light, and contaminants. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the outer wrap of geotextile material must be discarded before installation.

1.7 QUALITY ASSURANCE SAMPLING, TESTING, AND ACCEPTANCE

A. Geotextile: No testing required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Geotextile

1. High strength polypropylene woven geotextile with minimum mass per unit area of 16oz/yd^2•, unless otherwise shown on the drawings.
2. Resistant to ultraviolet degradation and to biological and chemical environments normally found in soils.
3. Minimum Average Roll Values (MARV) as indicated in table 02714-1:

PART 3 -EXECUTION

3.1 PREPARATION

A. Subgrade should have been smoothed and debris removed prior to geotextile placement.

B. Prepare surfaces to receive geotextile; remove any foreign matter from the subgrade.

3.2 INSTALLATION

A. The geotextile shall be placed in intimate contact with subgrade without wrinkles or folds. The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch so as to tear the geotextile.

B. Sandbags shall be used to hold fabric in place as necessary. Penetrating anchors may be allowed if approved by the ENGINEER.

C. Adjacent rolls of geotextile shall be sewn the full length of the adjacent roll using a "J" stich to form the seam. Prayer seams are not allowed.

D. Overlapped roll ends shall be a minimum of 3-feet in all instances or as directed by the ENGINEER.

E. When overlapping, successive lengths of the geotextile shall be overlapped in the direction of fill placement with subsequent rolls or panels being placed beneath the previous filled panel or roll.

F. Care shall be taken during installation so as to avoid damage occurring to the geotextile as a result of the installation process. Should the geotextile be damaged during installation the material shall be removed and replaced by the CONTRACTOR.

G. Field monitoring shall be performed to verify that fill placement does not damage the geotextile.

H. Any geotextile damaged during backfill placement shall be replaced as directed by the QA Inspector, at the CONTRACTOR ' s expense.

TABLE 02714-1
REQUIRED GEOTEXTILE PROPERTIES

Properties	Test Method	Manufacturer QC Test Frequency	Required Test Values
Mass per Unit Area	ASTM D5261	1 per 100,000 ft^2	> 16 oz/yd^2
Grab Strength	ASTM D4632	1 per 100,000 ft^2	> 380 lbs
CBR Puncture Resistance	ASTM D6241	1 per 100,000 ft^2	> 1,025 lbs
Permittivity	ASTM D4491	1 per 540,000 ft^2	> 0.5/s
Apparent Opening Size	ASTM 4751	1 per 540,000 ft^2	< 0.15 mm

U.V. Resistance % strength retained after 500hrs	ASTM D4355	1 per resin formulation	> 70%

END OF SECTION

PICACHO ASSOCIATES

SECTION 02771
GEOMEMBRANE

PART 2 — GENERAL

2.1 DESCRIPTION OF WORK

A. A separate Contractor, reporting directly to the Owner, shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the installation of high-density polyethylene (HDPE), as shown on the Drawings. The work shall be carried out as specified herein and in accordance with Drawings. The main CONTRACTOR shall coordinate the liner contractor, working directly for the owner.

B. Not used.

2.2 RELATED SECTIONS

A. Section 02300 – Earthwork

B. Section 02773 – Geosynthetic Clay Liner

2.3 REFERENCES

A. Drawings

B. Site Construction Quality Assurance (CQA) Plan

C. Latest version of the American Society for Testing and Materials (ASTM) standards:

ASTM D 638 Standard Test Method for Tensile Properties of Plastics

ASTM D 792 Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement

ASTM D 1004 Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting

ASTM D 1505 Standard Test Methods for Density of Plastics by Density-Gradient Technique

ASTM D 1603 Standard Test Method for Carbon Black in Olefin Plastics

ASTM D 4437 Standard Test Methods for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Geomembranes

ASTM D 5321 Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

ASTM D 5397 Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test

ASTM D 5596 Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds

ASTM D 5641 Practice for Geomembrane Seam Evaluation by Vacuum Chamber

ASTM D 5820 Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes

ASTM D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes

D. Latest version of the Geosynthetic Research Institute

GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth ad Textured Geomembranes

GRI GM 14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples using the Method of Attributes

2.4 QUALIFICATIONS

A. Geomembrane Manufacturer:

1. The Geomembrane Manufacturer shall be responsible for the production of geomembrane rolls from resin and shall have sufficient production capacity and qualified personnel to provide material meeting the requirements of this Section and the construction schedule for this project.

2. The Geomembrane Manufacturer shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. Geosynthetics Installer:

1. The Geosynthetics Installer shall be responsible and shall provide sufficient resources for field handling, deploying, seaming, temporarily restraining (against wind), and other aspects of the deployment and installation of the geomembrane and other geosynthetic components of the project.

2. The Geosynthetics Installer shall have successfully installed a minimum of 10,000,000 ft^2 of polyethylene geomembrane on previous projects using the type of seaming apparatus proposed for the use on this Project.

3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

4. Geosynthetics Installer shall provide a minimum of one Master Seamer for work on the project. The Master Seamer shall have experience seaming a minimum of

1,000,000 square feet of HDPE geomembrane using the same type of Manufacturer-approved seaming apparatus in use at the Site.

2.5 SUBMITTALS

A. Preinstallation Submittals.

1. Supplier's name, production facility, and identification of resin used to manufacture the geomembrane.

2. Copies of dated quality control certificates provided by resin supplier.

3. Statement that the amount of manufacturing-recycled polymer added to resin does not exceed 2% by weight.

4. Contractor's certification that the material was manufactured and tested in accordance with these specifications, together with a report of the test results, shall be furnished at the time of shipment. The QA Engineer shall review and approve of the geomembrane prior to installation.

5. Report of test results

6. Contractors QC manual for geomembrane installation

7. Manufacturer's certification of materials.

B. The Geosynthetic Installer shall submit the following information to the QA Engineer for approval 14 days prior to mobilization.

1. A drawing showing the installation layout identifying geomembrane panel configurations, dimensions, details, locations of seams, as well as any variance or additional details that deviate from the Drawings. The layout shall be adequate for use as a construction plan and shall include dimensions, details, etc. The layout drawings, as modified and/or approved by the QA Engineer, shall become part of these Specifications.

2. Installation schedule.

3. Copy of Geosynthetic Installer's letter of approval or license by the Geomembrane Manufacturer.

4. Installation capabilities, including:

   a. information on equipment proposed for this project;

   b. average daily production anticipated for this project; and

   c. quality control procedures.

d. A Certificate of Calibration less than 12 months old shall be submitted for each field tensiometer prior to installation of any geomembrane.

C. Installation and Post-Installation Submittals.

1. Daily Inspection and testing reports.

a. Quality Control Documentation.

b. Subgrade surface acceptance certificates signed by the Installer for each area that will be covered by geomembrane.

c. As-built drawings.

2.6 WARANTIES

A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.

B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

2.7 QUALITY ASSURANCE

A. The Geosynthetic Installer shall ensure that the materials and methods used for installation of the geomembrane meet the requirements of the Drawings and this Section. Any material or method that does not conform to these documents or alternatives that have not been approved in writing by the Engineer, will be rejected and shall be repaired or replaced by the Geosynthetic Installer.

B. The Geosynthetic Installer shall be aware of and accommodate all monitoring and conformance testing required by the CQA Plan. This monitoring and testing, including random conformance testing of construction materials and completed work, will be performed by the QA Engineer. If non conformances, or other deficiencies, are found in the Geosynthetic Installer's materials or completed work, the Geosynthetic Installer will be required to repair the deficiency or replace the deficient materials.

PART 3 — PRODUCTS

3.1 GEOMEMBRANE PROPERTIES

A. The Geomembrane Manufacturer shall furnish geomembrane having properties that comply with the required property values shown in Table 02771-1.

B. In addition to the property values listed in Table 02771-1, the geomembrane shall:

1. Contain a maximum of 1 percent by weight of additives, fillers, or extenders (not including carbon black).

2. The resin shall have a melt flow index valve of less than 1.0 g/10 min per ASTM D1238 and a density of 0.94 g/ml or less.

3. Not have striations, pinholes (holes), bubbles, blisters, nodules, undispersed raw materials, or any sign of contamination by foreign matter on the surface or in the interior.

3.2 MANUFACTURING QUALITY CONTROL

A. Rolls:

1. The Geomembrane Manufacturer shall continuously monitor geomembrane during the manufacturing process for defects.

2. No geomembrane shall be accepted that exhibits any defects.

3. The Geomembrane Manufacturer shall measure and report the geomembrane thickness at regular intervals along the roll length.

4. No geomembrane shall be accepted that fails to meet the specified thickness.

5. The Geomembrane Manufacturer shall sample and test the geomembrane to demonstrate that its properties conform to the values specified in Table 02771-1.

6. Any geomembrane sample that does not comply with the requirements of this Section will result in rejection of the roll from which the sample was obtained and will not be used for this project.

7. If a geomembrane sample fails to meet the quality control requirements of this Section, the Geomembrane Manufacturer shall sample and test, at the expense of the Manufacturer, rolls manufactured, in the same resin batch, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established to bound the failed roll(s).

8. Additional testing may be performed at the Geomembrane Manufacturer's discretion and expense, to isolate and more closely identify the non-complying rolls and/or to qualify individual rolls.

B. The Geomembrane Manufacturer shall permit the QA Engineer to visit the manufacturing plant for project specific visits. If possible, such visits will be prior to or during the manufacturing of the geomembrane rolls for the specific project.

C. Extrudate Rod or Bead

1. Extrudate material shall be made from some type of resin as the geomembrane;

2. Additives shall be thoroughly dispersed; and

3. Materials shall be free of contamination by moisture or foreign matters.

3.3 LABELING

A. Geomembrane rolls shall be labeled with the following information.

1. thickness of the material;
2. length and width of the roll;
3. name of Geomembrane Manufacturer;
4. product identification;
5. lot number; and
6. roll number.

3.4 TRANSPORTATION, HANDLING AND STORAGE

A. Handling and care of the geomembrane prior to and following installation at the site shall be the responsibility of the Geosynthetic Installer. The Geosynthetic Installer shall be liable for all damage to the materials incurred prior to final acceptance of the liner system by the QA Engineer.

B. Geosynthetic Installer shall be responsible for storage of the geomembrane at the site. The geomembrane shall be protected from excessive heat or cold, dirt, puncture, cutting, or other damaging or deleterious conditions. Any additional storage procedures required by the Geomembrane Manufacturer shall be the Geosynthetic Installer's responsibility. Geomembrane rolls shall not be stored or placed in a stack of more than two rolls high.

C. The geomembrane shall be delivered at least 14 days prior to the planned deployment date to allow the QA Engineer adequate time to perform conformance testing on the geomembrane samples as described in Part 3.5 of this Section. If the QA Engineer performed a visit to the manufacturing plant and performed the required conformance sampling, geomembrane can be delivered to the site within the 14 days prior to the planned deployment date as long as there is sufficient time for the QA Engineer to complete the conformance testing and confirm that the rolls shipped to the site are in compliance with this Section.

PART 4 — GEOMEMBRANE INSTALLATION

4.1 FAMILIARIZATION

A. Prior to implementing any of the work described in this Section, the Geosynthetic Installer shall become thoroughly familiar with all portions of the work falling within this Section.

B. Inspection:

1. The Geosynthetic Installer shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the work of this Section may properly commence without adverse effect.

2. If the Geosynthetic Installer has any concerns regarding the installed work of other Sections, he shall notify the QA Engineer in writing prior to the start of the work of this Section. Failure to inform the QA Engineer in writing or installation of the geomembrane will be construed as the Geosynthetic Installer's acceptance of the related work of all other Sections.

C. installation of other components of the composite liner system.

4.2 GEOMEMBRANE DEPLOYMENT

A. Field Panel Identification:

1. A geomembrane field panel is a roll, or a portion of roll, cut in the field.

2. Each field panel shall be given an identification code (number or letter-number). This identification code shall be agreed upon by the QA Engineer and Geosynthetic Installer.

B. Field Panel Placement:

1. Field panels shall be placed one at a time, and each field panel shall be seamed immediately after its placement.

2. Geomembrane shall not be placed when the ambient temperature is below 40°F or above 104°F, unless otherwise authorized in writing by the QA Engineer.

3. Geomembrane shall not be placed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds.

4. The Geosynthetic Installer shall ensure that:

   a. No vehicular traffic is allowed on the geomembrane.

   b. Equipment used does not damage the geomembrane by handling, trafficking, or leakage of hydrocarbons (i.e., fuels).

   c. Personnel working on the geomembrane do not smoke, wear damaging shoes, bring glass onto the geomembrane, or engage in other activities that could damage the geomembrane.

   d. The method used to unroll the panels does not scratch or crimp the geomembrane and does not damage the supporting soil or geosynthetics.

   e. The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels). The method used to place the panels results in intimate contact with adjacent components.

f. Temporary ballast and/or anchors (e.g., sandbags), not likely to damage the geomembrane, are placed on the geomembrane to prevent wind uplift.

g. The geomembrane is especially protected from damage in heavily trafficked areas.

h. Any rub sheets to facilitate seaming are removed prior to installation of subsequent panels.

5. Any field panel or portion thereof that becomes seriously damaged (torn, twisted, or crimped) shall be replaced with new material. Less serious damage to the geomembrane may be repaired, as approved by the QA Engineer. Damaged panels or portions of damaged panels that have been rejected shall be removed from the work area.

6. Enough slack shall be provided to allow for thermal expansion and contraction of material.

C. If the Geosynthetic Installer intends to install geomembrane between one hour before sunset and one hour after sunrise, he shall notify the QA Engineer in writing prior to the start of the work. The Geosynthetic Installer shall indicate additional precautions, which shall be taken during these installation hours. The Geosynthetic Installer shall provide proper illumination for work during this time period.

4.3 FIELD SEAMING

A. Seam Layout:

1. In corners and at odd-shaped geometric locations, the number of field seams shall be minimized.

2. No horizontal seam shall be along a slope with an inclination steeper than 10 percent unless otherwise approved by the QA Engineer. Horizontal seams shall be considered as any seam having an alignment exceeding 20 degrees from being perpendicular to the slope contour lines.

3. No seams shall be located in an area of potential stress concentration.

B. Personnel:

1. All personnel performing seaming operations shall be qualified as indicated in Part 1.4 of this Section. No seaming shall be performed unless a “master seamer” is present on-site.

C. Weather Conditions for Seaming:

1. Unless authorized in writing by the Engineer, seaming shall not be attempted at ambient temperatures below 40°F or above 104°F. If the Geosynthetic Installer

wishes to use methods that may allow seaming at ambient temperatures below 40°F or above 104°F, he shall use a procedure approved by the Engineer.

2. A meeting will be held with the Geosynthetic Installer and QA Engineer to establish acceptable installation procedures. In all cases, the geomembrane shall be dry and protected from wind damage.

3. Ambient temperatures shall be measured between 0 to 6 in. above the geomembrane surface.

D. Overlapping:

1. Geomembrane panels shall be sufficiently overlapped for welding and to allow peel tests to be performed on the seam. Any seams that cannot be destructively tested because of insufficient overlap shall be treated as failing seams.

E. Seam Preparation:

1. Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

2. If seam overlap grinding is required, the process shall be completed according to the Geomembrane Manufacturer's instructions within 20 minutes of the seaming operation and in a manner that does not damage the geomembrane. The grind depth shall not exceed ten percent of the geomembrane thickness.

3. Seams shall be aligned with the fewest possible number of wrinkles and "fishmouths."

F. General Seaming Requirements:

1. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is insufficient shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 in. beyond the cut in all directions.

2. Any electric generator shall be placed outside the area to be lined or mounted in a manner that protects the geomembrane from damage. The electric generator shall be properly grounded.

G. Seaming Process:

1. Approved processes for field seaming are extrusion welding and fusion welding. Only equipment identified as part of the approved submittal specified in Part 1.6 shall be used.

2. Extrusion Equipment and Procedures:

a. The Geosynthetics Installer shall maintain at least one spare operable seaming apparatus on site.

b. Extrusion welding apparatus shall be equipped with gauges giving the temperature in the apparatus.

c. Prior to beginning a seam, the extruder shall be purged until all heat-degraded extrudate has been removed from the barrel.

d. The Geosynthetics Installer shall provide documentation regarding the welding rod to the QA Engineer and shall certify that the welding rod is compatible with the specifications.

e. A smooth insulating plate or fabric shall be placed beneath the hot welding apparatus after use.

3. Fusion Equipment and Procedures:

a. The Geosynthetic Installer shall maintain at least one spare operable seaming apparatus on site.

b. Fusion-welding apparatus shall be automated self-propelled devices equipped with gauges giving the applicable temperatures and speed.

c. A smooth insulating plate or fabric shall be placed beneath the hot welding apparatus after use.

H. Trial Seams:

1. Trial seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. Trial seams shall be conducted on the same material to be installed and under similar field conditions as production seams. Such trial seams shall be made at the beginning of each seaming period, i.e., beginning of the day and after lunch, for each seaming apparatus used each day. The trial seam sample shall be a minimum of 5-ft long by 1-ft wide (after seaming) with the seam centered lengthwise for fusion equipment and at least 3-ft long by 1-ft wide for extrusion equipment. Seam overlap shall be as indicated in Part 3.3.D of this Section.

2. Four adjoining coupon specimens, each 1-in. wide, shall be cut from the trial seam sample by the installer using a die cutter to ensure precise 1-in. wide coupons. The coupons shall be tested in peel (outside (fusion only) and inside track) and shear using an electronic readout field tensiometer in accordance with ASTM D 6392, at a strain rate of 2 in./min., and they shall not fail in the seam (i.e., Film Tear Bond (FTB), which is failure in the parent material, is required). The required peel and shear seam strength is listed in Table 02771-2.

3. If a coupon specimen fails, the entire operation shall be repeated. If the additional coupon specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved.

I. Nondestructive Seam Continuity Testing:

1. The Geosynthetic Installer shall nondestructively test for continuity on all field seams over their full length. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming. The Geosynthetic Installer shall complete any required repairs in accordance with Part 3.3.K of this Section. The following procedures shall apply:

a. Vacuum testing in accordance with ASTM D 5641.

b. Air pressure testing (for double-track fusion seams only) in accordance with ASTM D 5820 and the following:

c. Energize the air pump to a pressure of 30 pounds per square inches, close valve, allow 2 minutes for relaxation and sustain the pressure for not less than 5 minutes.

If loss of pressure exceeds 3 pounds per square inches, or does not stabilize, locate the faulty area and repair in accordance with Part 3.3.K of this Section.

Cut opposite end of air channel from pressure gauge and observe release of pressure to ensure air channel is not blocked.

Remove needle, or other approved pressure feed device, and seal repair in accordance with Part 3.3.K of this Section.

d. The length of welded section tested by pressure shall not exceed 450 ft without prior approval of the Engineer.

J. Destructive Testing:

1. Destructive seam tests shall be performed on samples collected from selected locations to evaluate seam strength and integrity. Destructive tests shall be carried out as the seaming work progresses, not at the completion of all field seaming.

2. Sampling:

a. Destructive test samples shall be collected at a minimum average frequency of one test location per 500 ft of seam length. Test locations shall be determined during seaming, and may be prompted by suspicion of excess crystallinity, contamination, offset seams, or any other potential cause of imperfect seaming. The QA Engineer will be responsible for choosing the locations. The Geosynthetic Installer shall not be informed in advance of the locations

where the seam samples will be taken. The QA Engineer reserves the right to increase or decrease the sampling frequency.

b. Sampling frequency may be modified based on results and in accordance with the method described in GRI GM 14 attached to this specification.

c. Samples shall be cut by the Geosynthetic Installer at the locations designated by the QA Engineer as the seaming progresses in order to obtain laboratory test results before the geomembrane is covered by another material. Each sample shall be numbered, and the sample number and location identified on the panel layout drawing. All holes in the geomembrane resulting from the destructive seam sampling shall be immediately repaired in accordance with the repair procedures described in Part 3.3.K of this Section. The continuity of the new seams in the repaired areas shall be tested according to Part 3.3.I of this Section.

d. Two strips of dimensions 1-in. wide and 12 in. long with the seam centered parallel to the width shall be taken from either side of the sample location. These samples shall be tested in the field in accordance with Part 3.3.J.3 of this Section. If these samples pass the field test, a laboratory sample shall be taken. The laboratory sample shall be at least 1-ft wide by 3.5-ft long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

One portion 12-in. long to the Geosynthetic Installer.

One portion 18-in. long to the Geosynthetic CQA Laboratory for testing.

One portion 12-in. long to the QA Engineer for archival storage.

3. Field Testing: The two 1-in. wide strips shall be tested in the field tensiometer in the peel mode. The QA Engineer has the option to request an additional test in the shear mode. If any field test sample fails to meet the requirements in Table 02771-2, then the procedures outlined in Part 3.3.J.5 of this Section shall be followed.

4. Laboratory Testing: Testing by the Geosynthetics CQA Laboratory will include "Seam Strength" and "Peel Adhesion" (ASTM D 6392) with the 1-in. wide strip tested at a rate of 2 in./min. At least 5 specimens will be tested for each test method (peel and shear). Four of the five specimens per sample must pass both the shear strength test and peel adhesion test when tested in accordance with ASTM D 6392. The minimum acceptable values to be obtained in these tests are indicated in Table 02771-2. Both inside and outside tracks of the dual track fusion welds shall be tested in peel.

5. Destructive Test Failure:

a. The following procedures shall apply whenever a sample fails a destructive test, whether the test is conducted by the Geosynthetic CQA's laboratory, the Geosynthetic Installer laboratory, or by a field tensiometer. The Geosynthetic Installer shall have two options:

The Geosynthetic Installer can reconstruct the seam (e.g., remove the old seam and reseam) between any two passed destructive test locations.

The Geosynthetic Installer can trace the welding path to an intermediate location, a minimum of 10 feet from the location of the failed test (in each direction) and take a small sample for an additional field test at each location. If these additional samples pass the field tests, then full laboratory samples shall be taken. These full laboratory samples shall be tested in accordance with Part 3.3.J.4 of this Section. If these laboratory samples pass the tests, then the seam shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam should be reconstructed. All acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 ft of reconstructed seam, a sample taken from within the reconstructed zone must pass destructive testing.

b. Whenever a sample fails, the QA Engineer may require additional tests for seams that were formed by the same seamer and/or seaming apparatus or seamed during the same time shift.

K. Defects and Repairs:

1. The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be swept or washed by the Installer if surface contamination inhibits inspection.

2. Each suspected location, both in seam and non-seam areas, shall be nondestructively tested using the methods described Part 3.3.I of this Section, as appropriate. Each location that fails nondestructive testing shall be marked by the QA Engineer and repaired by the Geosynthetic Installer.

3. When seaming of a geomembrane is completed (or when seaming of a large area of a geomembrane is completed) and prior to placing overlying materials, the QA Engineer shall identify all excessive geomembrane wrinkles. The Geosynthetic Installer shall cut and reseam all wrinkles so identified. The seams thus produced shall be tested like any other seams.

4. Repair Procedures:

a. Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Geosynthetic Installer. Several repair procedures exist. The final decision as to the appropriate repair

procedure shall be agreed upon between the QA Engineer and the Geosynthetic Installer. The procedures available include:

patching, used to repair holes larger than 1/16 inch, tears, undispersed raw materials, and contamination by foreign matter;

abrading and reseaming, used to repair small sections of extruded seams;

spot seaming, used to repair minor, localized flaws;

capping, used to repair long lengths of failed seams; and

removing bad seam and replacing with a strip of new material seamed into place (used with long lengths of fusion seams).

b. In addition, the following criteria shall be satisfied:

surfaces of the geomembrane that are to be repaired shall be abraded no more than 20 minutes prior to the repair;

all surfaces must be clean and dry at the time of repair;

all seaming equipment used in repair procedures must be approved;

the repair procedures, materials, and techniques shall be approved in advance, for the specific repair, by the QA Engineer;

patches or caps shall extend at least 6 in. beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 in.; and

the geomembrane below large caps shall be appropriately cut to avoid water or gas collection between the two sheets.

5. Repair Verification:

a. Each repair shall be nondestructively tested using the methods described in Part 3.3.I of this Section, as appropriate. Repairs that pass the nondestructive test shall be taken as an indication of an adequate repair. Failed tests will require the repair to be redone and retested until a passing test results. At the discretion of the QA Engineer, destructive testing may be required on large caps.

4.4 MATERIALS IN CONTACT WITH THE GEOMEMBRANE

A. The Geosynthetic Installer shall take all necessary precautions to ensure that the geomembrane is not damaged during its installation. During the installation of other components of the liner system by the Contractor, the Contractor shall ensure that the geomembrane is not damaged. Any damage to the geomembrane shall be repaired by the Geosynthetic Installer.

B. Soil and aggregate materials shall not be placed over the geomembranes at ambient temperatures below 40°F or above 104°F, unless otherwise specified.

C. Efforts shall be made to minimize wrinkles in the geomembrane.

D. Equipment shall not be driven directly on the geomembrane.

4.5 CONFORMANCE TESTING

A. Samples of the geomembrane will be removed by the QA Engineer and sent to a Geosynthetic CQA Laboratory for testing to ensure conformance with the requirements of this Section. The Geosynthetic Installer shall assist the QA Engineer in obtaining conformance samples. The Geosynthetic Installer and Contractor shall account for this testing in the installation schedule. Only material that meets the requirements of Part 2.2 this Section shall be installed.

B. Samples will be selected by the QA Engineer in accordance with this Section and with the procedures outlined in the CQA Plan.

C. Samples will be taken at a minimum frequency of one sample per 200,000 ft^2.

D. The QA Engineer may increase the frequency of sampling if test results do not comply with the requirements of Part 2.2 of this Section.

E. The following tests will be performed by the QA Engineer:

Test	Test Method
Density	ASTM D 1505
Thickness	ASTM D 5994
Tensile Properties	ASTM D 6693
Carbon Black Content	ASTM D 1603
Carbon Black Dispersion	ASTM D 5596

F. Any geomembrane that is not certified in accordance with Part 1.5 of this Section, or that conformance testing indicates do not comply with Part 2.1 of this Section, will be rejected. The Geosynthetic Installer shall replace the rejected material with new material.

4.6 GEOMEMBRANE ACCEPTANCE

A. The Geosynthetic Installer shall retain all ownership and responsibility for the geomembrane until accepted by the QA Engineer.

B. The geomembrane shall be accepted by the QA Engineer when:

1. the installation is completed.

2. all documentation is submitted.

3. verification of the adequacy of all field seams and repairs, including associated testing, is complete; and

4. all warranties are submitted.

4.7 PROTECTION OF WORK

A. The Geosynthetic Installer and Contractor shall use all means necessary to protect all the work of this Section.

B. In the event of damage, the Geosynthetic Installer shall make all repairs and replacements necessary to the satisfaction of the QA Engineer.

END OF SECTION

SECTION 02773

GEOSYNTHETIC CLAY LINER (GCL)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Related Sections

B. Scope

C. References

D. Definitions

E. Submittals

F. Qualifications

G. Construction Quality Assurance (CQA)

H. Warranty

I. GCLs

J. Materials

K. Product Labeling

L. Packaging

M. Accessory Bentonite

N. Shipping And Handling

O. Storage

P. Placement

Q. Anchorage

R. Seaming

S. Detail Work

T. Damage Repair

1.2 RELATED SECTIONS

Section 02200	Site Preparation
Section 02300	Earthwork
Section 02400	Subgrade Preparation
Section 02714	Geotextile
Section 02773	Geosynthetic Clay Liner
Section 02711	Corrugated Polyethylene Pipe

1.3 SCOPE

This specification covers the technical requirements for the furnishing and installation of the geosynthetic clay liners described required for the slip joint between existing and new HDPE liner and for upstream embankment face liner on the 5840 raise. All materials used shall meet the requirements of this **SPECIFICATION**, and all work shall be performed in accordance with the procedures provided herein and the **PLANS**.

1.4 REFERENCES

A.	ASTM D 638	Test Method for Tensile Properties of Plastics
B.	ASTM D 792	Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
C.	ASTM D 882	Test Method for Tensile Properties of Thin Plastic Sheeting
D.	ASTM D 1141	Practice for Preparation of Substitute Ocean Water
E.	ASTM D 1505	Test Method for Density of Plastics by the Density-Gradient Method
F.	ASTM D 4354	Practice for Sampling of Geosynthetics for Testing
G.	ASTM D 4439	Terminology for Geosynthetics
H.	ASTM D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles
I.	ASTM D 4759	Practice for Determining the Specification Conformance of Geosynthetics
J.	ASTM D 5199	Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

K. ASTM D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles

L. ASTM D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes

M. ASTM D 5887 Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using Flexible Wall Permeameter

N. ASTM D 5888 Practice for Storage and Handling of Geosynthetic Clay Liners

O. ASTM D 5889 Practice for Quality Control of Geosynthetic Clay Liners

P. ASTM D 5890 Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners

Q. ASTM D 5891 Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners

R. ASTM D 5993 Test Method for Measuring the Mass Per Unit Area of Geosynthetic Clay Liners

S. ASTM D 5994 Test Method for Measuring the Core Thickness of Textured Geomembrane

T. ASTM D 6102 Guide for Installation of Geosynthetic Clay Liners

U. ASTM D 6141 Guide for Screening the Clay Portion of a GCL for Chemical Compatibility to Liquids

V. ASTM D 6243 Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method

W. ASTM D 6495 Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners

X. ASTM D 6496 Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners

Y. ASTM D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

Z. ASTM D 6766 Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Liquids

AA. ASTM 6768 Test Method for Tensile Strength of Geosynthetic Clay Liners

BB. GRI-GM13 Test Properties, Testing Frequency and Recommended Warrant for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

CC. GRI-GM17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

DD. GRI-GM18 Test Properties, Testing Frequency and Recommended Warrant for Flexible Polypropylene (fPP and fPP-R) Nonreinforced and Reinforced Geomembranes (Presently Suspended as of May 3, 2004)

1.5 DEFINITIONS

For the purposes of this specification guideline, the following terms are defined below:

A. **GEOSYNTHETIC CLAY LINER (GCL)**: A manufactured hydraulic barrier consisting of clay encapsulated by layer or layers of geosynthetics.

B. Minimum Average Roll Value (MARV): For geosynthetics, the value calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one (1) specific test method associated with one (1) specific property.

C. Overlap: Where two (2) adjacent **GCL** panels contact, the distance measuring perpendicular from the overlying edge of one (1) panel to the underlying edge of the other.

D. Typical Value: The mean value calculated from documented manufacturing quality control test results for a defined population obtained from one (1) test method associated with one (1) specific property.

1.6 MATERIAL SUBMITTALS

A. With the bid to supply the material, the **GCL MANUFACTURER** shall furnish the following information:

1. Plan for documenting compliance to these **SPECIFICATIONS**.
2. Historical data for
    a. 10,000-hour creep shear testing; and
    b. Seam flow data at two (2) psi confining pressure.
3. A copy of **GCL MANUFACTURER'S** ISO quality Certificate of Registration.
4. Representative samples of the **GCL** collected during manufacturing for third party conformance testing.
    a. During manufacturing, the **GCL MANUFACTURER** will obtain one (1) random sample per 100,000 square feet (min) of **GCL**;
    b. The **GCL MANUFACTURER** shall forward the sample(s) to a qualified Testing Laboratory for the following tests:
        1) Bentonite Mass/Area (ASTM D5993) at zero (0) percent moisture content;
        2) Grab Strength (ASTM D6768) in the Machine Direction; and
        3) Peel Strength (ASTM 6496).

B. Upon shipment, the **GCL MANUFACTURER** shall furnish Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this specification.

1.7 INSTALLATION SUBMITTALS

A. With the Bid to Install the **GCL**, the **CONTRACTOR** shall furnish the following information:

1. Conceptual description of the proposed plan for placement of the GCL panels over the area of installation.

2. A project reference list for the GCL(s) consisting of the principal details of similar projects.

B. As installation proceeds, the **CONTRACTOR** shall submit certificates of subgrade acceptance, signed by the **CONTRACTOR** and Quality Assurance Inspector (see Sections 1.6 and 3.3) for each area that is covered by the **GCL**.

1.8 QUALIFICATIONS

A. **GCL MANUFACTURER** must:

1. Have produced at least 100 million square feet of **GCL** within the past three (3) years with 3.5 lb/in (610 N/m) peel strength;

2. Utilize a manufacturing facility that has produced at least 100 million square feet of **GCL** within the past five (5) years in order to ensure consistency in material and workmanship.

B. The **GCL INSTALLER** must:

1. Either have installed at least one (1) million square feet of **GCL**; or

2. Provide to the **ENGINEER** satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the **GCL** will be installed in a competent, professional manner.

1.9 CONSTRUCTION QUALITY ASSURANCE (CQA)

A. The **OWNER** will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor installation (Quality Assurance Inspector);

1. Field quality assurance testing conducted by the Quality Assurance Inspector during installation shall be in accordance with industry standards;

B. The inspector shall have provided CQA services for the installation of the **GCL** and/or **GEOMEMBRANE** for at least five (5) completed projects totaling not less than 50 thousand square feet.

C. Testing of the **GCL**, as necessary to support the CQA effort, shall be performed by a third-party laboratory retained by the **OWNER** or **ENGINEER** and independent from the **GCL MANUFACTURER** and **GCL INSTALLER**.

1. The laboratory shall have provided **GCL** CQA testing of the proposed or similar GCL for at least five (5) completed projects totaling not less than 100 thousand square feet.

D. During Manufacturing, the **MANUFACTURER** shall obtain one (1) random sample per 50,000 square feet of **GCL**;

E. The **MANUFACTURER** shall forward the samples to a qualified Testing Laboratory selected by the **OWNER** and/or the **ENGINEER** for the following tests:

1. Bentonite Mass/Area at zero (0) percent moisture content (ASTM D5993);
2. GCL Grab Strength (ASTM D6768);
3. GCL Peel Strength (ASTM D6496);

F. CQA shall be provided in accordance with the CQA Plan provided by the **ENGINEER**.

1.10 DELIVERY, STORAGE AND HANDLING

A. Labeling – Each roll delivered to the site shall be wrapped in packaging that is resistant to photodegradation by ultraviolet (UV) light and labeled by the **MANUFACTURER**.

B. The label will identify:

1. **MANUFACTURER'S** NAME;
2. Product Identification;
3. Length;
4. Width; and
5. Roll Number.

C. The **GCL MANUFACTURER** shall be responsible for initial loading the **GCL**;

D. Shipping will be the responsibility of the **GCL MANUFACTURER**;

E. The **CONTRACTOR/ OWNER** shall be responsible for preparation of an on-site storage location for **GCL** material;

1. The location shall protect the **GCL** from punctures, abrasions and excessive dirt and moisture;
2. The location shall be approved by the **OWNER** and the **ENGINEER**, and shall have the following characteristics:
   a. Level;
   b. Smooth;

c. Dry;

d. Free of vegetation, large rock, and other debris that may damage **GCL** rolls;

e. **GCL** rolls shall not be stored on wooden pallets;

f. Protected from mud, soil, dirt and debris and from theft and vandalism; and

g. Adjacent to the area being lined or in another suitable location as directed by the **OWNER**.

F. Off-Loading

1. Off-loading of the **GCL** is the responsibility of the **CONTRACTOR/ OWNER**;

2. No off-loading of **GCL** shall be performed unless the Quality Assurance Inspector/ **OWNER** is present;

3. The **CONTRACTOR** and the Quality Assurance Inspector/ **OWNER** shall observe the offloading and inspect each roll for damage;

a. Any damage to the rolls shall be documented by the Quality Assurance Inspector/**OWNER**;

b. All damaged rolls must be stored separately from the undamaged rolls;

c. The rolls shall be unrolled to determine the extent of the damage;

d. The use of the roll or portions of the roll shall be only at the approval of the **ENGINEER**;

e. Any material rejected by the **ENGINEER** shall be replaced at no additional cost to the **OWNER**

4. Rolls shall be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks;

5. Rolls shall be stored in a manner that prevents damage or contamination;

6. The **GCL** shall be stored according to the **MANUFACTURER'S** recommendations and such that it is protected from puncture, dirt, grease, gasoline, diesel fuel, water, moisture, mud, mechanical abrasion, excessive heat, and other causes of damage to the material;

7. Rolls without the proper documentation shall be stored separately until all the required documentation is received and approval given for deployment by the **ENGINEER**;

8. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled;

9. Rolls shall not be stored on wooden pallets.

G. All **GCL** shall be stacked no more than three (3) rolls high.

H. All stored **GCL** materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin, provided by the **CONTRACTOR**, until their installation.

I. The integrity and legibility of the labels shall be preserved during storage.

J. Handling and storage of **GCL** material shall be:

1. In a manner to prevent damage;
2. Safe for all personnel; and
3. In accordance with the Manufacturer's printed instructions;

1.11 WARRANTY

K. All permanent materials furnished by the **GCL MANUFACTURER** under these **SPECIFICATIONS** shall be guaranteed by the **GCL MANUFACTURER**, for a period agreed to with OWNER;

1. Upon written notice that the material fails to meet the original intent of the Design or of failure of guaranteed materials during the guarantee period, the **GCL MANUFACTURER** shall promptly furnish new materials and/or furnish the workmanship necessary to repair the failure at no cost to the **OWNER**.

L. All workmanship furnished by the **CONTRACTOR** under these **SPECIFICATIONS** shall be guaranteed against failure due to improper installation for a period agreed to with OWNER;

1. Upon written notice that the workmanship fails to meet the original intent of the Design or of failure of guaranteed workmanship during the guarantee period, the **CONTRACTOR** shall promptly furnish and install new materials and/or furnish the workmanship necessary to repair the failure at no cost to the **OWNER**.

PART 2 PRODUCTS

2.1 GCLS

A. The **GCL** shall consist of a layer of natural sodium bentonite clay encapsulated between two (2) geotextiles and shall comply with all of the criteria listed in this Section.

2.2 MATERIALS

A. Acceptable unreinforced **GCL** for the slip joint is product is AGRU's GeoClay WN33, or an **ENGINEER** approved equal.

B. Acceptable high-strength reinforced **GCL** for the upstream face is **AGRU's** GeoClay NN66, or an **ENGINEER** approved equal.

C. The **GCL MANUFACTURER** shall certify that the GCL supplied for the project, when tested in accordance with the noted test method, shall meet or exceed the values (unless noted otherwise) shown in Table 1, below.

TABLE 1 CERTIFIED GCL PROPERTIES

Property	Test Method	Value		
		Criteria	Reinforced GCL	Unreinforced GCL
Bentonite Swell Index	ASTM D 5890	min	24 mL/2g	24 mL/2g
Bentonite Fluid Loss	ASTM D 5891	max	18 mL	18 mL
Bentonite Mass/Area1	ASTM D 5993	min	0.75 lb/ft²	0.75 lb/ft²
Grab Strength2	ASTM D 6768	MARV	50 lbs/in	50 lbs/in
Peel Strength	ASTM D 6496	min	3.5 lbs/in	1.0 lbs/in
Index Flux3	ASTM D 5887	max	1 x 10^{-8} m³/sec-m²	1 x 10^{-8} m³/sec-m²
Hydraulic Conductivity3	ASTM D 5887	max	5 x 10^{-9} cm/sec	5 x 10^{-9} cm/sec
Hydrated Internal Shear Strength	ASTM D 5321	Typ.	500 psf @ 200 psf	150 psf @ 200 psf

1. At zero (0) percent moisture content;
2. Machine Direction;
3. Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure;
4. Peak values measured at specified normal stress for a specimen hydrated for 48 hours.

D. A **GCL MANUFACTURER'S** certification stating that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished a minimum of one (1) week before shipment to the project site.

2.3 PRODUCT LABELING

A. Prior to shipment, the **GCL MANUFACTURER** shall label each roll, identifying:

1. Product identification information (**MANUFACTURER'S** name and address, brand product code).
2. Lot number and roll number.
3. Roll length, width and weight.

2.4 PACKAGING

A. The **GCL** shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.

B. All rolls shall be labeled and enclosed in a wrapper that is resistant to moisture and photo-degradation by ultraviolet (UV) light.

C. At a minimum, the label shall include information required by Part 2.03 of this **SPECIFICATION**.

D. Packaging shall be secure and of sufficient durability to ensure safe transportation to the point of delivery.

2.5 ACCESSORY BENTONITE

A. The **GCL MANUFACTURER** shall provide a suitable quantity of Accessory Bentonite necessary to perform a typical **GCL** Installation;

B. Prior to the start of **GCL** Installation, the **GCL INSTALLER** shall inventory the Accessory Bentonite provided by the **GCL MANUFACTURER**;

C. The granular bentonite sealing clay used for overlap seaming, penetration sealing and repairs shall be made from the same natural sodium bentonite as used in the **GCL** and shall be as recommended by the **GCL MANUFACTURER**.

D. Seaming of **GCL**s shall be conducted in accordance with the **GCL MANUFACTURER'S** guidelines for each particular **GCL**.

PART 3 EXECUTION

3.1 EXAMINATION

A. Preparation of surfaces shall be completed by the **CONTRACTOR**;

B. The Quality Assurance Inspector will inspect the prepared surfaces to verify that the surfaces prior to

GEOMEMBRANE placement;

C. The surfaces shall:

1. Meet the requirements for **BEDDING FILL** detailed in Section 02300;

2. Meet the requirements for **BEDDING FILL** detailed in Section 02300, Earthworks;

3. Be free from any rocks larger than 1/2-inch (2 centimeters), sticks, vegetation, roots, voids, large cracks, surface irregularities, or debris which could damage the **GCL**;

4. Be firm such that no rutting is caused be installation equipment or other construction vehicle traffic;

5. Be finish graded to fill any voids or desiccation cracks; and

6. Smooth-drum rolled to eliminate sharp irregularities or abrupt elevation changes;

D. Any surface areas or other conditions requiring correction shall be brought to the attention of the

ENGINEER and will be corrected at no additional cost to the **OWNER**;

E. Upon notification by the Quality Assurance Inspector of release of area or areas for liner installation, the **GCL INSTALLER** shall verify in writing that the surface on which the **GCL** will be installed meets all **SPECIFICATIONS**;

F. The **GCL INSTALLER** shall be responsible for maintenance of the subgrade surface in the accepted area or areas once installation begins;

G. The maintenance of the surface includes repair or replacement of any surface damaged following acceptance.

3.2 PREPARATION

A. The **GCL INSTALLER** shall maintain the surface suitability and integrity until the installation is completed and accepted;

B. The **GCL INSTALLER** shall repair rough areas and any damage to the subgrade caused by installation of the lining, and shall fill any ruts caused by equipment prior to deployment;

C. In order to avoid sharp bends in the **GCL**, the **CONTRACTOR** and/or **GCL INSTALLER** shall slightly round the leading edges of the anchor trench.

3.3 PLACEMENT

A. Reinforced **GCL** shall be placed on the as shown on the **DRAWINGS**.

B. **GCL** rolls should be delivered to the working area of the site in their original packaging;

1. Immediately prior to deployment, the packaging should be carefully removed without damaging the **GCL**.

2. The orientation of the **GCL** (i.e., which side faces up) should be in accordance with the **ENGINEER'S** recommendations.

C. Equipment, which could damage the **GCL**, shall not be allowed to travel directly on it.

D. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

E. Care must be taken to minimize the extent to which the **GCL** is dragged across the subgrade in order to avoid damage to the bottom surface of the **GCL**. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

F. The **GCL** panels shall be placed parallel to the direction of the slope.

G. All **GCL** panels should lie flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels.

H. Only as much **GCL** shall be deployed as can be covered at the end of the working day with, a geomembrane, or a temporary waterproof tarpaulin.

I. The **GCL** shall not be left uncovered overnight.

J. If the **GCL** is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material.

K. The **ENGINEER**, CQA inspector, and **GCL MANUFACTURER** should be consulted for specific guidance if premature hydration occurs.

3.4 ANCHORAGE

A. As directed by the **PLANS** and these **SPECIFICATIONS**, the end of the **GCL** roll shall be placed in an anchor trench at the top of the slope.

1. When utilizing an anchor trench design, the front edge of the trench should be rounded to eliminate any sharp corners.

2. Loose soil should be removed from the floor of the trench.

3. The **GCL** should cover the entire trench floor.

3.5 SEAMING

A. The **GCL** seams are constructed by overlapping their adjacent edges;

B. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris;

C. The minimum dimension of the longitudinal overlap should be six (6) inches (20 centimeters);

1. If the GCL is manufactured with a grooved cut in the nonwoven geotextile that allows bentonite to freely extrude into the longitudinal overlap then no supplemental bentonite is required for this overlap;

2. If the GCL does not have a grooved cut in the nonwoven geotextile longitudinal overlap, then bentonite-enhanced seams are required as described below;

D. End-of-roll overlapped seams should be constructed with a minimum overlap of 24 inches (40 centimeters);

1. Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone;

2. End-of-roll overlapped seams for all reinforced GCL seams require bentonite-enhanced seams as described below.

E. The **GCL** seams shall be continuously heat tacked using a Leister or another **ENGINEER** approved hot air device to prevent panel separation;

F. Bentonite-enhanced seams are constructed between the overlapping adjacent panels as follows:

1. The underlying edge of the overlap is exposed;

2. A continuous bead of granular sodium bentonite is applied in the center of the overlap; and

3. The granular bentonite shall be applied at a minimum application rate of one quarter pound per lineal foot (0.4 kg/m).

3.6 DETAIL WORK

A. The **GCL** shall be sealed around penetrations and embedded structures embedded in accordance with the design drawings and the **GCL MANUFACTURER'S** recommendations.

B. Cutting the **GCL** should be performed using a sharp utility knife.

1. Frequent blade changes are recommended to avoid damage to the geotextile components of the **GCL** during the cutting process.

3.7 DAMAGE REPAIR

A. If the **GCL** is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by placing a patch to fit over the damaged area.

B. The patch shall be obtained from a new **GCL** roll and shall be cut to size such that a minimum overlap of 12 inches (30 centimeters) is achieved around all of the damaged area.

C. Granular bentonite or bentonite mastic should be applied around the damaged area prior to placement of the patch.

D. The patch should be continuously heat tacked in place using a Leister or another **ENGINEER** approved device.

END OF SECTION

PICACHO ASSOCIATES

SECTION 02711

CORRUGATED POLYETHYLENE PIPE (CPE)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References

B. Submittals

C. Piping

D. Installation

E. Pipe Connections

F. Bedding and Backfill

1.02 RELATED SECTIONS

Section 02200	Site Preparation
Section 02300	Earthwork
Section 02400	Subgrade Preparation
Section 02714	Geotextile
Section 02773	Geosynthetic Clay Liner
Section 02711	Corrugated Polyethylene Pipe

1.03 REFERENCES

A. ASTM F 477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. ASTM F 2306 Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Application.

C. ASTM F 2648 Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications

D. AASHTO M252 Standard Specification for Corrugated Polyethylene Drainage Pipe

1.04 SUBMITTALS

A. Submit under provisions of Section 01300 Submittals.

B. Product Data:

1. The **MANUFACTURER** shall provide resin and strength data.

PART 2 PRODUCTS

2.01 PIPING

A. Pipe supplied by **OWNER** shall be ADS N-12 ST IB Pipe with Class II perforations meeting the requirements of AASHTO M252, Type S, or **OWNER** selected equivalent.

B. Solution/ water collection system and other miscellaneous pipe as shown on the project plans shall be provided by the **OWNER**, inclusive of end caps, tees, y's, or crosses, and pipe material transition couplers.

All other fittings shall be provided by **CONTRACTOR**.

2.02 JOINTS AND FITTINGS

A. The joint shall be soil-tight, and gaskets shall meet the requirements of ASTM F 477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer and provided by **OWNER** shall be used on the gasket and bell during assembly.

B. Fittings shall conform to ASTM F 2306.

PART 3 EXECUTION

3.01 INSTALLATION

A. Wrap pipe in 2 layers of 8oz geotextile securing the geotextile with wire and ensuring all pipe perforations and joints are wrapped by the geotextile.

B. Install piping according to manufacturer's recommendations and per **PLANS.**

C. Take all precautions necessary to not damage pipes during placement, including through loads from earthmoving equipment.

D. During loading, transportation and unloading, every precaution shall be taken to prevent damage to the pipe.

E. No pipe shall be dropped from trucks or allowed to roll down slides without proper retaining ropes.

F. During transportation each pipe shall rest on suitable pads, strips, skids, or blocks secured in place.

G. Any damaged pipe shall be replaced at no additional cost to the **OWNER**.

3.02 PIPE CONNECTIONS

A. Pipe shall be joined using a bell and spigot joint meeting ASTM F 2648.

B. The joint shall be soil-tight and gaskets, when applicable, shall meet the requirements of ASTM F 477.

C. A joint lubricant supplied by the manufacturer and provided by **OWNER** shall be used on the gasket and bell during assembly.

D. Fabricated fittings shall be welded at all accessible interior and exterior junctions.

E. End caps shall be permanently installed at the upstream end of primary collection pipes and all ballast pipe in accordance with manufacturer's installation guidelines.

3.03 BEDDING AND BACKFILL

A. Backfill/cover pipes as shown on the **PLANS**.

B. Backfill and compact in accordance with Section 02300, Earthwork.

C. Ensure compaction equipment does not damage pipes.

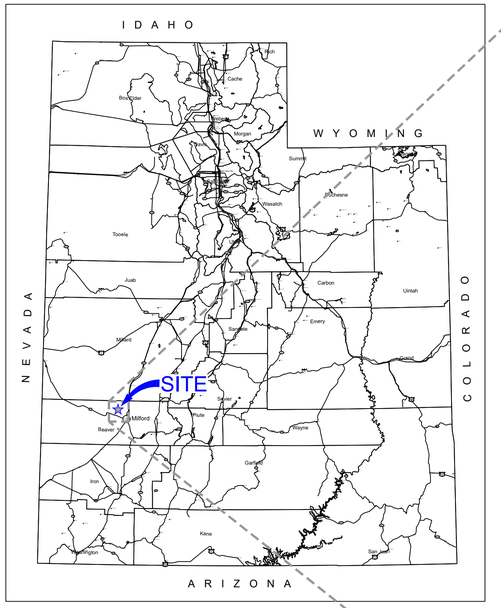
3.04 INSPECTION

A. Inspect the pipe for defects before installation.

B. Defective, damaged or unsound pipe will be rejected.

END OF SECTION

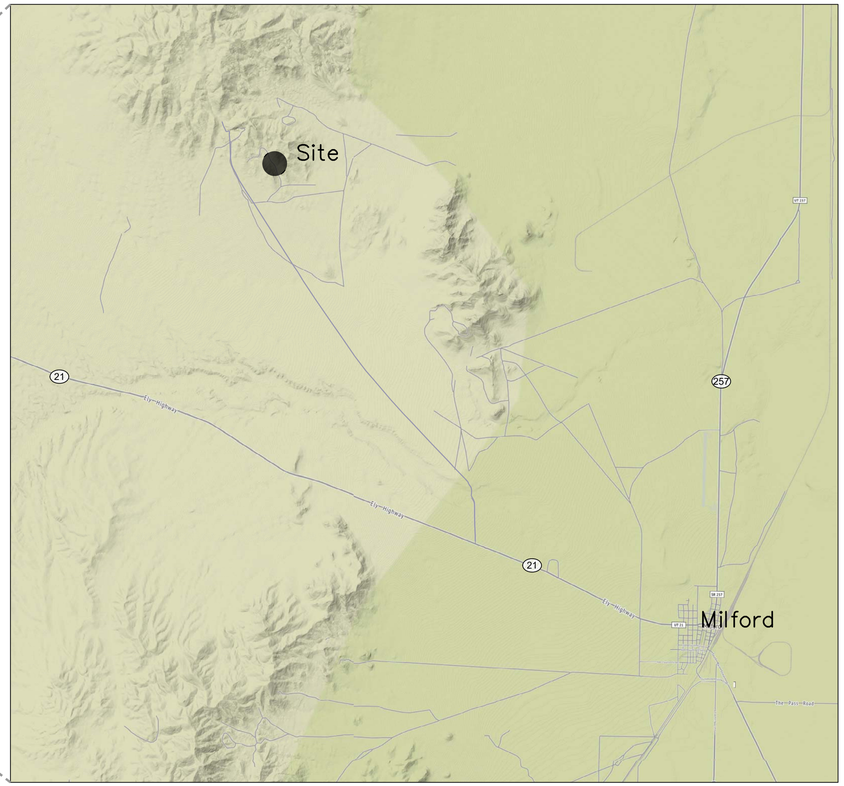
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT



SITE LOCATION

0 25 50 100 150

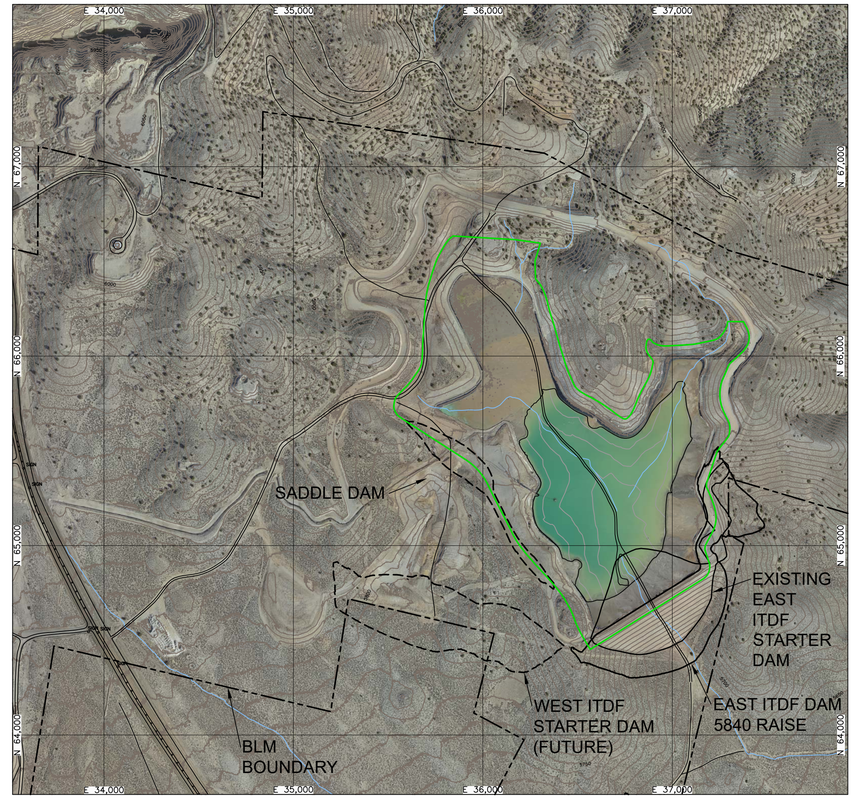
SCALE IN MILES



SITE VICINITY

0 1 2 4 6

SCALE IN MILES



SITE MAP

0 150 300 600 900

SCALE IN FEET

LIST OF DRAWINGS

1. TITLE SHEET
2. MINE SITE & DUMP LOCATIONS
3. WEST & EAST ITDF SITE PLAN
4. GEOTECHNICAL INVESTIGATION
5. EAST ITDF 5840 DAM RAISE & IMPOUNDMENT PLAN
6. EAST ITDF 5840 DAM RAISE & IMPOUNDMENT ISOPACH
7. EAST ITDF 5840 DAM RAISE DRAINS
8. EAST ITDF 5840 DAM RAISE SECTIONS
9. EAST ITDF 5840 DAM RAISE TYPICAL SECTION
10. EAST ITDF IMPOUNDMENT SECTIONS

11A. EAST ITDF PERIMETER ROAD SECTIONS

11B. EAST ITDF PERIMETER ROAD PROFILE

12. SECTIONS AND DETAILS
13. DETAILS
14. PIEZOMETER DETAILS
15. STORMWATER CHUTE PLAN & SECTIONS

PROFESSIONAL ENGINEER
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No. 10763935
STEPHEN J. TAYLOR
5/3/2024
STATE OF UTAH

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NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
A	11/1/23	TML	SJT	SJT	FOR BID
B	11/17/23	TML	SJT	SJT	FOR BID - CHANGED DOWNSTREAM RAISE
C	11/24/23	TML	SJT	SJT	FOR PERMITTING
0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION
1	5/3/24	TML	SJT	SJT	ADDED DRAWING 15

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PROJECT: MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

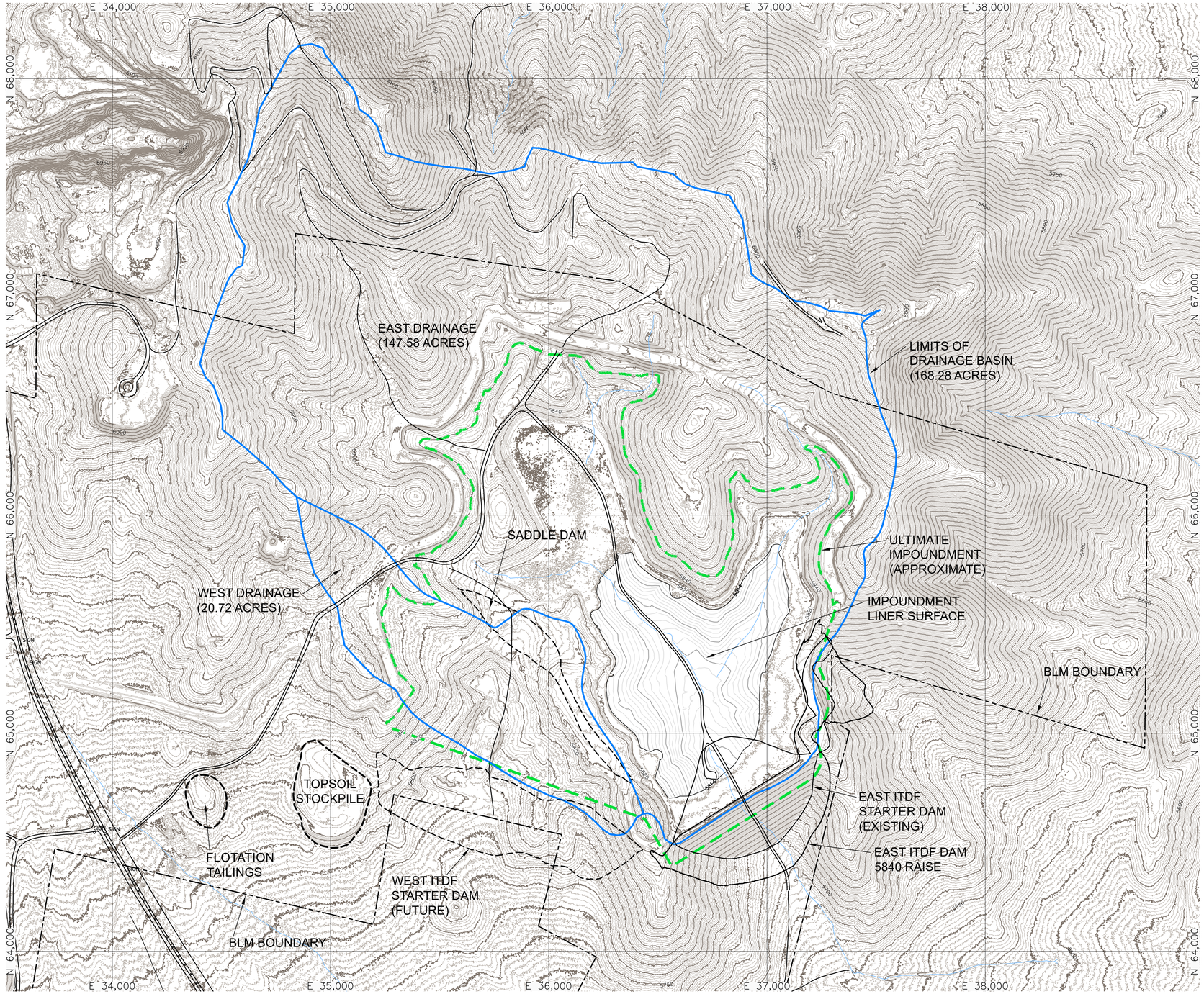
DRAWING: 1

TITLE: TITLE SHEET

FILE NAME:

REVISION:

Topography & BLM Boundary Provided by Tamra Mining: April 2018, to local mine coordinate system.



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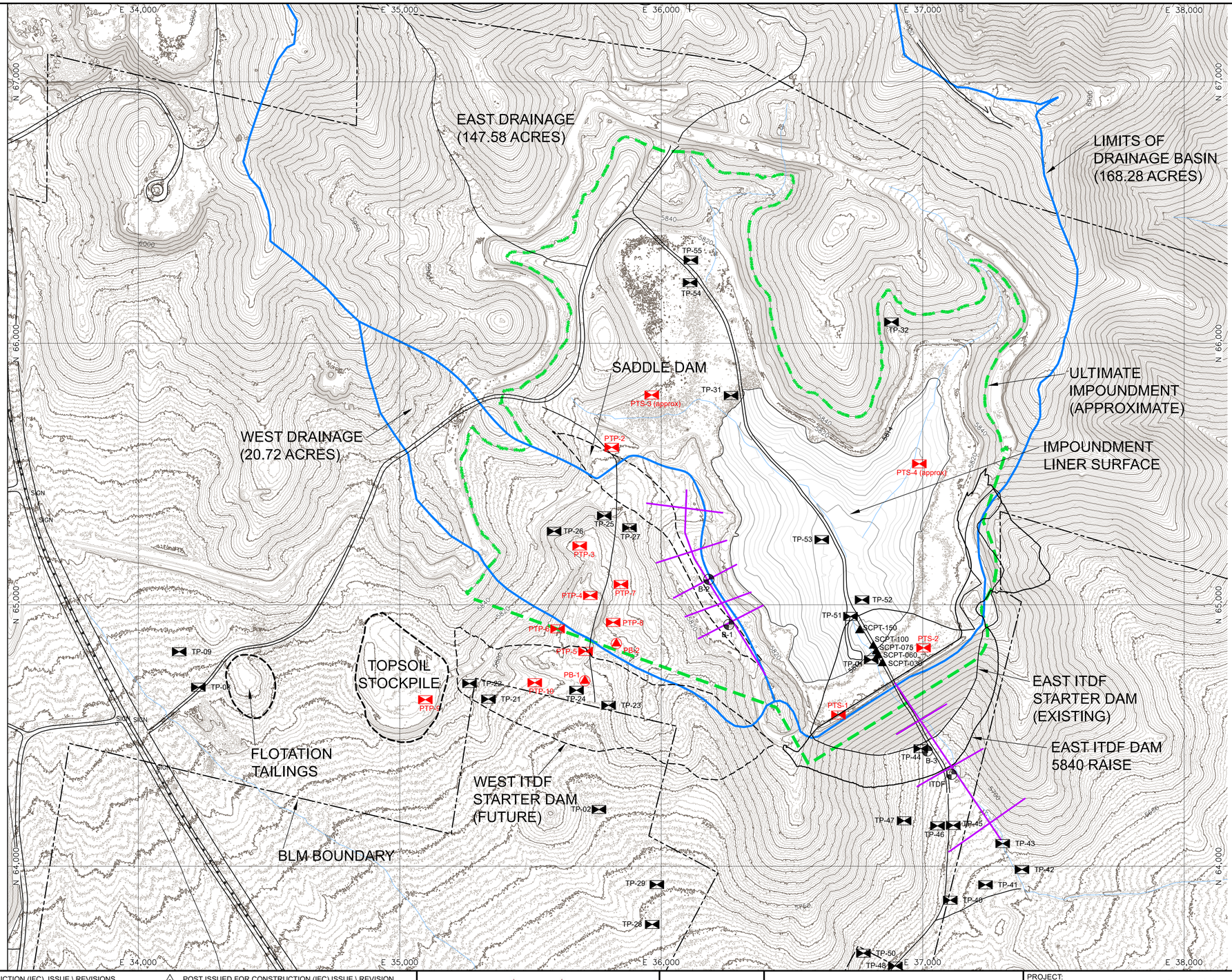
TITLE:
WEST & EAST ITDF
SITE PLAN

DRAWING
3

FILE NAME:

REVISION:



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SCALE IN FEET

CPT PROBE COORDINATES		
ID	LATITUDE	LONGITUDE
SCPT-030	38.48164	-113.11813
SCPT-060	38.48172	-113.11819
SCPT-075	38.48176	-113.11821
SCPT-100	38.48182	-113.11825
SCPT-150	38.481980	-113.11843

BORE HOLE COORDINATES (PLANT GRID)		
ID	EASTING	NORTHING
PB-1	35,707.95	64,709.00
PB-2	35,828.40	64,851.70

LEGEND

- SCPT Test Locations (2023)
- Picacho Boring Location (2017)
- Picacho Test Pit Location (2017)
- Existing Boring Location (2013)
- Existing Test Pit Location (2013)
- Approximate Geophysics Survey Location (2013)

NOTE:
TP-03, TP-04 TP-05, TP-06, Tp-07, and TP-49 are outside the area shown.

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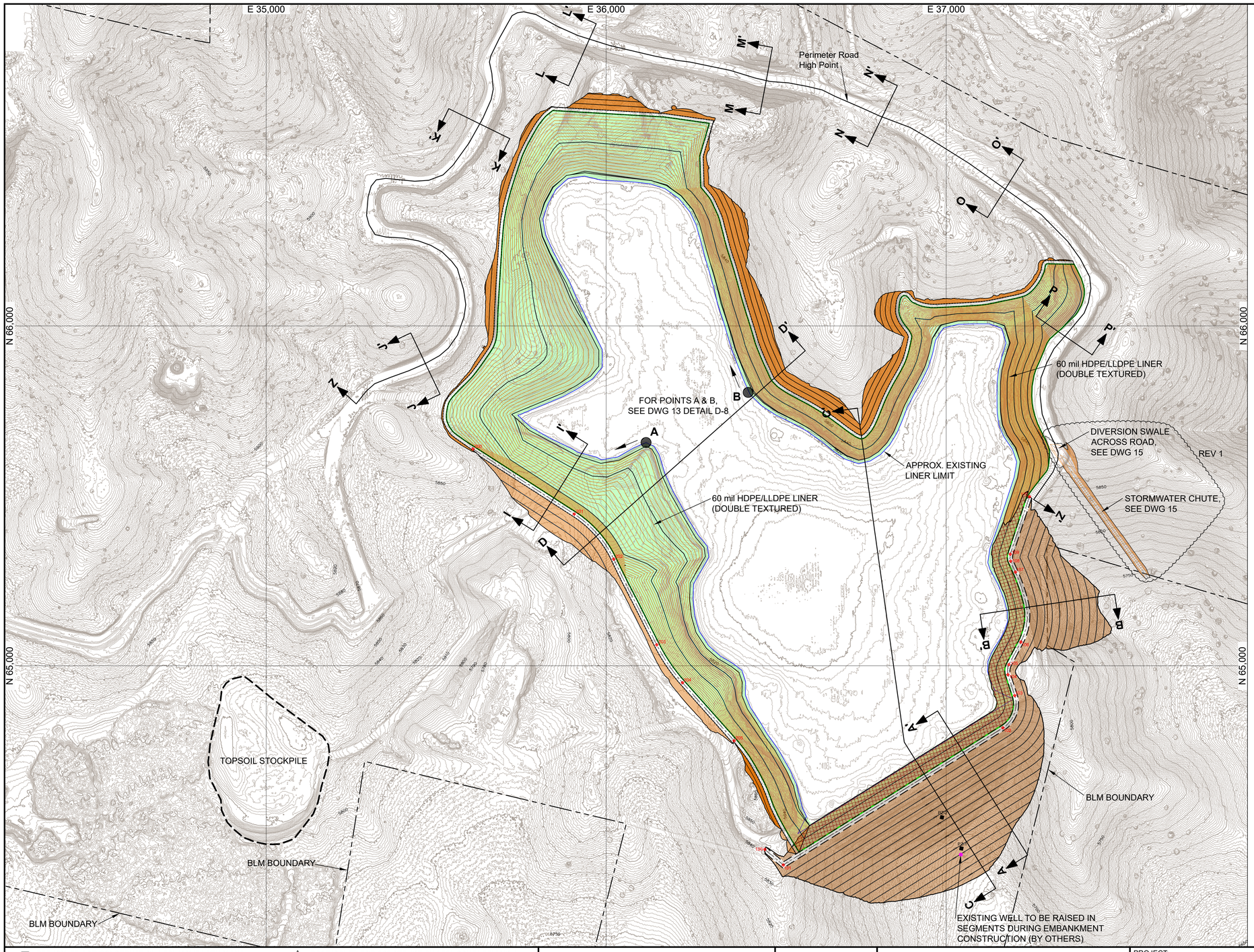
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

DRAWING
4

TITLE:
GEOTECHNICAL INVESTIGATION

FILE NAME:

REVISION:



0 75 150 300 450

SCALE IN FEET

QUANTITY SUMMARY:			
	Cut (cu. Yds.)	Fill (cu. Yds.)	Area (sq. ft.)
Impoundment	171,918	22,379	
East ITDF	7	345,437	
Saddle Dam	0	29,440	
Impoundment Liner Area	0	0	1,003,142
East ITDF Foundation Excavation	0	0	178,066
Saddle Dam Foundation Excavation	0	0	85,287
Downstream Blanket Drain	0	0	
5820 Anchor Trench Length = 6,460 ft.			
5840 Anchor Trench Length = 7,600 ft.			
Perimeter Road Berm Length = 4,375 ft.			

LEGEND

- Extent of New Liner Area Between 5820 and 5840
- Extent of Low Permeability Bedding (See Detail 11)
- PZ-1 ◆ Piezometer Locations

Notes:

1. No Benches, Steps, or Sharp Slope Changes Anywhere Along Embankment or Within Impoundment, Other Than as Shown at Elevations 5820 and 5840.
2. Impoundment Slopes no Steeper Than 2.2:1
3. Contour Interval = 1'

5840 DAM RAISE CONTROL POINTS TABLE			
POINT NUMBER	NORTHING	EASTING	ELEVETION
100	64459.83	36466.81	5840.00
101	64413.99	36520.88	5840.00
102	64817.59	37166.71	5840.00
103	64912.51	37201.62	5840.00
104	64973.90	37181.52	5840.00
105	65003.57	37184.59	5840.00
106	65070.04	37219.66	5840.00
107	65275.81	37203.68	5840.00
108	65307.91	37189.29	5840.00
109	65328.42	37188.62	5840.00
110	65497.66	37245.01	5840.00

SADDLE DAM CONTROL POINTS TABLE			
POINT NUMBER	NORTHING	EASTING	ELEVETION
200	65638.10	35608.52	5840.00
201	65446.43	35906.02	5840.00
202	65313.86	36022.13	5840.00
203	65061.75	36148.85	5840.00
204	64950.31	36224.48	5840.00
205	64779.55	36376.27	5840.00

PIEZOMETER CONTROL POINTS TABLE		
PIEZOMETER	NORTHING	EASTING
PZ-1	64462.70	37044.83
PZ-2	64554.21	36987.63

Source:
Topography is a July 2023 Drone Flight,
Provided By Rango Inc.

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1	5/3/24	TML	SJT	SJT	ADDED POINTS A & B AND STORMWATER CHUTE

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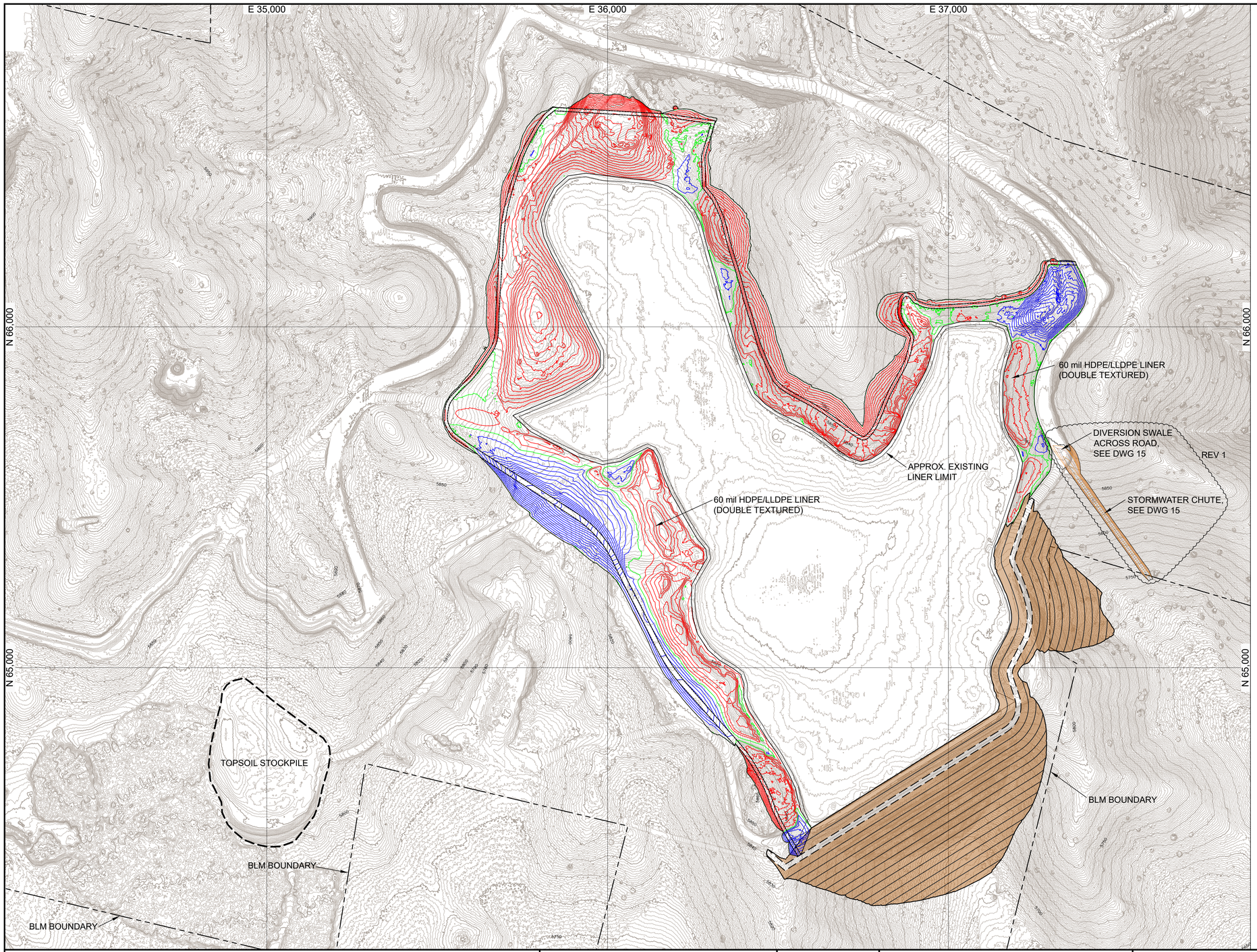
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

DRAWING
5

TITLE:
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT PLAN

FILE NAME:

REVISION:



0 75 150 300 450

SCALE IN FEET

LEGEND

- Native 1' Contours
- 2' Isopach Cut Contours
- 2' Isopach Fill Contours
- Isopach Zero Contours

Source:
Topography is a July 2023 Drone Flight,
Provided By Rango Inc.

PROFESSIONAL ENGINEER
S. Taylor
No. 10763935
STEPHEN J.
TAYLOR
5/3/2024
STATE OF UTAH

A PRE ISSUED FOR CONSTRUCTION (IFC) ISSUE \ REVISIONS

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C	11/24/23	TML	SJT	SJT	FOR PERMITTING
0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION
1	5/3/24	TML	SJT	SJT	ADDED STORMWATER CHUTE

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UTAH

PICACHO ASSOCIATES
522 West State Avenue
Phoenix, AZ 85021
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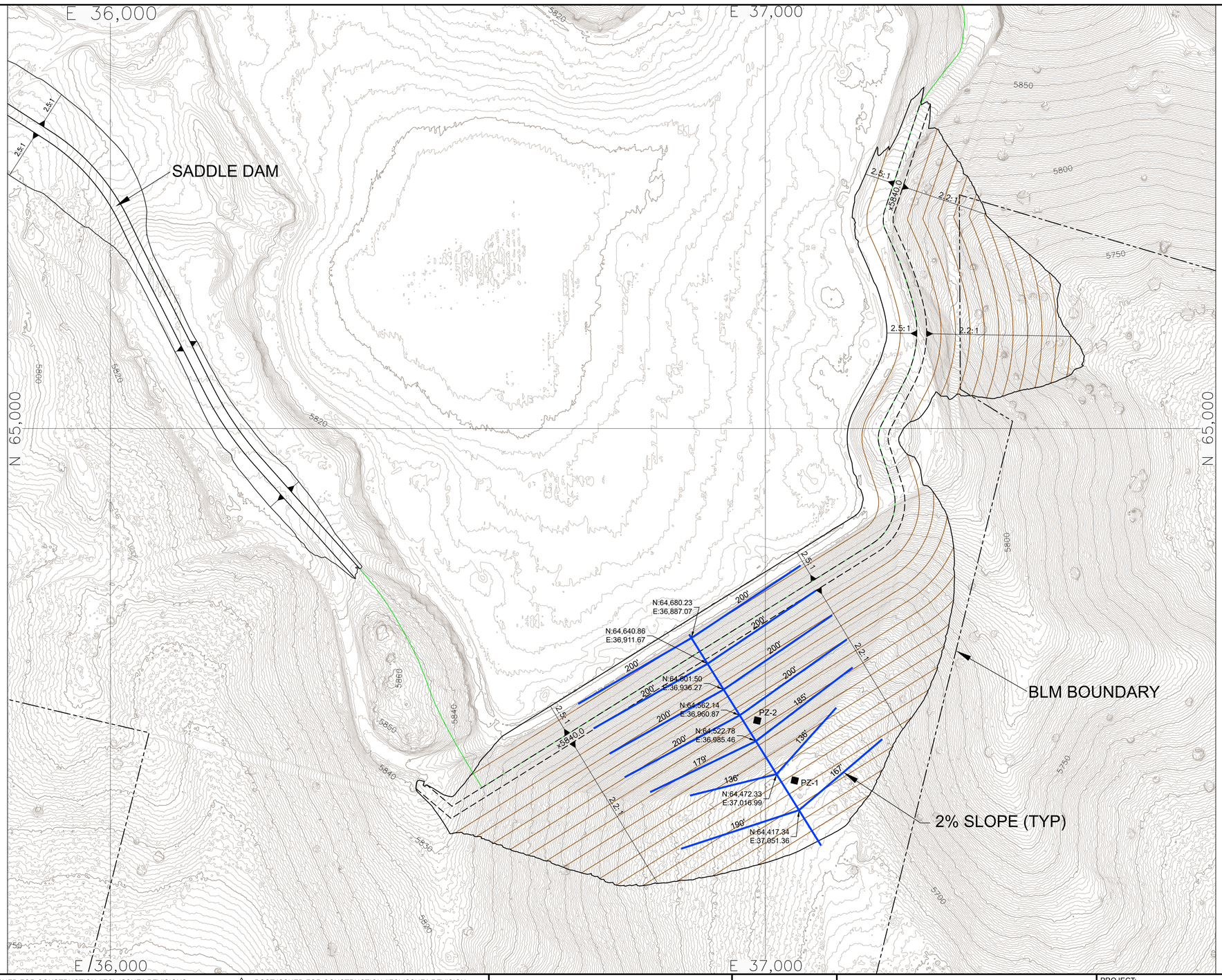
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

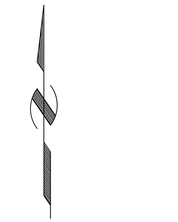
DRAWING
6

TITLE:
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT ISOPACH

FILE NAME:

REVISION:



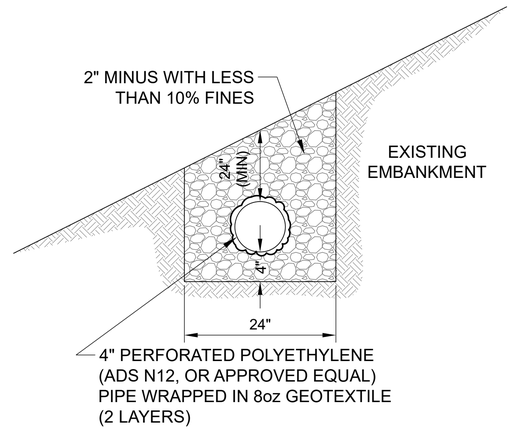


LEGEND

Spine/Lateral Drain 4-inch CPT

PZ-1 Piezometer Locations

PIEZOMETER CONTROL POINTS TABLE		
PIEZOMETER	NORTHING	EASTING
PZ-1	64462.70	37044.83
PZ-2	64554.21	36987.63



SPINE/LATERAL DRAIN TRENCH DETAIL

PROFESSIONAL ENGINEER
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0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION

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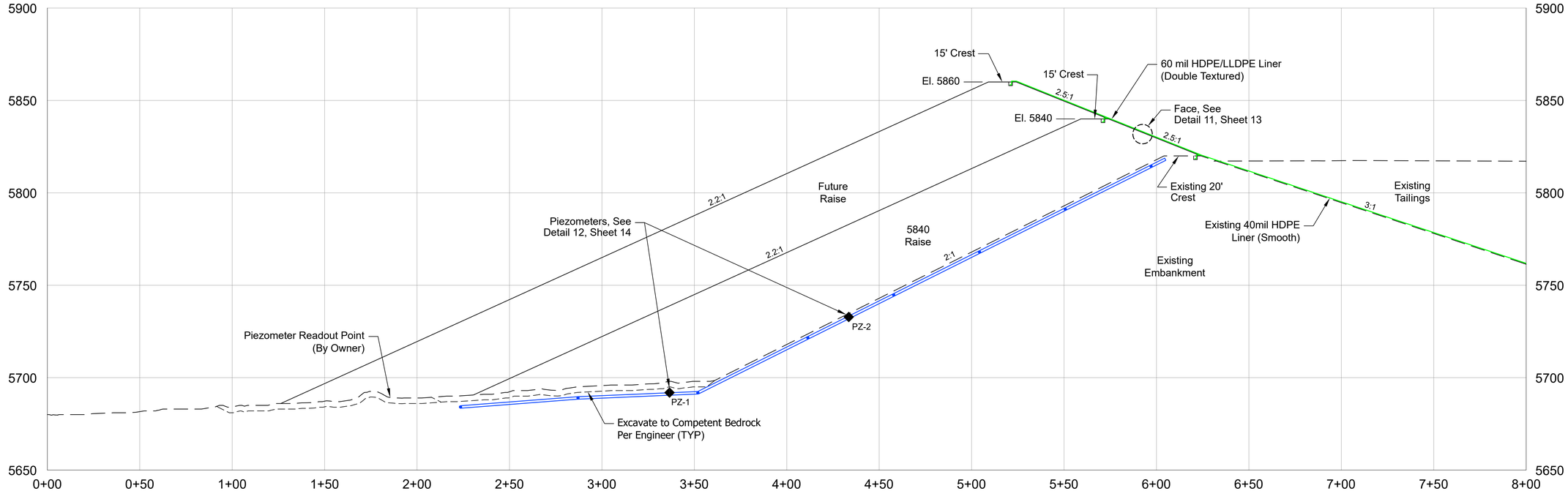
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840DAM RAISE & IMPOUNDMENT

DRAWING
7

TITLE:
EAST ITDF 5840 RAISE DRAINS

FILE NAME:

REVISION:



EAST ITDF DAM RAISE TYPICAL SECTION

Note:
Dam fill to be either select rock placed per method specification developed with Engineer, or random fill placed to 95% standard proctor (ASTM D 698). Transitions between fill types to avoid fines migrations per Engineer.

0 15 30 60 120
SCALE IN FEET
VERTICAL EXAGGERATION – 1:1

LEGEND

- Existing Ground
- Proposed Grade
- 3' Excavation or Bedrock

PROFESSIONAL ENGINEER
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0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION

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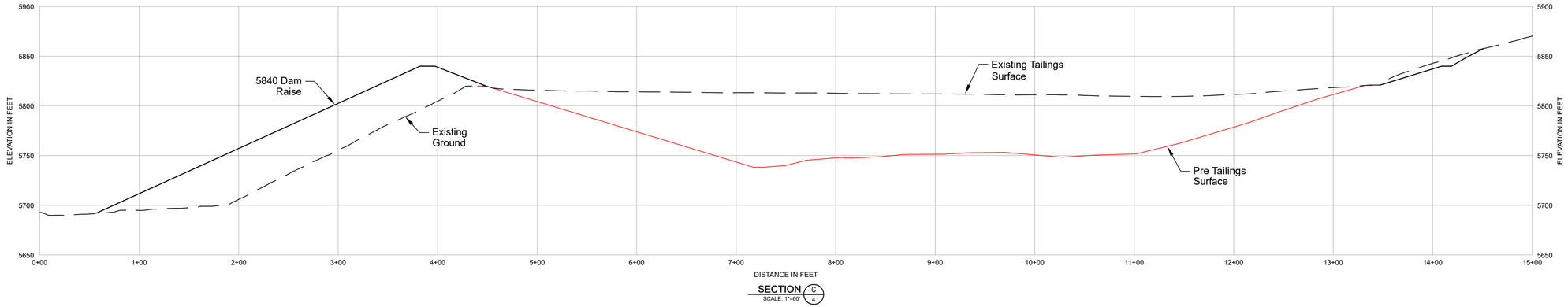
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

DRAWING
9

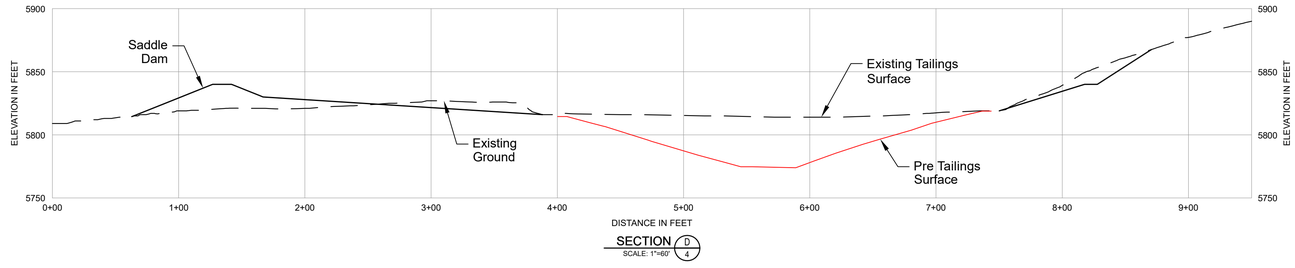
TITLE:
EAST ITDF DAM RAISE TYPICAL SECTION

FILE NAME:

REVISION:



SECTION C
SCALE: 1"=60' 4



SECTION D
SCALE: 1"=60' 4

LEGEND

- Existing Ground
- Existing Pre Tailings
- Expansion Grade

Note:
Impoundment to be shaped according to impoundment surface. See drawing 4

0 30 60 120 240
SCALE IN FEET
VERTICAL EXAGGERATION - 1:1

PROFESSIONAL ENGINEER
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1/8/2024
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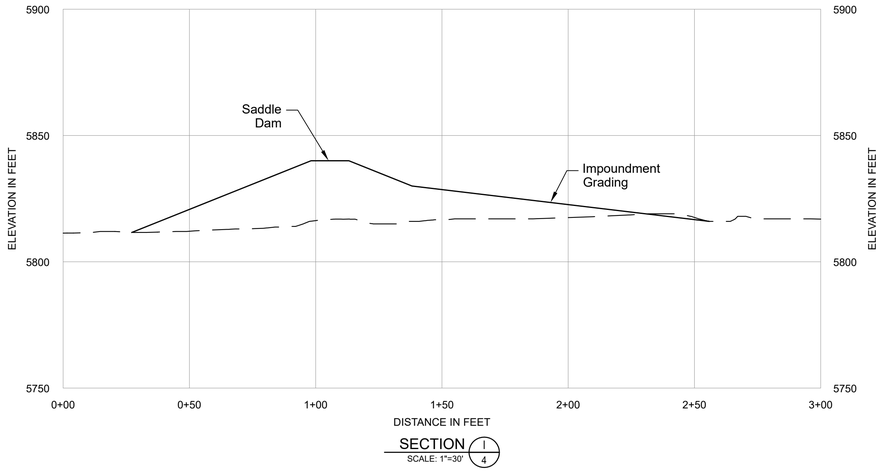
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

TITLE:
EAST ITDF IMPOUNDMENT SECTIONS

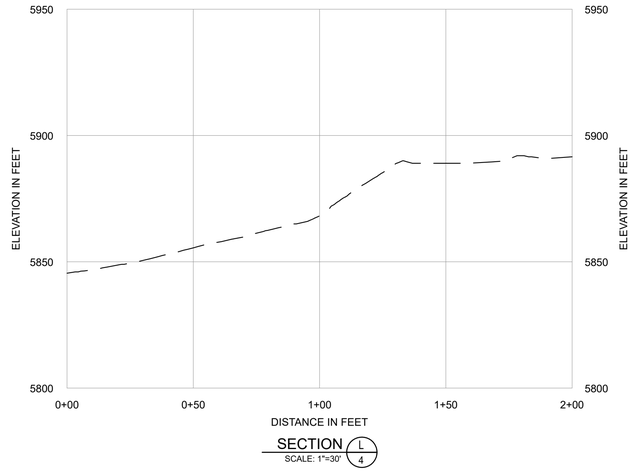
DRAWING
10

FILE NAME:

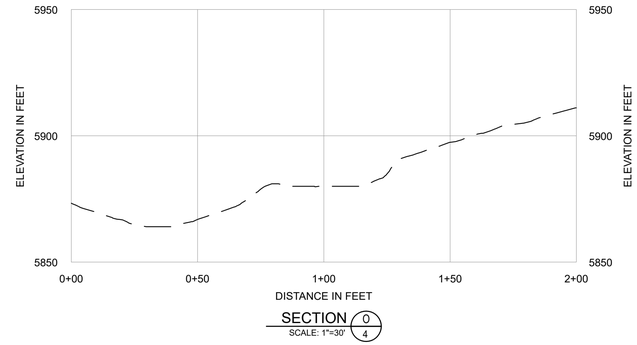
REVISION:



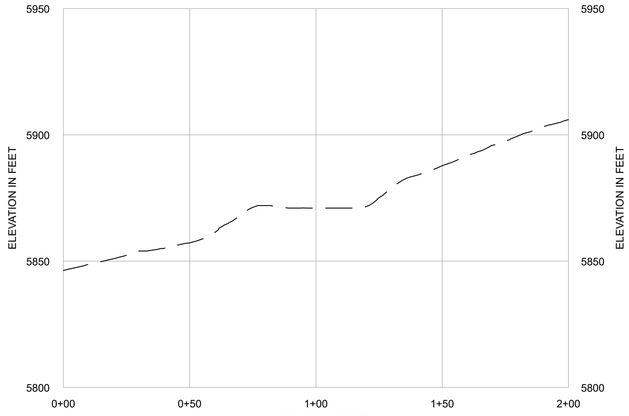
SECTION I / 4
SCALE: 1"=30'



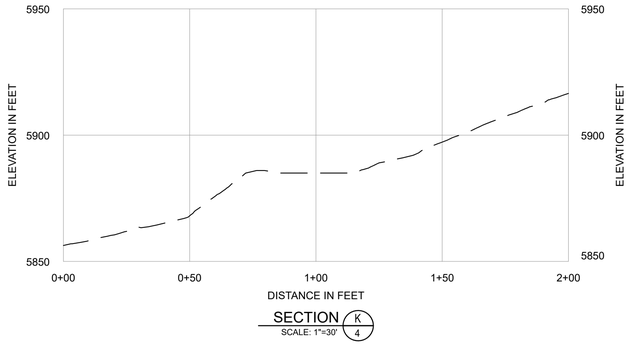
SECTION L / 4
SCALE: 1"=30'



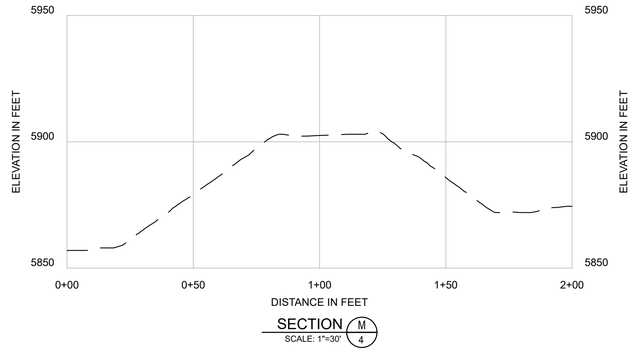
SECTION O / 4
SCALE: 1"=30'



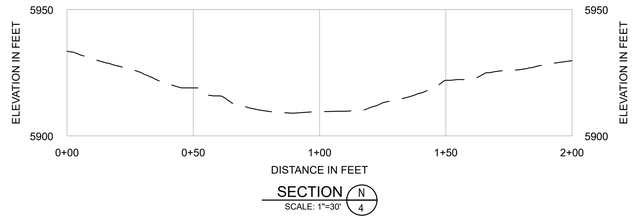
SECTION J / 4
SCALE: 1"=30'



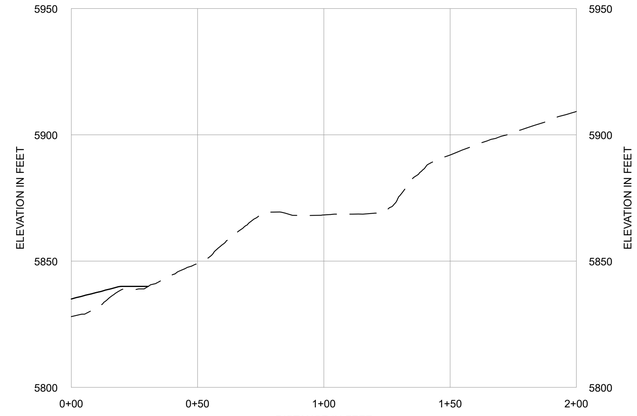
SECTION K / 4
SCALE: 1"=30'



SECTION M / 4
SCALE: 1"=30'



SECTION N / 4
SCALE: 1"=30'



SECTION P / 4
SCALE: 1"=30'

LEGEND

- Existing Ground
- Proposed Grade

0 15 30 60 120
SCALE IN FEET
VERTICAL EXAGGERATION - 1:1

PROFESSIONAL ENGINEER
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1/8/2024
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MILFORD MINING COMPANY
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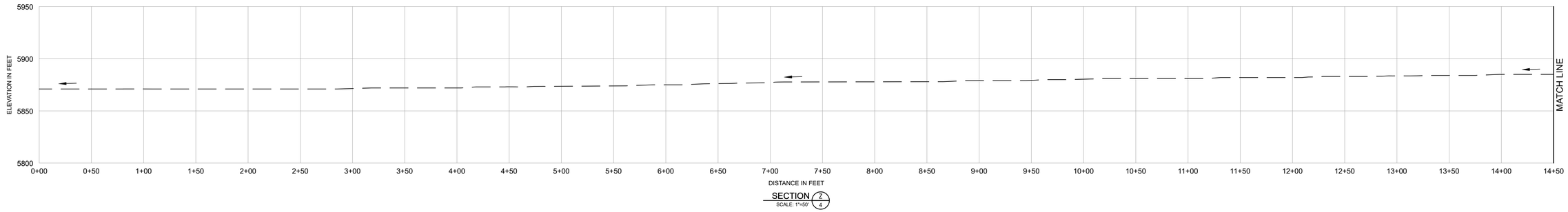
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

DRAWING
11A

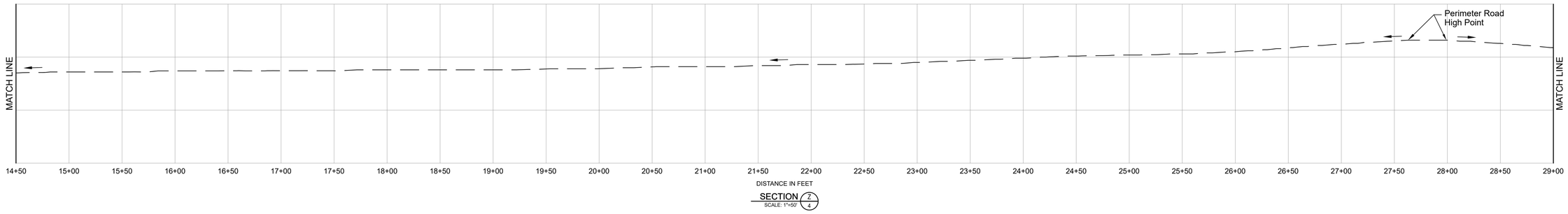
TITLE:
EAST ITDF PERIMETER ROAD SECTIONS

FILE NAME:

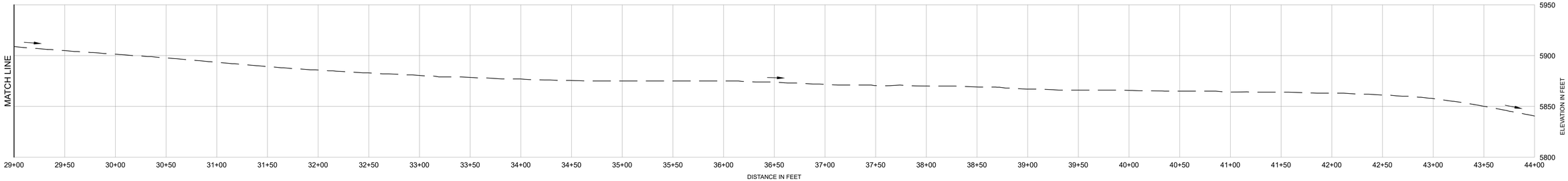
REVISION:



SECTION 2/4
SCALE: 1"=50'



SECTION 2/4
SCALE: 1"=50'



SECTION 2/4
SCALE: 1"=50'

Note:
Perimeter road to be graded to ensure longitudinal flow
along entire length with no ponding greater than 1 foot deep.

0 25 50 100 200
SCALE IN FEET
VERTICAL EXAGGERATION - 1:1

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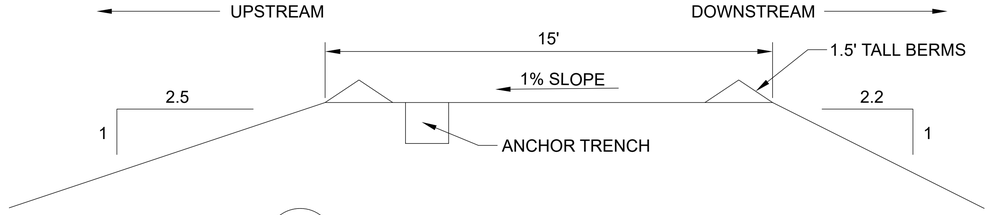
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

DRAWING
11B

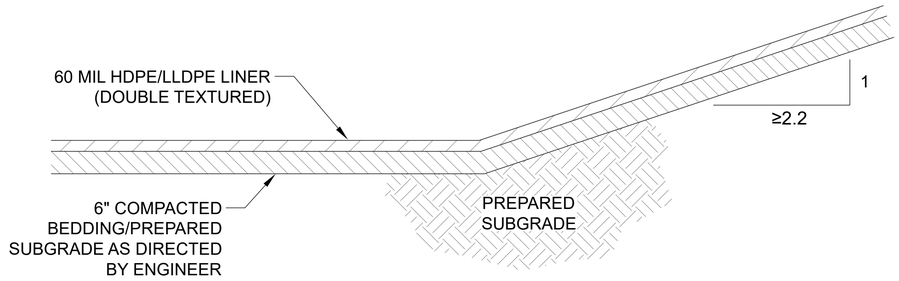
TITLE:
EAST ITDF PERIMETER ROAD PROFILE

FILE NAME:

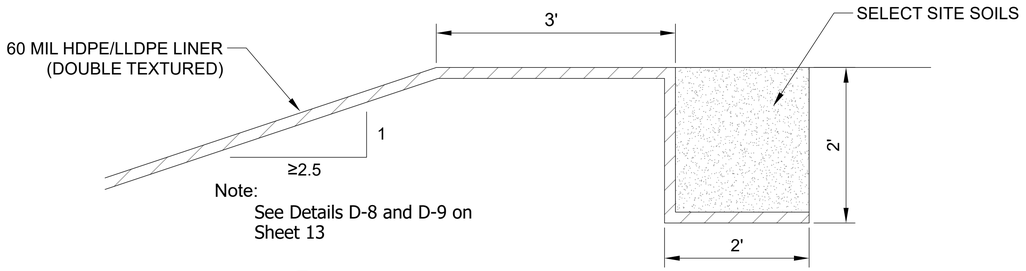
REVISION:



D-1 DETAIL 1 - 5840 RAISE CREST & SADDLE DAM
NTS

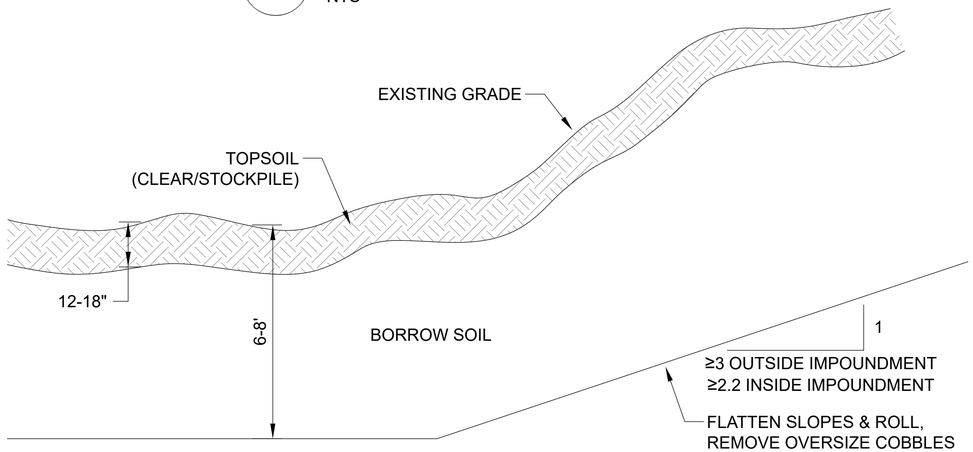


D-2 DETAIL 2 - HDPE INSTALLATION
NTS

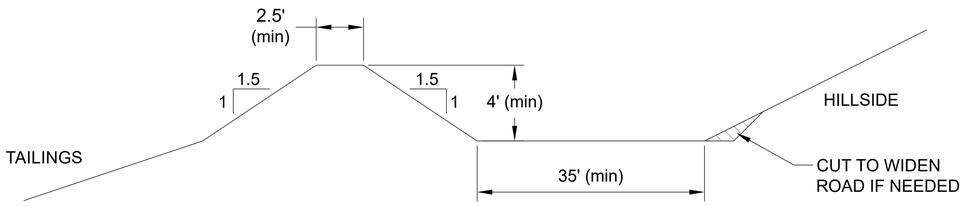


Note:
See Details D-8 and D-9 on Sheet 13

D-3 DETAIL 3 - EMBANKMENT & SADDLE DAM CREST
HDPE/LLDPE ANCHOR TRENCH
NTS



D-4 DETAIL 4 - BORROW & SUBGRADE PREPARATION
NTS



Note:
Compacted Fill, to be 95% Standard Proctor.

D-5 DETAIL 5 - TYPICAL ROAD STORMWATER INTERUPTOR BERM
(Along Perimeter Road Z-Z')
NTS

REV 1

PROFESSIONAL ENGINEER
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5/3/2024
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0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION
1	5/3/24	TML	SJT	SJT	REMOVED DETAILS D-6 & D-7

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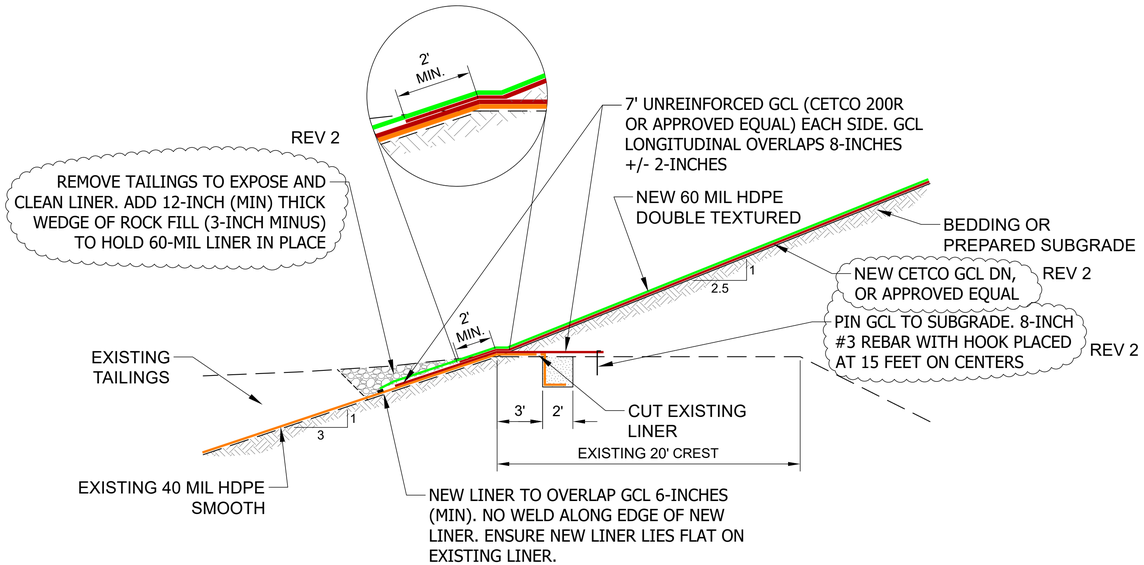
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

DRAWING
12

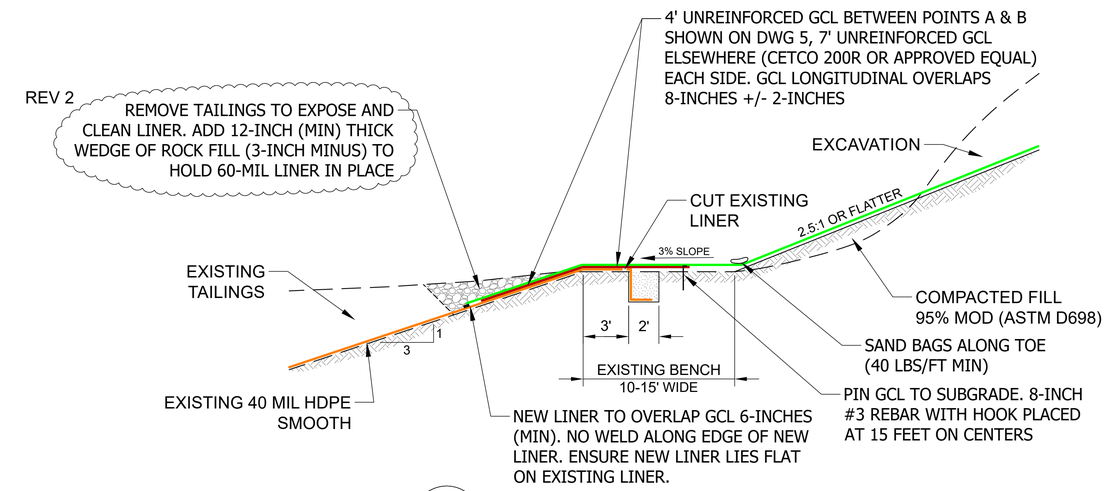
TITLE:
SECTIONS & DETAILS

FILE NAME:

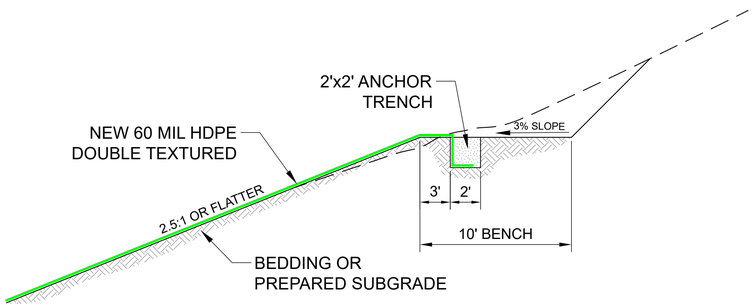
REVISION:



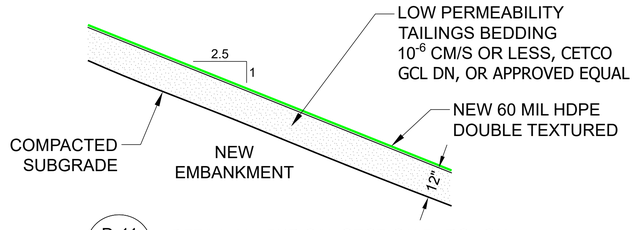
D-8 DETAIL 8 - SLIP JOINT & LINER CONNECTION
EMBANKMENT CREST AT 5820
SCALE: 1"=5'



D-9 DETAIL 9 - SLIP JOINT & LINER CONNECTION
BENCH AT 5820
SCALE: 1"=5'



D-10 DETAIL 10 - ANCHORING ON 5840 BENCH
SCALE: 1"=5'



D-11 DETAIL 11 - TYPICAL SECTION THROUGH
EMBANKMENT FACE
SCALE: 1"=5'

NOTES:

1. ROCK TO BE PLACED WITH LOW GROUND PRESSURE EQUIPMENT.
2. ALL GEOTEXTILE AND GCL TO BE SHINGLED FOR DOWNSLOPE WATER FLOW.
3. OPERATOR TO ENSURE DISCHARGED TAILINGS DO NOT ERODE ROCK FILL OVER SLIP JOINT.

PROFESSIONAL ENGINEER
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6/26/2024
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0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION
1	5/3/24	TML	SJT	SJT	ADJUSTED SLIP JOINT DETAILS D-8 & D-9 , CORRECTED D-10, REVISED NOTES
2	6/26/24	TML	SJT	SJT	CLARIFIED DETAIL DWG, CHANGED ROCK SIZE

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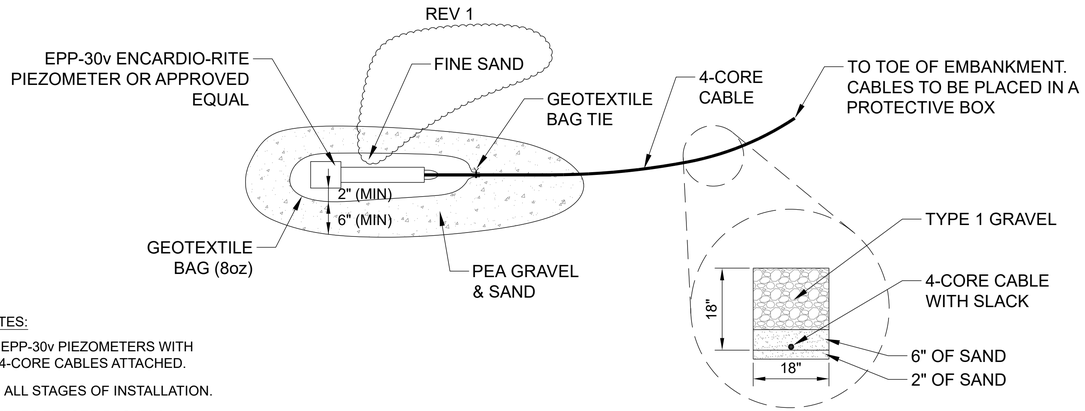
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

DRAWING
13

TITLE:
DETAILS

FILE NAME:

REVISION:



PIEZOMETER NOTES:

1. PURCHASE 2x EPP-30v PIEZOMETERS WITH 250' & 200' OF 4-CORE CABLES ATTACHED.
2. PHOTOGRAPH ALL STAGES OF INSTALLATION.
3. TEST PIEZOMETERS BEFORE BACKFILL.
4. FOLLOW ALL MANUFACTURERS INSTALLATION INSTRUCTIONS. (SEE EPP-30v USERS MANUAL)
5. SEE DRAWINGS 7 & 9 FOR PIEZOMETER LOCATIONS.
6. PLACE ALL ELECTRICAL WIRE IN 1"Ø HDPE SDR 11 CONDUIT OR SIMILAR APPROVED.

REV 1

D-12 DETAIL 12 - PIEZOMETER INSTALLATION (BY OWNER)
SCALE: NTS

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5/3/2024
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B	11/17/23	TML	SJT	SJT	FOR BID - CHANGED DOWNSTREAM RAISE
C	11/24/23	TML	SJT	SJT	FOR PERMITTING
0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION
1	5/3/24	TML	SJT	SJT	ADDED SAND & NOTE 6

MILFORD MINING COMPANY
UTAH

PICACHO ASSOCIATES
522 West State Avenue
Phoenix, AZ 85021
Tel: (801) 979 - 4056

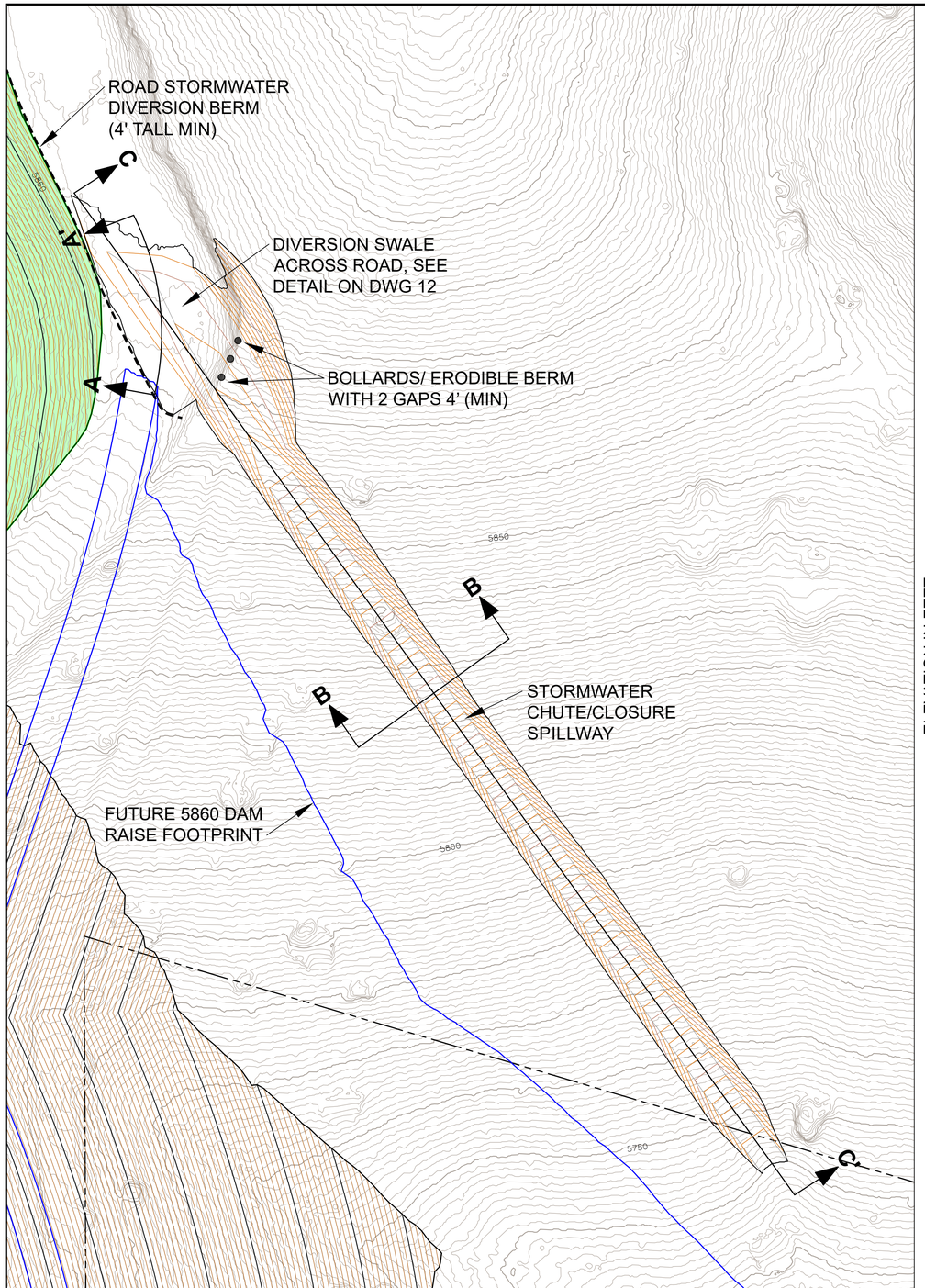
PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

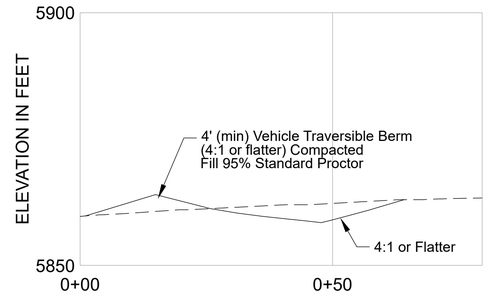
DRAWING
14

TITLE:
PIEZOMETER DETAILS

FILE NAME:

REVISION:





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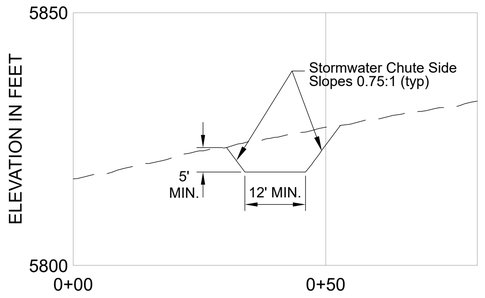

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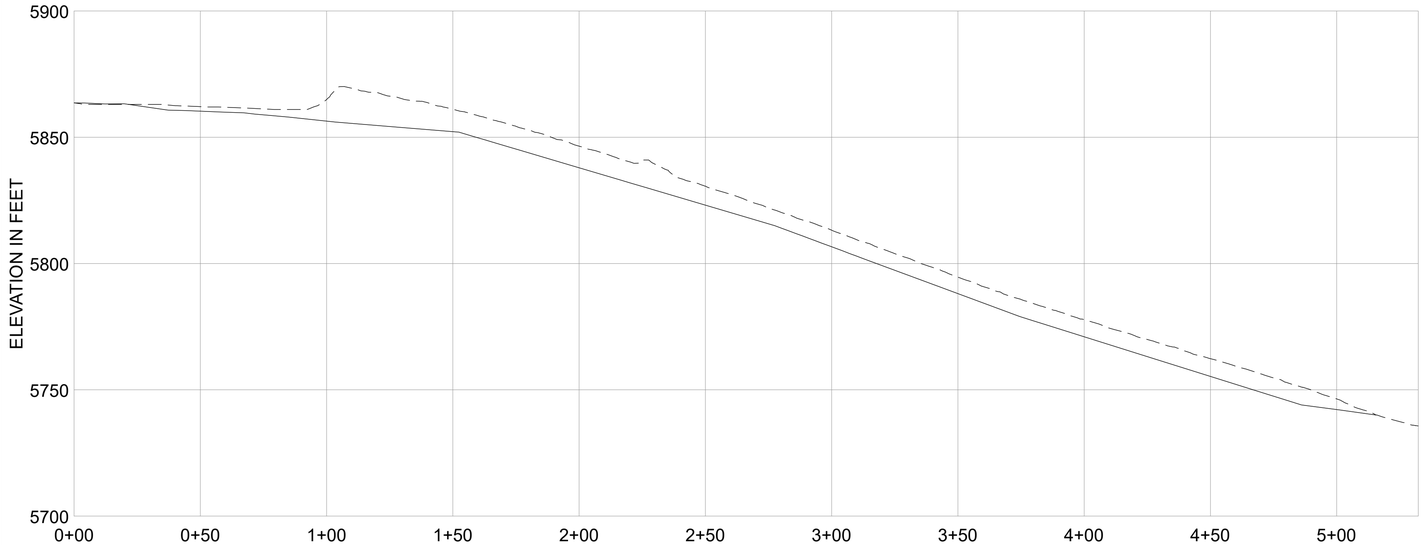

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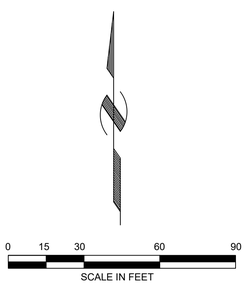

QUANTITY SUMMARY:		
	Cut (cu. Yds.)	Fill (cu. Yds.)
Stormwater Chute	2,644	47

PROFESSIONAL ENGINEER
STATE OF UTAH
No. 10763935
STEPHEN J. TAYLOR
5/3/2024

A PRE ISSUED FOR CONSTRUCTION (IFC) ISSUE \ REVISIONS
0 POST ISSUED FOR CONSTRUCTION (IFC) ISSUE \ REVISION

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
A	11/1/23	TML	SJT	SJT	FOR BID
B	11/17/23	TML	SJT	SJT	FOR BID - CHANGED DOWNSTREAM RAISE
C	11/24/23	TML	SJT	SJT	FOR PERMITTING
0	1/8/24	TML	SJT	SJT	FOR CONSTRUCTION
1	5/3/24	TML	SJT	SJT	ADDED NEW DRAWING 15

MILFORD MINING COMPANY
UTAH

PICACHO ASSOCIATES
522 West State Avenue
Phoenix, AZ 85021
Tel: (801) 979 - 4056

PROJECT:
MILFORD MINING COMPANY
EAST ITDF 5840 DAM RAISE & IMPOUNDMENT

TITLE:
STORMWATER CHUTE PLAN & SECTIONS

DRAWING
15

FILE NAME:

REVISION:

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

JAN 17 2014

Ronald Wunderlich
Land and Permitting Manager
CS Mining, LLC
PO Box 608
Milford, UT 84751

Dear Mr. Wunderlich:

Subject: **Construction Permit** for Lined Supernatant Clarification Ponds, CS Mining LLC

On December 23, 2013 the Division of Water Quality (DWQ) received the engineering plans and specifications for Lined Supernatant Clarification Ponds prepared by Intermountain GeoEnvironmental Services, Inc. (IGES). A condition of the Permit-By-Rule issued on October 5, 2009 stated the following "it is our understanding that the tailings impoundment will be lined with a single flexible membrane liner (FML) that will limit subsurface leakage to *de minimis* levels." These new Lined Supernatant Clarification Ponds will also meet that requirement of a single FML to limit subsurface leakage to *de minimis* levels.

In a meeting on September 9, 2013 with John Wallace and Robert Bayer also indicated that CS Mining is looking at constructing a new copper extraction process. This new process will require an application for a Ground Water Discharge Permit which will be submitted in the near future. Therefore the present tailing impoundment and these new Lined Supernatant Clarification Ponds are temporary until the new processing facilities can per permitted, constructed and put into operation.

The following is a summary of the proposed major construction projects:

- Excavation and construction of two relatively small lined clarification ponds. The liner material will be 45-mil ethylene propylene diene monomer (EPDM).

The plans and specifications, as submitted, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code).* A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. *Any revisions or modifications to the approved plans and specifications must be submitted to DWQ for review and approval, before construction or implementation thereof. Please submit any changes for review and approval directly to Woodrow Campbell, P.E., of the DWQ Ground Water Protection Section.*

2. *A written operations and maintenance manual, containing a description of the*

functioning of the facilities, an outline of routine maintenance procedures, and all checklists and maintenance logs needed for proper operation of the system, must be submitted and approved before the final inspection and operation of the system.

3. *The approved facilities must not be placed in service unless DWQ has conducted a final inspection, reviewed and approved the As-Built Construction Certification Report, and provided written authorization to place the constructed facilities in service.*

The plans and specifications for this project must be stamped and signed by a Professional Engineer currently licensed to practice in the state of Utah. The construction design, inspection supervision, and written construction certification of all work associated with this Construction Permit must be performed by a Professional Engineer licensed to practice in the state of Utah.

This Construction Permit will expire one year from the date of its issuance, as evidenced by the date of this letter, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you, in any way, of your obligations to comply with other applicable local requirements. You may contact Southwest Utah Public Health 435-986-2582 or Paul Wright, Southwest Utah District Engineer 435-986-2590 for further assistance regarding local matters.

Because of the inherent hazard potential at lagoons and ponds, warning signs should be posted at these facilities to state the dangers of drowning and asphyxiation. Safety ropes running down the pond side slopes, and fastened to posts at the top of the dikes should be available to allow anyone trapped in the ponds to escape.

Please contact Mr. Campbell at the beginning of construction to allow periodic inspections to be scheduled. Upon completion of the project, a final inspection and approval of the As-Built Construction Certification Report is required before the approval to operate the completed facilities can be issued. Please remain in contact with Mr. Campbell to schedule the final inspection. The Construction Certification Report with final as-built drawings must include test results for the following construction quality assurance and quality control (CQA/QC) elements:

<u>Soil Subgrade</u>

- Proctor Curves,
- Soil Classification,
- Field Compaction Testing, and
- Subgrade Acceptance Certification.

<u>Flexible Membrane Liner</u>

- Panel Placement Log,
- Trial Seam Test Log,
- Seaming Record,
- Seam Test Record,
- Repair Log,
- As-Built Drawing,
- Manufactures Certification including QA/QC Testing of the Rolls, and
- Professional Engineer Certification.

If we can be of further assistance, please contact Mr. Woodrow Campbell at wwcampbell@utah.gov or (801) 536-4353.

Sincerely,

Walter L. Baker, P.E.
Director

WLB/WWC/DJH:fb

cc: Paul Wright, Southwest Utah District Engineer (via e-mail)
Southwest Utah Public Health (via e-mail)
John F. Wallace, P.E.

DWQ-2014-001142

State of Utah

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

Water Quality Board
Jay I. Olsen, *Chair*
Paula Doughty, *Vice-Chair*
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David F. Echols
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Darrell H. Mensel
Leland J. Myers
Amanda Smith
Gregory L. Rowley
Steven P. Simpson
Daniel C. Snarr
Phil Wright
Walter L. Baker
Executive Secretary

October 5, 2009

Mr. Mark Dotson
Western Utah Copper Company
1208 South, 200 West
Milford, UT 84751

RECEIVED E-Mail
MAR 1 8 2010
Div. of Oil, Gas & Mining

Dear Mr. Dotson:

Subject: Ground Water Discharge Permit-By-Rule for New Tailings Impoundment

The Division of Water Quality (DWQ) has completed a review of the "Mill Tailings Impound Basin Technical Report and Permit Application", dated September 2, 2009, as well as other information submitted in response to questions from DWQ. Western Utah Copper Company intends to construct a lined impoundment to contain mill tailings and allow reclamation and re-use of process water from its flotation ore mill located in SE 1/4, NW ¼, Section 7, Township 27 South, Range 11 West, SLBM, Beaver County, Utah. Currently, process water discharges from the mill building and flows downslope to an unlined pit, due to unforeseen difficulties with the mill process and equipment.

The following factors are relevant for determining the appropriate regulation of this new facility under the Utah Ground Water Quality Protection Rules (UAC R317-6):

1. The mill and proposed tailings impoundment are located on a sloping pediment surface on the south flank of the Beaver Lake Mountains. Pits within the footprint of the impoundment and nearby drill holes suggest that the site is underlain by a thin layer of alluvial sand, gravel and silt over crystalline igneous bedrock.

2. Ground water data in the area is sparse, but two monitoring wells were drilled in 1996 approximately 200 feet south of the new tailings impoundment site. One boring encountered 50 feet of alluvium over igneous bedrock and the other boring encountered bedrock at the surface. Ground water was encountered in these wells at depths of approximately 250 feet below ground surface (bgs) within the igneous bedrock. After well completion and development, the static water level in these wells then rose to 80 feet bgs. Ground water in the igneous bedrock is likely contained within fractures. Samples from these wells indicate that ground water in the area is Class II Drinking Water Quality, with total dissolved solids content ranging from 785 to 1,010 mg/l.

3. The geologic structure at the impoundment site could potentially allow ground water recharge to aquifers in the Milford Valley to the east and south of the site, but the region has a very dry climate and actual recharge from the area around the impoundment site is probably very small.

4. The mill uses a flotation process in which dilute concentrations of reagents with generally low toxicity are added to the feed stock, and most of these reagents are removed from the tailings waste stream along with the ore minerals. MSDS sheets for these reagents are contained in DWQ's administrative files for this case. An analysis of the tailings water showed a total dissolved solids content of 2,160 mg/l, and concentrations of metals below Utah ground water quality standards, though concentrations of arsenic and selenium were near the ground water quality standard of 0.05 mg/l for both of these metals.

5. Although a construction permit has not been issued yet, it is our understanding that the tailings impoundment will be lined with a single flexible membrane liner that will limit subsurface leakage to *de minimis* levels. In addition, the removal and recycling of tailings water will prevent hydraulic head to build up on the liner.

Under UAC R317-6-6.2.A.25 of the Administrative Rules for Ground Water Quality Protection, facilities may be granted permit-by-rule if the Executive Secretary determines after a review of the application that the facility will have a *de minimis* actual or potential effect on ground water quality. UAC R317-6-6.2.B stipulates that no facility permitted by rule under R317-6-6.2.A may cause ground water to exceed ground water quality standards or the applicable class TDS limits in R317-6-3.1 to R317-6-3.7. If the background concentration for affected ground water exceeds the ground water quality standard, the facility may not cause an increase over background.

Ground water discharge permit-by-rule is hereby granted under the condition that a Construction Permit is obtained from DWQ prior to any construction activities for the proposed tailings impoundment. It is our understanding that the basin will be constructed with a synthetic flexible membrane liner and operated in such a manner as to limit any leakage to the subsurface to *de minimis* levels. Western Utah Copper Company must notify DWQ if there are any changes in the milling process including flotation reagents and any other factors cited during the operational life of the tailings impoundment.

Please contact Mark Novak at (801) 538-6518 or mnovak@utah.gov if you have any questions about this letter or other ground water protection issues.

Sincerely,

RECEIVED E-Mail
MAR 1 8 2010
Div. of Oil, Gas & Mining

Rob Herbert, P.G., Manager
Ground Water Protection Section

RFH/MTN

cc: Southwest Utah Public Health Department
John Chartier, Southwest District Engineer

N:\RHERBERT\WP\PBR LETTERS\WUCCTAILINGSIMPOUNDPBR_LTR.DOC

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

APR 0 7 2014

Ronald Wunderlich
Land and Permitting Manager
CS Mining, LLC
PO Box 608
Milford, UT 84751

Dear Mr. Wunderlich:

Subject: Approval to Use the Two Lined Supernatant Clarification Ponds, CS Mining LLC

The Division of Water Quality (DWQ) performed a final inspection of the two Lined Supernatant Clarification Ponds on March 10, 2014. The as-built report entitled Geotechnical Construction Observation and Documentation CS Mining – Decant Ponds was received by DWQ on March 13, 2014.

The review of this document indicated that the roll certification reports and the pages showing the testing of the seams of the larger east pond were not included in the report. This was communicated to both John Wallace of IGES and Matt Johnson of H2J. The pages for the testing of the seams on the larger pond were received by email on March 18, 2014. On March 25, 2014, a letter from Firestone Building Products Co. that was addressed to Matthew Johnson of H2J Liners was forwarded by email to me certifying that the 16 rolls of EPDM geomembrane exceed the minimum requirements set forth by ASTM D 7356 for Type I non-reinforced EPDM geomembranes. This letter also contained a table showing the various requirements and tests that are performed. The documentation is now complete and the final inspection was completed on March 10, 2014.

Based on the final inspection and a review of the as-built report, DWQ hereby approves the use of these two ponds.

If you have any questions about this letter please contact me at (801) 536- 4353 or wwcampbell@utah.gov.

Sincerely,

Woodrow W. Campbell

Woodrow Campbell, P.E.
Environmental Engineer
Ground Water Protection Section

WWC:DJH:mc

cc: Paul Wright, Southwest District Engineer (via email)
Southwest Utah Public Health (via e-mail)
John F. Wallace, P.E.

DWQ-2014.004185

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

MAY 01 2014

Ronald Wunderlich
Land and Permitting Manager
CS Mining, LLC
PO Box 608
Milford, UT 84751

Dear Mr. Wunderlich:

Subject: **Construction Permit** for Mill Tailings Impoundment Expansion – NE 5 Acres

On April 24, 2014, the Division of Water Quality (DWQ) received the Technical Report and Permit Modification for the Mill Tailings Impoundment Expansion – NE 5 Acres prepared by John Wallace, P.E. (Professional Engineer) of IGES Inc. The Technical Report also contained the Plans and Specifications for the Construction Permit. A condition of the Permit-By-Rule issued on October 5, 2009 stated the following "it is our understanding that the tailings impoundment will be lined with a single flexible membrane liner (FML) that will limit subsurface leakage to *de minimis* levels".

This new 5 acre lined lateral expansion will be lined with a 40 mil HDPE and will be attached to the previous 40 mil HPDE liner installed with the original pond construction. The Technical Report also contained a description of the site conditions including the following:

- General geologic conditions;
- Subsurface investigation including soils, bedrock and groundwater;
- Seismicity; and
- Liquefaction potential.

The following is a summary of the proposed major construction projects:

- Extend the lined area adjacent to the north east corner of the existing facility and
- The use of this area may require a downstream raise of 5 feet along the southern half of the west side and along approximately 400 feet along the western end of the southern embankment. This downstream raise would also be lined with 40 mil HDPE.

The plans and specifications, as submitted, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code).* A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. *Any revisions or modifications to the approved plans and specifications must be submitted to DWQ for review and approval, before construction or implementation thereof. Please submit any changes for review and approval directly to Woodrow Campbell, P.E., of the DWQ Ground Water Protection Section.*

2. *A written operations and maintenance manual, containing a description of the functioning of the facilities, an outline of routine maintenance procedures, and all checklists and maintenance logs needed for proper operation of the system, must be submitted and approved before the final inspection and operation of the system.*

3. *The approved facilities must not be placed in service unless DWQ has conducted a final inspection, reviewed and approved the As-Built Construction Certification Report, and provided written authorization to place the constructed facilities in service.*

Construction activities that disturb one acre or more are required to obtain coverage under the Utah Pollutant Discharge Elimination System (UPDES) Storm Water General Permit for Construction Activities. The permit requires the development of a storm water pollution prevention plan (SWPPP) to be implemented and updated from the commencement of any soil disturbing activities at the site until final stabilization of the project. For more information, or to obtain permit coverage on-line, please go to: http://www.waterquality.utah.gov/UPDES/stormwater.htm

The plans and specifications for this project have been stamped and signed by a Professional Engineer currently licensed to practice in the state of Utah. The construction design, inspection supervision, and written construction certification of all work associated with this Construction Permit must be performed by a Professional Engineer licensed to practice in the state of Utah.

This Construction Permit will expire one year from the date of its issuance, as evidenced by the date of this letter, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you, in any way, of your obligations to comply with other applicable local requirements. You may contact Southwest Utah Public Health 435-986-2582 or Paul Wright, Southwest Utah District Engineer 435-986-2590 for further assistance regarding local matters.

Because of the inherent hazard potential at lagoons and ponds, warning signs should be posted at these facilities to state the dangers of drowning and asphyxiation. Safety ropes running down the pond side slopes, and fastened to posts at the top of the dikes should be available to allow anyone trapped in the ponds to escape.

Please contact Mr. Campbell at the beginning of construction to allow periodic inspections to be scheduled. Upon completion of the project, a final inspection and approval of the As-Built Construction Certification Report is required before the approval to operate the completed facilities can be issued. Please remain in contact with Mr. Campbell to schedule the final inspection. The Construction Certification Report with final as-built drawings must include test results for the following construction quality assurance and quality control (CQA/QC) elements [only include elements applicable to the project]:

<u>Soil Subgrade</u>

- Proctor Curves,
- Soil Classification,
- Field Compaction Testing, and
- Subgrade Acceptance Certification.

Flexible membrane Liner

- Panel Placement Log,
- Trial Seam Test Log,
- Seaming Record,
- Seam Test Record,
- Repair Log,
- As-Built Drawing,
- Manufactures Certification including QA/QC Testing of the Rolls, and
- Professional Engineer Certification.

If we can be of further assistance, please contact Mr. Woodrow Campbell at wwcampbell@utah.gov or (801) 536-4353.

Sincerely,

John J. Whitehead
Acting Director

JJW:WWC:DJH:pe

cc: Paul Wright, Southwest Utah District Engineer (via e-mail)
Southwest Utah Public Health (via e-mail)
John F. Wallace, P.E.

DWQ-2014-005665

FILE COPY

STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER QUALITY
WATER QUALITY BOARD
P.O. BOX 144870
SALT LAKE CITY, UTAH 84114-4870

Ground Water Discharge and Construction Permit
Permit No. UGW010014

In compliance with the provisions of the Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated 1953, as amended, the Act,

CS Mining, LLC
1208 South 200 West
P.O. Box 608
Milford, Utah 84751

hereafter referred to as the Permittee, is granted a Ground Water Discharge and Construction Permit for process water ponds and a tailings impoundment to support a copper mining and beneficiation operation in Beaver County. The process water ponds are located in the NW ¼ of Section 7, Township 27 South, Range 11 West, SLBM, and the tailings impoundment is located in the SW ¼ of Section 5, SE ¼ of Section 6, NE ¼ of Section 7 and the NW ¼ of Section 8, Township 27 South, Range 11 West, SLBM.

This permit is based on representation made by the Permittee and other information contained in the administrative record. It is the responsibility of the Permittee to read and understand all provisions of this permit.

The facility shall be constructed and operated in accordance with conditions set forth in the permit and the Utah Administrative Rules for Ground Water Quality Protection (UAC R317-6 and R317-1).

This permit shall become effective on June 5, 2014.

This permit and authorization to operate shall expire at midnight June 5, 2018.

Signed this 5th day of June, 2014.

Leah Ann Lamb
Acting Director

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I. SPECIFIC CONDITIONS

A. GROUND WATER CLASSIFICATION

Based on samples taken from water wells WW-3, located approximately 1 ¼ miles northwest of the proposed tailings dams and up-gradient of the mine facilities, and WW-6, located approximately ½ mile south and down-gradient of the proposed tailings dams, ground water in the area is Class II. A formal determination of ground water class in these wells and new monitor wells to be drilled for this permit will be made following background monitoring.

B. BACKGROUND GROUND WATER QUALITY

Background water quality data for samples taken from water wells WW-3 and WW-6 are given in Table 7 of CS Mining's ground water discharge permit application.

C. GROUND WATER PROTECTION LEVELS

Ground water protection levels will be established for the two monitor wells that will be drilled at the site of CS Mining's proposed Intermediate Tailings Disposal Facility following background monitoring, provided these wells encounter ground water.

The following preliminary protection levels are established for the down-gradient water well WW-6:

Table 1: Interim Ground Water Protection Levels

Parameter	Protection Level (mg/l)
pH (units)	6.5-8.5[1]
Sulfate	998[2]
Total Dissolved Solids	2200[2]

[1] Ground Water Standard from Table 1 of UAC R317-6
[2] Equals 1.25 x background concentration

Protection levels for well WW-6 will be revised following background sampling as required in Part I.H.

D. BEST AVAILABLE TECHNOLOGY (BAT) STANDARD

1. Authorized Construction - This permit authorizes construction and operation of two or three process water ponds, consisting of one pregnant leach solution pond and one or two raffinate ponds; and also an intermediate tailings disposal facility (ITDF).

2. Design and Construction - the authorized process water ponds and ITDF will be constructed in accordance with the engineering design plans and specifications approved in this permit. Construction permit conditions are included in Appendix A. Engineering plans and specification for construction of the other facilities are included as Appendices B, C and D.

The process water ponds will be underlain by a double liner system consisting of an upper 38-mil XR-5 liner overlaying a drainage net, which overlays a lower liner of 30-mil XR-5. The space between the two XR-5 liners drains to a sump enabling detection of leaks in the upper liner. The lined area of each pond is 2.2 acres.

The tailings disposal facility will be constructed in two small canyons east of the milling operations. Two dams will be constructed across these drainages to create an impoundment of approximately 3 million cubic yards capacity. A 40-mil HDPE liner will be installed over the drainage bottoms and in those parts of the impoundment where water separated from the tailings will pond. The upper margins of the impoundment will be covered with a geo-composite liner (GCL), a woven mat containing bentonite. Upon completion of the facility, approximately 80% of the impoundment will be lined with HDPE. Water that collects in the impoundment will be pumped back to the mill facilities for recycling, minimizing hydraulic head on the HDPE liner.

Approved construction elements of the process water ponds include:

a. Subgrade Preparation - the subgrade will be graded, scarified, moisture conditioned and re-compacted to 95% on the Modified Proctor Scale (ASTM 1557).

b. Secondary Liner - a 30-mil 8130 XR-5 liner will be installed immediately above the subgrade across the entire operating area in accordance with the construction quality assurance/quality control manual approved by the Construction Permit.

c. Leak Detection Layer – a drainage net layer will be installed between the primary and secondary XR-5 liners to route leakage through the primary liner to the leak detection sump.

d. Leak Detection Sump – The ponds will slope to a leak detection sump located beneath an adjacent pump station. The sump will be gravel-filled and have a capacity of approximately 600 gallons. A dedicated leak recovery pump will engage automatically when water reaches a specified level(drawing 80-GA-05 in Appendix B of the permit application). The volume of water recovered will be measured and recorded on a daily basis.

e. Primary Liner - a 38-mil 8138 XR-5 liner will be installed on top of the drainage net in accordance with the construction quality assurance/quality control manual approved by the Construction Permit.

Approved construction elements of the ITDF include:

f. Two dams across existing drainages will be constructed to contain the ITDF impoundment. Borrow for the dams will come from unconsolidated alluvial fill and weathered, fractured bedrock from within the footprint of the ITDF. The dams will be constructed, beginning with low starter dams, concurrently as tailings are placed into the ITDF. The

starter dams will have slopes of 3H:1V on the upstream sides and 2H:1V on the downstream sides. Raises will have slopes of 2.5H:1V on the downstream sides and 1.5H:1V on the upstream sides The dams will have crest widths of 20 feet and 2 feet of freeboard will be provided. Final dam volumes will be approximately 467,000 yd^3 for the eastern dam and 204,000 yd^3 for the western dam. The ITDF will have an ultimate capacity to contain 4,777,800 yd^3 of tailings.

g. Subgrade for the lined parts of the ITDF impoundment will be graded, moisture conditioned, scarified and compacted. One-inch minus material will be used as bedding material for the 40-mil HDPE flexible membrane liner. Upon completion of the ITDF, approximately 2,400,000 square feet, or 80% of the impoundment area, will be underlain by the HDPE liner.

h. The remaining 20% of the impoundment will be lined with GCL, Bentomat ST or the equivalent. The GCL will be installed in accordance with manufacturer's recommendation. HDPE and GCL will be joined by overlapping them in the HDPE anchor trench or placing powdered bentonite, when joining the two materials in an anchor trench is not possible.

3. BAT Performance Monitoring for the process water ponds - Best available technology monitoring will include minimum vertical freeboard, maximum allowable leakage rate, and maximum allowable head monitoring. These performance standards are based on the precedence of previous ground water discharge permits and *Action Leakage Rates for Leak Detection Systems* (EPA, January 1992).

a. Minimum Vertical Freeboard – a minimum of 24 inches of vertical freeboard shall be maintained to ensure total containment of the process water ponds.

b. Maximum Allowable Leakage Rate – based on a pond area of 2.2 acres, the maximum allowable leakage rate through the primary XR-5 liner of the evaporation/surge pond will be 440 gallons per day.

c. Maximum Allowable Head – the maximum head that will be allowed in the leak detection sump is one (1) foot. Any fluids collected in the leak detection sump will be removed and placed back into the pond from which it came.

4. Spill Containment - The permittee shall design, maintain and construct all pipelines, storage tanks, and mill facilities with a spill containment system that shall:

a. Prevent any spills or leakage from any contact with the ground surface or ground water.

b. Convey all spills or leakage to the evaporation/surge pond or contain all spills within separate, isolated secondary containments.

Any spill that does come into contact with the surface or ground water that causes pollution or has the potential to cause pollution to waters of the state shall be reported in accordance with Part II.I.

5. Monitoring Well Construction- Monitoring well construction shall conform to *A Guide to the Selection of Materials for Monitoring Well Construction* (EPA 600/52-84-024, 1983) and *RCRA Groundwater Monitoring Technical Enforcement Guidance Document* (EPA OSWER-99501.1, 1986).

E. COMPLIANCE MONITORING REQUIREMENTS

1. Process Water Ponds Monitoring

Water recovered from the leak detection sumps under the double-lined process water ponds will pass through a totalizer before being discharged back into the pond where it originated. CS Mining shall record daily totalizer readings for each process water pond. A daily total of over 440 gallons per day (based on a pond size of 2.2 acres) constitutes non-compliance with the terms of this permit. CS Mining shall make these records of daily pond leakage available to DWQ upon request.

2. Source Monitoring

After mill start-up and disposal of tailings in the ITDF, tailings water will be sampled daily from the tailings water return line at the plant terminus of that line, and pH, temperature and electroconductivity will be measured at the site. Following plant start-up and stabilization of the milling process, or after one month of operations (whichever comes first), a return tailings water sample will be collected and analyzed for the parameters listed in Part I.E.4(b)3, below. Additional samples will be collected at monthly intervals for 90 days and quarterly thereafter.

3. Ground Water Monitoring

a. Ground Water Quality Sampling and Analysis Quality Assurance Project Plan - All water quality monitoring shall be conducted in accordance with the general requirements, hereunder, and the specific requirements of the Ground Water Sampling and Analysis Quality Assurance Project Plan, as required in Part I.H and approved by the Director of DWQ.

b. Compliance Wells – In addition to water well WW-6, two monitoring wells that will be installed hydraulically down-gradient of the ITDF will serve as ground water compliance monitoring points. If ground water is not encountered in either of these new wells, CS Mining shall propose an alternative plan to monitor for seepage from the ITDF. Additionally, CS Mining shall sample up-gradient water well WW-3 semi-annually and analyze the samples for the parameters listed in Part I.E.4(b)(3), below; and measure static water level in WW-3 quarterly.

c. Protection of Monitoring Wells - All compliance monitoring wells must be protected from damage due to surface vehicular traffic or contamination due to surface spills. All compliance monitoring wells shall be maintained in full operational condition for the life of this

permit. Any compliance monitoring well that becomes damaged beyond repair or is rendered unusable for any reason will be replaced by the permittee within 90 days or as directed by the Director.

4. Quarterly Compliance Monitoring

a. Water Level Measurements – water level measurements shall be made in each monitoring well prior to any well purging or collection of ground water samples. These measurements will be made from a surveyed permanent reference point clearly demarcated on the top of the well or surface casing. Water level measurements will be made to the nearest 0.01 foot.

b. Ground Water Quality Samples - grab samples of ground water from compliance monitoring wells will be collected for laboratory analysis on a quarterly basis.

1) Analysis by Certified Laboratories - analysis of all ground water samples shall be performed by laboratories certified by the Utah State Health Laboratory.

2) Ground Water Analytical Methods - methods used to analyze ground water samples must comply with the following:

a) Methods cited in UAC R317-6-6.3L, and

b) Method detection limits are less than Ground Water Protection Levels in Part I.C.

3) Analysis Parameters - the following analyses will be conducted on all ground water samples collected:

a) Field Parameters - pH, temperature, and specific conductance.

b) Laboratory Parameters:

i. Major ions: sodium, calcium, magnesium, potassium, chloride, sulfate, alkalinity.

ii. Metals from Table 1 of UAC R317-6

iii. Gross alpha and Ra 226 + 228

iv. Additional parameters may be required upon review of data from Source Monitoring required in Part I.E.2.

F. NON-COMPLIANCE STATUS

1. Out-of Compliance Due to Failure of Best Available Technology- if process water collects in the sumps of any process water pond at a rate greater than 200 gal/acre/day (440 gal/day for a 2.2-acre pond), the permittee shall notify the

Division of Water Quality by telephone within 24 hours and in writing within five working days. Unless it can be demonstrated that the fluid in the sump is not process water that has leaked from the impoundment, the permittee shall immediately begin activities to locate, isolate to temporarily exclude process water from the liner and repair any leaks in the pond's liners. Within thirty days of the discovery of leakage exceeding the 200 gal/acre/day standard, the permittee shall submit a report to DWQ containing a description of the source of the excessive leakage, its duration, and if the leakage has not been corrected, the anticipated time it is expected to continue; and steps already taken or plans to reduce, eliminate and prevent recurrence of the leakage. The plans may be subject to modification by DWQ. An evaluation shall also be made of whether process water or other contaminants have been released to the environment. If there is a catastrophic failure of the pond's containment system, the Director of DWQ may require cessation of discharge or pond closure. Upon completion of any repairs or remediation activities, the permittee shall submit a report demonstrating the integrity of the pond's containment system.

2. Probable Out-of-Compliance Status Due to Exceedence of Ground Water Protection Level - The permittee shall evaluate results of each ground water sampling event to determine any exceedence of the Ground Water Protection Levels found in Part I.C, above, in water well WW-6, and upon completion of accelerated background monitoring and designation of Protection Levels in new monitor wells. Upon determination that a Ground Water Protection Level has been exceeded at any down-gradient compliance monitoring well, the permittee shall:

   a. Immediately re-sample the monitoring well(s) found to be in probable out-of-compliance status for laboratory analysis of the exceeded protection level parameter(s). Submit the analytical results thereof, and notify the Director of the probable out-of-compliance status within 30 days of the initial detection.

   b. Upon exceedence of any one parameter listed in Part I.C for two consecutive sampling events, immediately implement an accelerated schedule of monthly sampling analysis, consistent with the requirements of this permit. This monthly sampling will continue for at least two months or until the compliance status can be determined by the Director. Reports of the results of this sampling will be submitted to the Director as soon as they are available, but not later than 30 days from each date of sampling.

3. Out-of-Compliance Status Based on Confirmed Exceedence of Permit Ground Water Protection Levels

   a. Out of Compliance Status shall be defined as follows:
      1) For parameters that have been defined as detectable in the background and for which protection levels have been established, out-of-compliance shall be defined as two consecutive samples exceeding the protection level, and the mean background concentration by two standard deviations.

2) For parameters that have background data sets containing between 50-85% non-detectable analyses, out-of-compliance shall be defined as two consecutive samples from a compliance monitoring point exceeding the established protection level.

3) For parameters that have been non-detectable in the background and for which protection levels have been determined based on 0.25 times the ground water quality standard, out-of-compliance shall be defined as two consecutive samples from a compliance monitoring point exceeding the established protection level.

b. Notification and Accelerated Monitoring - upon determination by the permittee or the Director, in accordance with UAC R317-6-6.17, that an out-of-compliance status exists, the permittee shall:

1) Verbally notify the Director of the out-of-compliance status or acknowledge Director notice that such a status exists within 24 hours of receipt of data, and

2) Provide written notice within 5 days of the determination, and

3) Continue an accelerated schedule of monthly ground water monitoring for at least two months and continue monthly monitoring until the facility is brought into compliance as determined by the Director.

c. Source and Contamination Assessment Study Plan - within 30 days after the written notice to the Director required in Part I.F. 2.b.2, above, the permittee shall submit an assessment study plan and compliance schedule for:

1) Assessment of the source or cause of the contamination, and determination of steps necessary to correct the source.

2) Assessment of the extent of the ground water contamination and any potential dispersion.

3) Evaluation of potential remedial actions to restore and maintain ground water quality, and ensure that the ground water standards will not be exceeded at the compliance monitoring wells.

4. Out-of-Compliance Status Based Upon Failure To Maintain Best Available Technology - In the event that BAT monitoring indicates a violation of any of the construction or performance standards outlined in Part I.D of this permit, the permittee shall submit to the Director a notification and description of the violation in accordance with Part II.I of this permit.

G. REPORTING REQUIREMENTS

1. Quarterly Ground Water Monitoring - monitoring required in Part I.E.2 above shall be reported according to the schedule in Table 3 below, unless modified by the Director:

Table 3: Quarterly Compliance Monitoring Report Schedule

Quarter	Report Due Date
1st (January, February, March)	April 30th
2nd (April, May, June)	July 31st
3rd (July, August, September)	October 31st
4th (October, November, December)	January 31st

2. Water Level Measurements - water level measurements from ground water monitoring wells will be reported as measured depth to ground water from the surveyed casing measuring point, and ground water elevations as converted by casing measuring point elevations.

3. Ground Water Quality Sampling - reporting will include:

   a. Field Data Sheets - or copies thereof, including the field measurements, required in Part I.E.2 .b.3 above, and other pertinent field data, such as: well name/number, date and time, names of sampling crew, type of sampling pump or bail, volume of water purged before sampling.

   b. Laboratory Analytical Results - including date sampled, date received; and the results of analysis for each parameter, including: value or concentration, units of measurement, reporting limit (minimum detection limit for the examination), analytical method, and the date of the analysis.

4. Daily Leak Detection Monitoring- reporting will include:

   a. Number of days in the quarter that fluids were present in the leak detection sump.

   b. Largest daily volume of fluid removed from the leak detection sump during the quarter, if fluids were present.

   c. If the permittee wishes to argue that fluids removed from the sump were not process water that leaked from the impoundment, results of sampling and analysis of collected fluid. The report of these results will meet the same requirements for ground water samples in Part I.G.3 above.

   d. The disposition of any fluids in the leak detection sump, if they were not returned to the impoundment.

5. Electronic Filing Requirements - In addition to submittal of the hard copy data, above, the permittee will electronically submit the required ground water monitoring data in the electronic format specified by the Director. The data may be submitted by e-mail, compact disc, or other approved transmittal mechanism.

H. COMPLIANCE SCHEDULE

1. Monitoring Well As-Built Report - For each well constructed, the permittee shall submit diagrams and descriptions of the final completion of the monitoring wells. The report is due within 60 days of the date of well completion. The report shall include:

a. Casing: depth, diameter, and type of material.
b. Screen: length, depth interval, diameter, material type, slot size.
c. Sand Pack: depth interval, material type and grain size.
d. Annular Seals: depth interval, material type.
e. Surface Casing and Cap: depth, diameter, material type, protection measures constructed.
f. Elevation and Location: ground surface elevation, elevation of water level measuring point, latitude and longitude in hours, minutes and seconds.
g. Well construction description, well completion description, results of well pump tests or slug tests.

Wells should be completed to allow for sampling of the uppermost significant occurrence of ground water. If neither of the proposed two new wells intercepts ground water, CS Mining shall propose an alternate plan for monitoring seepage from the ITDF within 30 days of completion of drilling.

2. Sampling, Analysis and Quality Assurance Plan- Within 60 days of permit issuance CS Mining shall submit a Sampling, Analysis and Quality Assurance Plan for approval by the Director of DWQ. Following approval this plan shall be used for all water sampling required for this permit. The Plan must meet the requirements of UAC R317-6-6.3(I) and UAC R317-6-6.3 (L). Methods for sampling, quality assurance/quality control and laboratory analytical methods should be listed in the Plan and followed consistently. Laboratory methods may only be changed with approval of the Director. In accordance with UAC R317-6-6.12(A), all samples must be analyzed by a Utah-certified laboratory. Upon approval by DWQ, the Plan shall become an enforceable appendix to this permit.

3. Accelerated Background Monitoring Program – The permittee shall conduct an accelerated ground water monitoring program to establish ground water protection levels for compliance monitoring wells. Ground water quality samples will be collected and analyzed from all new compliance monitoring wells and water wells WW-3 and WW-6, in accordance with the following requirements:

a. Independent grab samples will be collected over a one-year period from each well according to the requirements of Part I.E.2 above, and the approved Sampling, Analysis and Quality Assurance Plan, until a total of eight (8) sampling events have been completed. Existing samples may be used for background sampling, provided sampling and analytical methods are the same for all samples.

b. After eight (8) sample events have been completed, the permittee will submit an Accelerated Background Monitoring Report with all field data sheets, laboratory analytical reports, and the following statistical calculations presented in spreadsheet format for each parameter in Table 2 for each well.

1) Non-detect values converted to the detection limit times 0.5
2) Mean concentration
3) Standard deviation
4) Mean concentration plus 2 standard deviations

5) Mean total dissolved solids concentration times 1.25
6) Mean concentration of all other parameters times 1.5
7) Ground water quality standard times 0.5

After review and approval of the Accelerated Background Monitoring Report, the Director will establish well-specific ground water protection parameters in accordance with R317-6-4 of the Ground Water Quality Protection Rules.

c. After the Director has re-opened the permit and established well-specific ground water protection levels, sampling will be relaxed to the compliance monitoring frequency in Part I.E above.

4. Final Closure Plan. One year prior to the last placement of tailings in the ITDF, the permittee shall submit a final closure plan for the facility that is protective of the quality of waters of the state. The plan must evaluate the potential for the tailings to leach contaminants into ground or surface water based on testing of representative samples of the tailings. The final closure plan shall be implemented following approval by the Director of DWQ.

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. REPRESENTATIVE SAMPLING

Samples taken in compliance with the monitoring requirements established under Part I shall be representative of the monitored activity.

B. ANALYTICAL PROCEDURES

Water sample analysis must be conducted according to test procedures specified under UAC R317-6-6.3.L, unless other test procedures have been specified in this permit.

C. PENALTIES FOR TAMPERING

The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. REPORTING OF MONITORING RESULTS

Monitoring results obtained during each reporting period specified in the permit, shall be submitted to the Director, Utah Division of Water Quality at the following address no later than the 15th day of the month following the completed reporting period:

State of Utah
Division of Water Quality
P.O. Box 144870
Salt Lake City, Utah 84114-4870
Attention: Ground Water Protection Section

E. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. ADDITIONAL MONITORING BY THE PERMITTEE

If the permittee monitors any pollutant more frequently than required by this permit, using approved test procedures as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted. Such increased frequency shall also be indicated.

G. RECORDS CONTENTS

Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:
2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. RETENTION OF RECORDS

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

I. TWENTY-FOUR HOUR NOTICE OF NONCOMPLIANCE REPORTING

1. The permittee shall verbally report any noncompliance which may endanger public health or the environment as soon as possible, but no later than 24 hours from the time the permittee first became aware of the circumstances. The report shall be made to the Utah Department of Environmental Quality 24 hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 536-4300, during normal business hours (Monday through Friday 8:00 am - 5:00 pm Mountain Time).

2. A written submission shall also be provided to the Director within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

   b. The period of noncompliance, including exact dates and times;

   c. The estimated time noncompliance is expected to continue if it has not been corrected; and,

   d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. Reports shall be submitted to the addresses in Part II.D, Reporting of Monitoring Results.

J. OTHER NONCOMPLIANCE REPORTING

Instances of noncompliance not required to be reported within 24 hours, shall be reported at the time that monitoring reports for Part II.D are submitted.

K. INSPECTION AND ENTRY

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

III. COMPLIANCE RESPONSIBILITIES

A. DUTY TO COMPLY

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. PENALTIES FOR VIOLATIONS OF PERMIT CONDITIONS.

The Act provides that any person who violates a permit condition implementing provisions of the Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions is subject to a fine not exceeding $25,000 per day of violation. Any person convicted under Section 19-5-115(2) of the Act a second time shall be punished by a fine not exceeding $50,000 per day. Nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. DUTY TO MITIGATE

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. PROPER OPERATION AND MAINTENANCE

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

IV. GENERAL REQUIREMENTS

A. PLANNED CHANGES

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required when the alteration or addition could significantly change the nature of the facility or increase the quantity of pollutants discharged.

B. ANTICIPATED NONCOMPLIANCE

The permittee shall give advance notice of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

C. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. DUTY TO REAPPLY

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a permit renewal or extension. The application should be submitted at least 180 days before the expiration date of this permit.

E. DUTY TO PROVIDE INFORMATION

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

F. OTHER INFORMATION

When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

G. SIGNATORY REQUIREMENTS

All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed as follows:

    a. For a corporation: by a responsible corporate officer;

    b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

    c. For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described above and submitted to the Director, and,

b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to Authorization. If an authorization under Part IV.G.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part IV.G.2 must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. PENALTIES FOR FALSIFICATION OF REPORTS

The Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

I. AVAILABILITY OF REPORTS

Except for data determined to be confidential by the permittee, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director. As required by the Act, permit applications, permits, effluent data, and ground water quality data shall not be considered confidential.

J. PROPERTY RIGHTS

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

K. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

L. TRANSFERS

This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

M. STATE LAWS

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, penalties established pursuant to any applicable state law or regulation under authority preserved by Section 19-5-117 of the Act.

N. REOPENER PROVISION

This permit may be reopened and modified (following proper administrative procedures) to include the appropriate limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. If new ground water standards are adopted by the Board, the permit may be reopened and modified to extend the terms of the permit or to include pollutants covered by new standards. The permittee may apply for a variance under the conditions outlined in R317-6-6.4.D.

2. If alternative compliance mechanisms are required.

3. If subsequent ground water monitoring data reveals the background water quality values in Part I Table 1 are not accurate.

Appendix A **Construction Permit Requirements**

Appendix B **Raffinate and PLS Pond Plans and Specifications**

Appendix C **Intermediate Tailings Disposal Facility Plans and Specifications**

Appendix D **Concrete Design Plans and Specifications**

State of Utah
GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

Ronald Wunderlich
Land and Permitting Manager
CS Mining
P.O. Box 608
1208 South 200 West
Milford, UT 84751

Dear Mr. Wunderlich:

Subject: Approval to Use the CS Mining Mill Tailings Impound Basin

The following is a chronologic summary of events for the CS Mining Mill Tailings Impound Basin review and approval process.

- October 11, 2011 – The Division of Water Quality (DWQ) received a Technical Report and Permit Application (TRPA) prepared by GEM Engineering, Inc. (GEM) for a Construction Permit for a new Tailings Impound Basin.
- October 25, 2011 – DWQ issued a letter with Completeness Review Comments and Request for Information to GEM regarding the TRPA for a new Tailings Impound Basin.
- November 3, 2011 – DWQ issued a Construction Permit for a new Mill Tailings Impound Basin.
- May 2, 2012 – A final inspection was performed by DWQ Environmental Engineer Woodrow Campbell, P.E., for the Mill Tailings Impound Basin.
- May 11, 2012 – DWQ received the Certification Report for the CS Mining Mill Tailings Impound Basin, Beaver County, Utah prepared by GEM Engineering, Inc. (GEM). Based on the results of that review, the tailings pond could not be approved at that time.
- May 24, 2012 – DWQ issued a letter addressed to GEM and H2J Environmental, LLC (H2J) requiring additional information,
- May 29, 2012 – A meeting was held in Milford with all concerned parties to discuss and possibly resolve the issues detailed in the May 24, 2012 letter.
- May 30, 2012 – DWQ received a letter from GEM via email in response to the May 24, 2012 letter and May 29, 2012 meeting.
- June 4, 2012 – A meeting was held at DWQ with H2J. After the review of the additional information there were still a few unresolved issues concerning the Certification Report that were resolved in this meeting. It was very clear that using appropriate forms and allowing enough space on the forms and maps to write out the required information would

have been very helpful in the review of the Certification Report.

- June 6, 2012 – DWQ received an Operation and Maintenance Manual for the Tailings Impound Basin from GEM via email. Based on the results of a DWQ review, this manual is hereby approved.

Based on the final inspection and review and approval of the Certification Report and Operation and Maintenance Manual, DWQ hereby approves the use of the Mill Tailings Impound Basin.

If you have any questions about this letter please contact me at (801) 536- 4353 or wwcampbell@utah.gov.

Sincerely,

Woodrow W. Campbell

Woodrow W. Campbell, P.E.
Environmental Engineer
Ground Water Protection Section

WWC/RFH:fb

cc: Joel Myers, GEM Engineering, Inc. 485 North Aviation Way, Cedar City, UT 84721
Matt Johnson, H2J Environmental, LLC, 1351 Ridgeway Road, Santaquin, UT 84655
Paul Wright, Southwest Utah District Engineer
Southwest Utah Public Health Department

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State of Utah

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Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

NOV 0 3 2014

FILE COPY

Alysen Swenson
Environmental Specialist
CS Mining, LLC
1208 South 200 West
Milford, UT 84751

Dear Ms. Swenson:

Subject: Approval to Use the two lined Supernatant Clarification Ponds for Storage of Flotation Tailings

The Division of Water Quality (DWQ) received by email a letter requesting the use of the two lined Supernatant Clarification Ponds (Ponds) for Storage of Flotation Tailings. The following was noted in the letter:

- Construction of the ponds was completed with an FML liner, which limits the subsurface leakage to de minimis levels and
- The water going into the ponds is already coming from the flotation tailings pond.

The letter has been reviewed and the request is hereby approved.

If you have any questions about this letter please contact me at (801) 536- 4353 or wwcampbell@utah.gov.

Sincerely,

Woodrow W. Campbell

Woodrow W. Campbell
Environmental Engineer
Ground Water Protection Section

Document Date 11/6/2014
DWQ-2014-014699

WWC:DJH:nf

cc: Paul Wright, Southwest District Engineer (via email)
Southwest Utah Public Health (via email)

DWQ-2014-014346

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

JAN 17 2014

Ronald Wunderlich
Land and Permitting Manager
CS Mining, LLC
PO Box 608
Milford, UT 84751

Dear Mr. Wunderlich:

Subject: **Construction Permit** for Lined Supernatant Clarification Ponds, CS Mining LLC

On December 23, 2013 the Division of Water Quality (DWQ) received the engineering plans and specifications for Lined Supernatant Clarification Ponds prepared by Intermountain GeoEnvironmental Services, Inc. (IGES). A condition of the Permit-By-Rule issued on October 5, 2009 stated the following "it is our understanding that the tailings impoundment will be lined with a single flexible membrane liner (FML) that will limit subsurface leakage to *de minimis* levels." These new Lined Supernatant Clarification Ponds will also meet that requirement of a single FML to limit subsurface leakage to *de minimis* levels.

In a meeting on September 9, 2013 with John Wallace and Robert Bayer also indicated that CS Mining is looking at constructing a new copper extraction process. This new process will require an application for a Ground Water Discharge Permit which will be submitted in the near future. Therefore the present tailing impoundment and these new Lined Supernatant Clarification Ponds are temporary until the new processing facilities can per permitted, constructed and put into operation.

The following is a summary of the proposed major construction projects:

- Excavation and construction of two relatively small lined clarification ponds. The liner material will be 45-mil ethylene propylene diene monomer (EPDM).

The plans and specifications, as submitted, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code).* A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. *Any revisions or modifications to the approved plans and specifications must be submitted to DWQ for review and approval, before construction or implementation thereof. Please submit any changes for review and approval directly to Woodrow Campbell, P.E., of the DWQ Ground Water Protection Section.*

2. *A written operations and maintenance manual, containing a description of the*

functioning of the facilities, an outline of routine maintenance procedures, and all checklists and maintenance logs needed for proper operation of the system, must be submitted and approved before the final inspection and operation of the system.

3. *The approved facilities must not be placed in service unless DWQ has conducted a final inspection, reviewed and approved the As-Built Construction Certification Report, and provided written authorization to place the constructed facilities in service.*

The plans and specifications for this project must be stamped and signed by a Professional Engineer currently licensed to practice in the state of Utah. The construction design, inspection supervision, and written construction certification of all work associated with this Construction Permit must be performed by a Professional Engineer licensed to practice in the state of Utah.

This Construction Permit will expire one year from the date of its issuance, as evidenced by the date of this letter, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you, in any way, of your obligations to comply with other applicable local requirements. You may contact Southwest Utah Public Health 435-986-2582 or Paul Wright, Southwest Utah District Engineer 435-986-2590 for further assistance regarding local matters.

Because of the inherent hazard potential at lagoons and ponds, warning signs should be posted at these facilities to state the dangers of drowning and asphyxiation. Safety ropes running down the pond side slopes, and fastened to posts at the top of the dikes should be available to allow anyone trapped in the ponds to escape.

Please contact Mr. Campbell at the beginning of construction to allow periodic inspections to be scheduled. Upon completion of the project, a final inspection and approval of the As-Built Construction Certification Report is required before the approval to operate the completed facilities can be issued. Please remain in contact with Mr. Campbell to schedule the final inspection. The Construction Certification Report with final as-built drawings must include test results for the following construction quality assurance and quality control (CQA/QC) elements:

<u>Soil Subgrade</u>

- Proctor Curves,
- Soil Classification,
- Field Compaction Testing, and
- Subgrade Acceptance Certification.

<u>Flexible Membrane Liner</u>

- Panel Placement Log,
- Trial Seam Test Log,
- Seaming Record,
- Seam Test Record,
- Repair Log,
- As-Built Drawing,
- Manufactures Certification including QA/QC Testing of the Rolls, and
- Professional Engineer Certification.

If we can be of further assistance, please contact Mr. Woodrow Campbell at wwcampbell@utah.gov or (801) 536-4353.

Sincerely,

Walter L. Baker, P.E.
Director

WLB/WWC/DJH:fb

cc: Paul Wright, Southwest Utah District Engineer (via e-mail)
Southwest Utah Public Health (via e-mail)
John F. Wallace, P.E.

DWQ-2014-001142

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

APR 0 7 2014

Ronald Wunderlich
Land and Permitting Manager
CS Mining, LLC
PO Box 608
Milford, UT 84751

Dear Mr. Wunderlich:

Subject: Approval to Use the Two Lined Supernatant Clarification Ponds, CS Mining LLC

The Division of Water Quality (DWQ) performed a final inspection of the two Lined Supernatant Clarification Ponds on March 10, 2014. The as-built report entitled Geotechnical Construction Observation and Documentation CS Mining – Decant Ponds was received by DWQ on March 13, 2014.

The review of this document indicated that the roll certification reports and the pages showing the testing of the seams of the larger east pond were not included in the report. This was communicated to both John Wallace of IGES and Matt Johnson of H2J. The pages for the testing of the seams on the larger pond were received by email on March 18, 2014. On March 25, 2014, a letter from Firestone Building Products Co. that was addressed to Matthew Johnson of H2J Liners was forwarded by email to me certifying that the 16 rolls of EPDM geomembrane exceed the minimum requirements set forth by ASTM D 7356 for Type I non-reinforced EPDM geomembranes. This letter also contained a table showing the various requirements and tests that are performed. The documentation is now complete and the final inspection was completed on March 10, 2014.

Based on the final inspection and a review of the as-built report, DWQ hereby approves the use of these two ponds.

If you have any questions about this letter please contact me at (801) 536- 4353 or wwcampbell@utah.gov.

Sincerely,

Woodrow W. Campbell

Woodrow Campbell, P.E.
Environmental Engineer
Ground Water Protection Section

WWC:DJH:mc

cc: Paul Wright, Southwest District Engineer (via email)
Southwest Utah Public Health (via e-mail)
John F. Wallace, P.E.

DWQ-2014.004185

APPENDIX K

Water Quality

STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER QUALITY
WATER QUALITY BOARD
PO BOX 144870
SALT LAKE CITY, UTAH 84114-4870

Ground Water Discharge and Construction Permit
Permit No. UGW010014

In compliance with the provisions of the Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated 1953, as amended, the Act,

Tamra Mining Company, LLC
1208 South 200 West
PO Box 827
Milford, Utah 84751

hereafter referred to as the Permittee, is granted a Ground Water Discharge Permit for process water ponds and tailings impoundments to support a copper mining and beneficiation operation in Beaver County. The process water ponds are located in the NW ¼ of Section 7, Township 27 South, Range 11 West, SLBM, and the tailings impoundment is located in the SW ¼ of Section 5, SE ¼ of Section 6, NE ¼ of Section 7 and the NW ¼ of Section 8, Township 27 South, Range 11 West, SLBM.

This permit is based on representation made by the Permittee and other information contained in the administrative record. It is the responsibility of the Permittee to read and understand all provisions of this permit.

The facility shall be constructed and operated in accordance with conditions set forth in the permit and the Utah Administrative Rules for Ground Water Quality Protection (UAC R317-6 and R317-1).

This permit shall become effective on May 1, 2021.

This permit and authorization to operate shall expire at midnight April 30, 2026.

Signed this 30th day of April, 2021.

Erica Gaddis, PhD
Director

DWQ-2021-003584

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I. SPECIFIC CONDITIONS

A. GROUND WATER CLASSIFICATION

Based on samples taken from water wells WW-3, located approximately 1 ¼ miles northwest of the Intermediate Tailings Disposal Facility (ITDF) and up-gradient of the mine facilities, WW-6, located approximately ½ mile south and down-gradient of the ITDF, monitor well ITFD-1, located at the toe of the east ITDF dam, and Lab Well 1, located near the southeast corner of the Flotation Tails Pond, water in the area is Class II.

B. BACKGROUND GROUND WATER QUALITY

Background water quality data for samples taken from water wells WW-3 and WW-6 and monitor wells ITDF-1 and Lab Well 1 are given in Table 1. Values for WW-3 and Lab Well 1 are preliminary and based on data existing at the time of permit issuance.

Table 1. Background Water Quality

Well	WW-3[1]	ITDF-1	Lab Well 1[1]	WW-6
TDS	1680	1757	1260	1483
Sulfate	717	121	191	424
pH	7.19	7.44	7.48	7.51
Antimony	< 0.04	< 0.004	< 0.004	< 0.004
Arsenic	< 0.002	< 0.002	0.003	0.002
Barium	0.0107	0.152	0.134	0.023
Beryllium	< 0.002	< 0.002	< 0.002	< 0.002
Cadmium	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chromium	< 0.002	0.007	0.0025	< 0.002
Copper	0.0113	0.010	0.0105	0.003
Lead	< 0.002	< 0.002	0.0026	< 0.002
Mercury	< 0.00009	< 0.00015	0.00055	< 0.00015
Selenium	< 0.002	0.0076	0.0026	< 0.002
Silver	< 0.002	< 0.002	< 0.002	< 0.002
Thallium	< 0.002	< 0.002	< 0.002	< 0.002
Zinc	0.166	0.026	1.14	0.60

1. Preliminary values from available data.

C. GROUND WATER PROTECTION LEVELS

Ground water protection levels based on the standards for Class II ground water in UAC R317-6-4.5 for down gradient wells ITDF-1, Lab Well 1 and WW-6 are listed in Table 2. Protection levels for Lab Well 1 are based on available data and will be revised following completion of accelerated background monitoring required under Part I.H.3.

Table 2. Protection Levels for Down-gradient Wells

Well	ITDF-1	Lab Well 1*	WW-6
TDS	2225[1]	1575[2]	1911[1]
Sulfate	151[2]	239[2]	530[2]
pH	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Copper	0.325[3]	0.325[3]	0.325[3]

1. Mean x 2(standard deviation)
2. mean x 1.25
3. ground water standard x 0.25

*. Preliminary values based on existing information.

D. AUTHORIZED DESIGN AND CONSTRUCTION

1. These following facilities have been constructed and are in use:
   - Two smaller Lined Supernatant Clarification Ponds – Construction permit was issued on January 17, 2014 and Approval to Use was issued on April 7, 2014.
   - Intermediate Tailings Disposal Facility (east drainage) – Construction Permit was issued along with the first version of Ground Water Discharge Permit UGW010014 on June 5, 2014 and the Approval to Use was issued on March 3, 2015.
   - SX/EW Raffinate and Pregnant Solution Ponds, and the SX/EW Process and Storage Tanks and Secondary Containment – Construction Permit was issued along with the Ground Water Discharge Permit issued on June 5, 2014 and the Approval to Use was issued on December 17, 2015.
   - Flotation Tails Pond, an existing impound basin for tailings from the flotation circuit and much of the tailings had been sent back through the new SX/EW process to remove copper remaining in the tailings. The impoundment dikes were still in place and did not need to be reconstructed. However, the original liner was completely removed and the entire pond needed to be relined. A Construction Permit was issued on May 25, 2018. An Approval to Use was issued on May 23, 2018.
   - Flotation Tails Pond Dam Raise- Construction Permit was issued on August 13, 2018 and the Approval to Use issued on August 5, 2019.

2. Future or Proposed Projects that require Construction Permits:
   - West drainage ITDF – A Construction Permit was issued on September 5, 2018. To date no construction activities have started.
   - The west drainage ITDF will join with the existing east drainage ITDF to make one large tailings facility. Tamra has proposed additional raises to increase the tailings capacity of this facility. Each raise will require a Construction Permit.

3. BAT Performance Monitoring- Best available technology monitoring will include minimum vertical freeboard, maximum allowable leakage rate, and maximum allowable head monitoring. These performance standards are based on the precedence of previous ground water discharge permits and *Action Leakage Rates for Leak Detection Systems* (EPA, January 1992).

   a. Minimum Vertical Freeboard – a minimum of 24 inches of vertical

freeboard shall be maintained to ensure total containment of the evaporation/surge pond and peripheral ditches.

b. Maximum Allowable Leakage Rate – based on a pond area of 2.2 acres, the maximum allowable leakage rate through the primary HDPE liner of the evaporation/surge pond will be 440 gallons per day.

c. Maximum Allowable Head – the maximum head that will be allowed in the leak detection sump is one (1) foot. Any fluids collected in the leak detection sump will be removed and placed back into the pond from which it came.

4. Spill Containment - The permittee shall design, maintain and construct all pipelines, storage tanks, and mill facilities with a spill containment system that shall:

a. Prevent any spills or leakage from any contact with the ground surface or ground water.
b. Convey all spills or leakage to the evaporation/surge pond.

Any spill that does come into contact with the ground surface or ground water that causes pollution or has the potential to cause pollution to waters of the state shall be reported in accordance with Part II.I.

5. Monitoring Well Construction- Monitoring well construction shall conform to *A Guide to the Selection of Materials for Monitoring Well Construction* (EPA 600/52-84-024, 1983) and *RCRA Groundwater Monitoring Technical Enforcement Guidance Document* (EPA OSWER-99501.1, 1986).

E. COMPLIANCE MONITORING REQUIREMENTS

1. Process Water Ponds Monitoring

Water recovered from the leak detection sumps under the double-lined process water ponds will pass through a totalizer before being discharged back into the pond where it originated. The permittee shall record daily totalizer readings for each process water pond. A daily total of over 440 gallons per day (based on a pond size of 2.2 acres) constitutes non-compliance with the terms of this permit. The permittee shall make these records of daily pond leakage available to DWQ upon request.

2. Source Monitoring

During mill operation and disposal of tailings in a permitted impoundment, tailings water will be sampled daily from the tailings water return line at the plant terminus of that line, and pH, temperature and electroconductivity will be measured at the site. Following plant start-up and stabilization of the milling process, or after one month of operations (whichever comes first), a return tailings water sample will be collected and analyzed for the parameters listed in Part I.E.4(b)3, below. Additional samples will be collected at monthly intervals for 90 days and quarterly thereafter.

3. Ground Water Monitoring

a. Ground Water Quality Sampling and Analysis Quality Assurance Project Plan - All water quality monitoring shall be conducted in accordance with the general requirements, hereunder, and the specific requirements of the Ground Water Sampling and Analysis Quality Assurance Project Plan, as described in CS Mining's First Quarter, 2016 monitoring report, or the plan most recently approved by DWQ. Analytical methods may only be changed upon DWQ approval.

b. Compliance Wells – Wells WW-6, ITSD-1 and Lab Well 1 shall be sampled quarterly for the parameters listed in in Part I.E.4(b)(3), below, and upgradient well WW-3 sampled for the same parameters semiannually. Ground water elevations in all wells shall be measured quarterly and reported in feet above mean sea level.

c. Protection of Monitoring Wells - All compliance monitoring wells must be protected from damage due to surface vehicular traffic or contamination due to surface spills. All compliance monitoring wells shall be maintained in full operational condition for the life of this permit. Any compliance monitoring well that becomes damaged beyond repair or is rendered unusable for any reason will be replaced by the permittee within 90 days or as directed by the Director.

4. Quarterly Compliance Monitoring

a. Water Level Measurements – water level measurements shall be made in each monitoring well prior to any well purging or collection of ground water samples. These measurements will be made from a surveyed permanent reference point clearly demarcated on the top of the well or surface casing. Water level measurements will be made to the nearest 0.01 foot.

b. Ground Water Quality Samples - grab samples of ground water from compliance monitoring wells will be collected for laboratory analysis on a quarterly basis.

1) Analysis by Certified Laboratories - analysis of all ground water samples shall be performed by laboratories certified by the Utah State Health Laboratory.

2) Ground Water Analytical Methods - methods used to analyze ground water samples must comply with the following:

a) Methods cited in UAC R317-6-6.3L, and
b) Method detection limits are less than Ground Water Protection Levels in Part I.C.

3) Analytical Parameters - the following analyses will be conducted on all ground water samples collected:

a) Field Parameters - pH, temperature, and specific conductance.

b) Laboratory Parameters:

i. Major ions: sodium, calcium, magnesium, potassium, chloride, sulfate, alkalinity.

ii. Metals from Table 1 of UAC R317-6

iii. Additional parameters may be required upon review of data from Source Monitoring required in Part I.E.2.

F. NON-COMPLIANCE STATUS

1. Out-of Compliance Due to Failure of Best Available Technology- if process water collects in the sumps of any process water pond at a rate greater than 200 gal/acre/day (440 gal/day for a 2.2-acre pond), the permittee shall notify the Division of Water Quality by telephone within 24 hours and in writing within five working days. Unless it can be demonstrated that the fluid in the sump is not process water that has leaked from the impoundment, the permittee shall immediately begin activities to locate, isolate to temporarily exclude process water from the liner and repair any leaks in the pond's liners. Within thirty days of the discovery of leakage exceeding the 200 gal/acre/day standard, the permittee shall submit a report to DWQ containing a description of the source of the excessive leakage, its duration, and if the leakage has not been corrected, the anticipated time it is expected to continue; and steps already taken or plans to reduce, eliminate and prevent recurrence of the leakage. The plans may be subject to modification by DWQ. An evaluation shall also be made of whether process water or other contaminants have been released to the environment. If there is a catastrophic failure of the pond's containment system, the Director of DWQ may require cessation of discharge or pond closure. Upon completion of any repairs or remediation activities, the permittee shall submit a report demonstrating the integrity of the pond's containment system.

2. Probable Out-of-Compliance Status Due to Exceedance of Ground Water Protection Level - The permittee shall evaluate results of each ground water sampling event to determine any exceedance of the Ground Water Protection Levels found in Part I.C, above, in existing down-gradient wells, and upon completion of accelerated background monitoring and designation of Protection Levels in new monitor wells. Upon determination that a Ground Water Protection Level has been exceeded at any down-gradient compliance monitoring well, the permittee shall:

a. Immediately re-sample the monitoring well(s) found to be in probable out-of-compliance status for laboratory analysis of the exceeded protection level parameter(s). Submit the analytical results thereof, and notify the Director of the probable out-of-compliance status within 30 days of the initial detection.

b. Upon exceedance of any one parameter listed in Part I.C for two

consecutive sampling events, immediately implement an accelerated schedule of monthly sampling analysis, consistent with the requirements of this permit. This monthly sampling will continue for at least two months or until the compliance status can be determined by the Director. Reports of the results of this sampling will be submitted to the Director as soon as they are available, but not later than 30 days from each date of sampling.

3. Out-of-Compliance Status Based on Confirmed Exceedance of Permit Ground Water Protection Levels

   a. Out of Compliance Status shall be defined as two consecutive samples from a down-gradient monitor well exceeding a protection level defined in this permit.

   b. Notification and Accelerated Monitoring - upon determination by the permittee or DWQ, in accordance with UAC R317-6-6.17, that an out-of-compliance status exists, the permittee shall:

      1) Verbally notify DWQ of the out-of-compliance status or acknowledge Director notice that such a status exists within 24 hours of receipt of data, and

      2) Provide written notice within 5 days of the determination, and

      3) Continue an accelerated schedule of monthly ground water monitoring for at least two months and continue monthly monitoring until the facility is brought into compliance as determined by DWQ, or other notification from DWQ that the monthly sampling schedule may be discontinued.

   c. Source and Contamination Assessment Study Plan – after the facility has been determined to be in out-of-compliance status and upon written notice from DWQ, the permittee shall submit an assessment study plan and compliance schedule for:

      1) Assessment of the source or cause of the contamination, and determination of steps necessary to correct the source.

      2) Assessment of the extent of the ground water contamination and any potential dispersion.

      3) Evaluation of potential remedial actions to restore and maintain ground water quality, and ensure that the ground water standards will not be exceeded at the compliance monitoring wells.

4. Out-of-Compliance Status Based Upon Failure To Maintain Best Available Technology - In the event that BAT monitoring indicates a violation of any of the construction or performance standards outlined in Part I.D of this permit, the permittee shall submit to the Director a notification and description of the violation in accordance with Part II.I of this permit.

G. REPORTING REQUIREMENTS

1. Quarterly Ground Water Monitoring - monitoring required in Part I.E.2 above shall be reported according to the schedule in Table 3 below, unless modified by the Director:

Table 3: Quarterly Compliance Monitoring Report Schedule

Quarter		Report Due Date
1st	(January, February, March)	April 30th
2nd	(April, May, June)	July 31st
3rd	(July, August, September)	October 31st
4th	(October, November, December)	January 31st

2. Water Level Measurements - water level measurements from ground water monitoring wells will be reported as measured depth to ground water from the surveyed casing measuring point, and ground water elevations as converted by casing measuring point elevations.

3. Ground Water Quality Sampling - reporting will include:

   a. Field Data Sheets - or copies thereof, including the field measurements, required in Part I.E.2 .b.3 above, and other pertinent field data, such as: well name/number, date and time, names of sampling crew, type of sampling pump or bail, volume of water purged before sampling.

   b. Laboratory Analytical Results - including date sampled, date received; and the results of analysis for each parameter, including: value or concentration, units of measurement, reporting limit (minimum detection limit for the examination), analytical method, and the date of the analysis.

4. Daily Leak Detection Monitoring- reporting will include:

   a. Number of days in the quarter that fluids were present in the leak detection sump.

   b. Largest daily volume of fluid removed from the leak detection sump during the quarter, if fluids were present.

   c. If the permittee wishes to argue that fluids removed from the sump were not process water that leaked from the impoundment, results of sampling and analysis of collected fluid. The report of these results will meet the same requirements for ground water samples in Part I.G.3 above.

   d. The disposition of any fluids in the leak detection sump, if they were not returned to the impoundment.

5. Electronic Filing Requirements - In addition to submittal of the hard copy data, above, the permittee will electronically submit the required ground water monitoring data in the electronic format specified by the Director. Analytical data shall be submitted each quarter in Excel spreadsheet format, showing data for each parameter from all previous sampling events as well as the current event. Quarterly

reports will be submitted to the Division of Water Quality's electronic data submission portal at:

https://deq.utah.gov/water-quality/water-quality-electronic-submissions

Permit Review Report- Within 30 days after receipt of this permit, the permittee shall report to the Director that the person(s) responsible for implementing this permit has read and is personally familiar with all the terms and conditions of this permit.

H. COMPLIANCE SCHEDULE

1. Monitoring Well As-Built Report - For each new monitoring well that is constructed, the permittee shall submit diagrams and descriptions of the final completion of the monitoring wells. The report is due within 60 days of the date of well completion. The report shall include:

   a. Casing: depth, diameter, and type of material;

   b. Screen: length, depth interval, diameter, material type, slot size;

   c. Sand Pack: depth interval, material type and grain size;

   d. Annular Seals: depth interval, material type;

   e. Surface Casing and Cap: depth, diameter, material type, protection measures constructed;

   f. Elevation and Location: ground surface elevation, elevation of water level measuring point, latitude and longitude in hours, minutes and seconds;

   g. Well construction description, well completion description, results of well pump tests or slug tests.

   Wells should be completed to allow for sampling of the uppermost significant occurrence of ground water

2. New Construction- At least six months before beginning construction of any new facility that will contain wastewater, tailings or process water, the permittee shall apply to DWQ for a Construction Permit and modification of this permit to include the new facilities.

3. Accelerated Background Monitoring Program – The permittee shall conduct an accelerated ground water monitoring program to establish ground water protection levels for compliance monitoring wells. Ground water quality samples will be collected and analyzed from all new compliance monitoring wells and water wells WW-3 and WW-6, in accordance with the following requirements:

   a. Independent grab samples will be collected over a one-year period from each well according to the requirements of Part I.E.2 above, and the approved Sampling, Analysis and Quality Assurance Plan, until a total of eight (8) sampling events have been completed. Existing samples may be used for background sampling, provided sampling and analytical methods are the same for all samples.

b. After eight (8) sampling events have been completed for any new monitoring well, the permittee will submit an Accelerated Background Monitoring Report with all field data sheets, laboratory analytical reports, and all analytical data in Excel spreadsheet format. After review and approval of the Accelerated Background Monitoring Report, DWQ will re-open this permit and establish well-specific ground water background quality and protection levels in accordance with R317-6-4 of the Ground Water Quality Protection Rules.

c. After the DWQ has received the results from at least eight independent sampling events from any new monitoring well, the sampling schedule will be relaxed to the compliance monitoring frequency in Part I.E.3(b) above.

4. Final Closure Plan. One year prior to the last placement of tailings in any acid leach tailings impoundment, the permittee shall submit a final closure plan for the facility that is protective of the quality of waters of the state. The plan must evaluate the potential for the tailings to leach contaminants into ground or surface water based on testing of representative samples of the tailings. To the greatest extent practicable, the tailings must be drained of interstitial fluids until they are no longer free-draining. The final closure plan shall be implemented following approval by DWQ.

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. REPRESENTATIVE SAMPLING

Samples taken in compliance with the monitoring requirements established under Part I shall be representative of the monitored activity.

B. ANALYTICAL PROCEDURES

Water sample analysis must be conducted according to test procedures specified under UAC R317-6-6.3.L, unless other test procedures have been specified in this permit.

C. PENALTIES FOR TAMPERING

The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. REPORTING OF MONITORING RESULTS

Monitoring results obtained during each reporting period specified in the permit, shall be submitted to the Director, Utah Division of Water Quality at the following address no later than the 15th day of the month following the completed reporting period:

State of Utah
Division of Water Quality
P.O. Box 144870
Salt Lake City, Utah 84114-4870
Attention: Ground Water Protection Section

E. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. ADDITIONAL MONITORING BY THE PERMITTEE

If the permittee monitors any pollutant more frequently than required by this permit, using approved test procedures as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted. Such increased frequency shall also be indicated.

G. RECORDS CONTENTS

Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:
2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. RETENTION OF RECORDS

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years

from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

I. TWENTY-FOUR HOUR NOTICE OF NONCOMPLIANCE REPORTING

1. The permittee shall verbally report any noncompliance which may endanger public health or the environment as soon as possible, but no later than 24 hours from the time the permittee first became aware of the circumstances. The report shall be made to the Utah Department of Environmental Quality 24 hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 536-4300, during normal business hours (Monday through Friday 8:00 am - 5:00 pm Mountain Time).

2. A written submission shall also be provided to the Director within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

   b. The period of noncompliance, including exact dates and times;

   c. The estimated time noncompliance is expected to continue if it has not been corrected; and,

   d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. Reports shall be submitted to the addresses in Part II.D, Reporting of Monitoring Results.

J. OTHER NONCOMPLIANCE REPORTING

Instances of noncompliance not required to be reported within 24 hours, shall be reported at the time that monitoring reports for Part II.D are submitted.

K. INSPECTION AND ENTRY

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

III. COMPLIANCE RESPONSIBILITIES

A. DUTY TO COMPLY

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. PENALTIES FOR VIOLATIONS OF PERMIT CONDITIONS.

The Act provides that any person who violates a permit condition implementing provisions of the Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions is subject to a fine not exceeding $25,000 per day of violation. Any person convicted under Section 19-5-115(2) of the Act a second time shall be punished by a fine not exceeding $50,000 per day. Nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. DUTY TO MITIGATE

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. PROPER OPERATION AND MAINTENANCE

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

IV. GENERAL REQUIREMENTS

A. PLANNED CHANGES

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required when the alteration or addition could significantly change the nature of the facility or increase the quantity of pollutants discharged.

B. ANTICIPATED NONCOMPLIANCE

The permittee shall give advance notice of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

C. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. DUTY TO REAPPLY

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a permit renewal or extension. The application should be submitted at least 180 days before the expiration date of this permit.

E. DUTY TO PROVIDE INFORMATION

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

F. OTHER INFORMATION

When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

G. SIGNATORY REQUIREMENTS

All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed as follows:

   a. For a corporation: by a responsible corporate officer;

   b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

   c. For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director, and,

   b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to Authorization. If an authorization under Part IV.G.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part IV.G.2 must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. PENALTIES FOR FALSIFICATION OF REPORTS

The Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

I. AVAILABILITY OF REPORTS

Except for data determined to be confidential by the permittee, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director. As required by the Act, permit applications, permits, effluent data, and ground water quality data shall not be considered confidential.

J. PROPERTY RIGHTS

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

K. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

L. TRANSFERS

This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

M. STATE LAWS

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, penalties established pursuant to any applicable state law or regulation under authority preserved by Section 19-5-117 of the Act.

N. REOPENER PROVISION

This permit may be reopened and modified (following proper administrative procedures) to include the appropriate limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. If new ground water standards are adopted by the Board, the permit may be reopened and modified to extend the terms of the permit or to include pollutants covered by new standards. The permittee may apply for a variance under the conditions outlined in R317-6-6.4.D.

2. If alternative compliance mechanisms are required.

3. If subsequent ground water monitoring data reveals the background water quality values in Part I Table 1 are not accurate.

MILFORD MINING COMPANY
UTAH

April 30th, 2024

Attention: Woody Campbell - *Groundwater Protection Permitting Section*
State of Utah Division of Water Quality
PO Box 144870
Salt Lake City, Utah 84114-4870

Subject: *Q1 2024 Report Ground Water Discharge Permit #UGW010014*

Milford Mining Company Utah (MMCU) has remained in a period of care and maintenance throughout the first quarter of 2024 with no mining or mill processing. The focus of activities has centered on process facilities maintenance and repair, PLS and Raffinate pond modifications, re-lining, and maintenance, site cleanup and permitting updates and renewals to the GWDP as well as other various permits.

At this time, MMCU looks forward to compiling a GWDP quarterly report for Q2 of 2024. During Q2 of 2024 MMCU has been and will be working on the facilities construction and process plant infrastructure to render them commissioned and operational within the second quarter. The equipment needed to sample ground water from the monitoring wells is still under development with tentative plans to sample the ground water during the second quarter of 2024.

If there are any questions or concerns please reach out to our HSE Manager, Robert Covington at 435-864-7823 (robert.covington@milfordmining.com) or our Environmental Engineer, Greg Guzzle at 801-755-5539 (greg.guzzle@tamramining.com)

Sincerely,

Robert Covington

HSE Manager

PO Box 827 Milford, UT 84751
WWW.MILFORDMINING.COM 435-387-2000

MILFORD MINING COMPANY
UTAH

August 1st, 2024

Attention: Woody Campbell - *Groundwater Protection Permitting Section*
State of Utah Division of Water Quality
PO Box 144870
Salt Lake City, Utah 84114-4870

Subject: *Q2 2024 Report Ground Water Discharge Permit #UGW010014*

Please review the following Q2 of RY2024 GWDP report from Milford Mining Company Utah. The report was written in compliance with Ground Water Discharge Permit *#UGW010014 Part 1 G "Reporting Requirements"* and contains the elements required in *Part 1.G.1-5*. **As discussed** with Woody Campbell via telephone and email notification, **this report is being delivered outside of the required reporting time period due to shipping issues and errors outside of Milford Mining Company Utah's control.**

If there are any questions or concerns please reach out to our HSE Manager, Robert Covington at 435-864-7823 (robert.covington@milfordmining.com) or our Environmental Engineer, Greg Guzzle at 801-755-5539 (greg.guzzle@milfordmining.com)

Sincerely,

Robert Covington

HSE Manager

PO Box 827 Milford, UT 84751
WWW.MILFORDMINING.COM 435-387-2000

2nd Quarter RY2024 Compliance Monitoring Report

Milford Mining Company Utah, LLC

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1.0 Summary

Milford Mining Company Utah (MMCU) is pleased to present its first GWDP report to contain lab analytical results, process pond water information, and other various items required in MMCU's GWDP *Part 1.G.1-5*. This report will be the first report for the mine since CS Mining's GWDP report in 2017 that will contain actual analytical data and supplemental information. Since the second quarter of RY2024 MMCU commissioned the acid leach circuit, CCD circuit, and SX-EW circuits. As such, our GWDP defines the following in *Part 1.E.2.:*

> "during mill operation and disposal of tailings in a permitted impoundment, tailings water will be sampled daily from the tailings water return line …., and pH, temperature and electroconductivity will be measured…., Following plant start-up and stabilization of the milling process, or after one month of operations (whichever comes first), a return tailings water sample will be collected and analyzed for the parameters listed in *Part 1.E.4(b)3* below. Additional samples will be collected at monthly intervals for 90 days and quarterly thereafter."

The analytical results from the tailings return water line are attached in Appendix B. The remaining analytical results from the first 90 days of operations (referenced above) will be included in the Q3 of RY2024 report as the remainder of the first 90 days of operations will take place in Q3.

This report will not contain any lab analytical results for samples taken from Lab Well 1, or the ITDF monitoring well. Please see "2.0 Commissioning – Well Assessment & Operation" for further information and Appendix D for supplemental photos.

2.0 Commissioning

Plant Commissioning

The plant is being commissioned in stages and is still undergoing maintenance and repair. The first stage of commissioning has included the agitated leach tanks, the four counter-current decantation (CCD) tanks, as well as the solvent extraction (SX) & electrowinning (EW) facilities, pregnant leach solution, and raffinate process water facilities. The flotation mill is in a state of maintenance and repair; planned commissioning of this facility and portion of the copper beneficiary process is targeted for Q4 of 2024 at the earliest. This will be the second stage of commissioning.

The process facilities mentioned above are currently discharging tailings material into our south mill tailings impoundment. The ITDF is undergoing modifications and repairs to reflect a 20-foot raise. MMCU plans on the ITDF being functional in Q3 of 2024 at the earliest.

During the first stage of commissioning, the feed to plant was approximately 1,000 tons per day (tpd) of dry stacked tailings material left over from previous operators. As MMCU overcomes operational difficulties and facility mechanical and maintenance challenges, MMCU plans to stabilize at a feed rate of approximately 2,100-2,400 tpd.

Well Assessment & Operation

Upon commissioning parts of the copper beneficiary process plant, the environmental team at MMCU has been working to repair and modify the permitted water monitoring system.

The ITDF monitoring well is undergoing modifications as the ITDF receives its 20-foot lift around the containment and East starter dam areas. In conjunction with the East starter dam raise, the footprint of the starter dam has extended Westward, engulfing the ITDF monitoring well. MMCU has reacted to this by placing 10-foot extensions on the ITDF well collar to protect and maintain the functionality of the ITDF monitoring well. As such, during modifications, MMCU has been unable to pull ground water samples from the ITDF well.

During Q2 of RY2024 MMCU attempted to sample the ground water and take depth to water (DTW) measurements at Lab Well 1. During DTW attempts, it was apparently clear that there were multiple blockages in the monitoring well. As such, a professional contractor was hired to clear the blockages and service & inspect the groundwater pump at the bottom of the well. During attempts to clear the blockages the contractor noted that the casing had failed at a depth of about 75’ and began repairs accordingly. During this period of repairs, it was determined by the contractor that the well displayed multiple failure points in the casing and multiple blockages in the well. The contractor got their tool stuck on the bottom most block which required pulling the well casing and pump out in its entirety. This well is currently still undergoing repairs to fix the issues stated above.

Please see Appendix D for photos of each well in its current state of repair(s).

3.0 Ground Water Monitoring

Process Water Ponds Modifications

Before commissioning the CCD circuit, SX-EW facilities, MMCU obtained construction permits and modified the pregnant leach solution and raffinate process water (PLS & raff.) ponds. The process water ponds were modified in a manner that required new bund installation between the low grade and high grade raffinate ponds. Modifications also included the removal of the maintenance water and high grade PLS bund located in the high grade PLS process water pond. MMCU has since been working directly with Woody Campbell, Utah Division of Water Quality Ground Water Division, to monitor and report the process water ponds post modifications.

The leak detection sumps are monitored daily and maintained daily or weekly on an as needed basis. For more information on the leak detection system and leak detection results for Q2 of RY2024, *as required in GWDP UGW010014 Part 1.E.2*, please see Appendix C.

Field Information

Information gathered in the field during sampling of the GWDP monitoring wells includes:

1. Weather conditions during sampling
2. Depth to water (DTW) measured from the top of the well casing using electronic tape
3. Temperature, pH, and electroconductivity (EC) of the ground water (field parameters)

All wells, including the ITDF and Lab Well 1, either are or will be equipped with dedicated submersible pumps. Each sampling event begins with measuring the water level in the well and analyzing for field parameters followed by purging of the well approximately one well volume of water. This is performed in the early morning of the date of sampling. The well is allowed to recover for approximately six hours and is then tested again for the field parameters. Samples are collected after well recovery for analyses of the suite of parameters listed in *UGW010014 Part 1.4(b).3(b)*. Field information for the sampled monitoring wells can be found in Appendix A of this report.

Sampling dates for the field information as well as the lab analytical results fall outside of Q2 2024; due to shipping errors in and during Q2 2024, our samples were received outside of the temperature upon arrival range. This fact was discussed with Woody Campbell from DWQ prior to compiling this report. Please see the cover letter for more information.

Appendix A

Field information

Q2 2024 GWDP Sampling Field Data

Station	Weather	DTW (ft)	T (c.)	pH	EC	Time	Date
WW-6	Sunny, 85 degrees	410.19	22.6	7.01	2020	8:30	7/8/2024
ITDF-1	Sunny, 90 degrees	258.33	NA	NA	NA	12:53	6/24/2024
Lab Well 1	Sunny, 89 degrees	125.02	NA	NA	NA	11:22	6/24/2024
*RTW	Sunny, 87 degrees	NA	22.0	5.75	1920	11:55	7/8/2024

**RTW (return tailings water)*

Appendix B

Lab Results

Chemtech-Ford Laboratories
Serving the Intermountain West Since 1953

9632 South 500 West
Sandy, UT 84070
O:(801) 262-7299 F: (866) 792-0093
www.ChemtechFord.com

Certificate of Analysis

Milford Mining Company Utah
Greg Guzzle
9701 North 5200 West
Milford, UT 84751

PO#:
Receipt: **7/9/24 11:56 @ 2.7 °C**
Date Reported: 7/18/2024
Project Name: **Q@ 2024 GDWP**

Sample ID: **WW-6**
Matrix: **Water**
Lab ID: **24G0561-01**
Date Sampled: **7/8/24 8:30**
Sampled By: **Greg Guzzle**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Alkalinity - Bicarbonate (as CaCO3)	81.2	mg/L	1.0	SM 2320 B	7/10/24	7/10/24	
Alkalinity - Carbonate (as CaCO3)	ND	mg/L	1.0	SM 2320 B	7/10/24	7/10/24	
Alkalinity - Hydroxide (as CaCO3)	ND	mg/L	1.0	SM 2320 B	7/10/24	7/10/24	
Alkalinity - Total (as CaCO3)	81.2	mg/L	1.0	SM 2320 B	7/10/24	7/10/24	
Chloride	437	mg/L	2.00	EPA 300.0	7/11/24	7/12/24	
Sulfate	419	mg/L	2.00	EPA 300.0	7/11/24	7/12/24	
Total Dissolved Solids (TDS)	1520	mg/L	20	SM 2540 C	7/10/24	7/10/24	
Metals							
Antimony, Total	ND	mg/L	0.0005	EPA 200.8/200.8	7/10/24	7/10/24	
Arsenic, Total	0.0012	mg/L	0.0005	EPA 200.8/200.8	7/10/24	7/10/24	
Barium, Total	0.023	mg/L	0.005	EPA 200.7/200.2	7/10/24	7/10/24	
Beryllium, Total	ND	mg/L	0.0005	EPA 200.8/200.8	7/10/24	7/10/24	
Cadmium, Total	0.0002	mg/L	0.0002	EPA 200.8/200.8	7/10/24	7/10/24	
Calcium, Total	256	mg/L	2.0	EPA 200.7/200.2	7/10/24	7/10/24	
Chromium, Total	0.0007	mg/L	0.0005	EPA 200.8/200.8	7/10/24	7/10/24	
Copper, Total	0.0012	mg/L	0.0012	EPA 200.8/200.8	7/10/24	7/10/24	
Lead, Total	ND	mg/L	0.0005	EPA 200.8/200.8	7/10/24	7/10/24	
Magnesium, Total	72.7	mg/L	15.0	EPA 200.7/200.2	7/10/24	7/10/24	
Mercury, Total	ND	mg/L	0.00016	EPA 245.1	7/10/24	7/11/24	
Potassium, Total	6.4	mg/L	0.5	EPA 200.7/200.2	7/10/24	7/10/24	
Selenium, Total	0.0020	mg/L	0.0007	EPA 200.8/200.8	7/10/24	7/10/24	
Silver, Total	ND	mg/L	0.0005	EPA 200.8/200.8	7/10/24	7/10/24	
Sodium, Total	72.8	mg/L	2.0	EPA 200.7/200.2	7/10/24	7/10/24	
Thallium, Total	ND	mg/L	0.0002	EPA 200.8/200.8	7/10/24	7/10/24	
Zinc, Total	ND	mg/L	0.01	EPA 200.8/200.8	7/10/24	7/10/24	

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www.ChemtechFord.com

Certificate of Analysis

Milford Mining Company Utah
Greg Guzzle
9701 North 5200 West
Milford, UT 84751

PO#:
Receipt: **7/9/24 11:56 @ 2.7 °C**
Date Reported: 7/18/2024
Project Name: **Q@ 2024 GDWP**

Sample ID: **TRW (Tailings Return Water)**
Matrix: **Water**
Lab ID: **24G0561-03**
Date Sampled: **7/8/24 11:55**
Sampled By: **Greg Guzzle**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Alkalinity - Bicarbonate (as CaCO3)	ND	mg/L	1.0	SM 2320 B	7/10/24	7/11/24	
Alkalinity - Carbonate (as CaCO3)	ND	mg/L	1.0	SM 2320 B	7/10/24	7/11/24	
Alkalinity - Hydroxide (as CaCO3)	ND	mg/L	1.0	SM 2320 B	7/10/24	7/11/24	
Alkalinity - Total (as CaCO3)	ND	mg/L	1.0	SM 2320 B	7/10/24	7/11/24	
Chloride	518	mg/L	50.0	EPA 300.0	7/11/24	7/12/24	
Sulfate	23700	mg/L	100	EPA 300.0	7/12/24	7/12/24	
Total Dissolved Solids (TDS)	35800	mg/L	500	SM 2540 C	7/10/24	7/10/24	
Metals							
Antimony, Total	0.0686	mg/L	0.0250	EPA 200.8/200.2	7/9/24	7/10/24	
Arsenic, Total	9.26	mg/L	0.0250	EPA 200.8/200.2	7/9/24	7/10/24	
Barium, Total	0.058	mg/L	0.050	EPA 200.7/200.2	7/9/24	7/10/24	
Beryllium, Total	0.0754	mg/L	0.0250	EPA 200.8/200.2	7/9/24	7/10/24	
Cadmium, Total	3.30	mg/L	0.0100	EPA 200.8/200.2	7/9/24	7/10/24	
Calcium, Total	473	mg/L	2.0	EPA 200.7/200.2	7/9/24	7/10/24	
Chromium, Total	1.36	mg/L	0.0250	EPA 200.8/200.2	7/9/24	7/10/24	
Copper, Total	476	mg/L	0.600	EPA 200.8/200.2	7/9/24	7/10/24	
Lead, Total	4.89	mg/L	0.0250	EPA 200.8/200.2	7/9/24	7/10/24	
Magnesium, Total	3180	mg/L	15.0	EPA 200.7/200.2	7/9/24	7/10/24	
Mercury, Total	0.00079	mg/L	0.00016	EPA 245.1	7/10/24	7/11/24	
Potassium, Total	95.3	mg/L	5.0	EPA 200.7/200.2	7/9/24	7/10/24	
Selenium, Total	0.0927	mg/L	0.0350	EPA 200.8/200.2	7/9/24	7/10/24	
Silver, Total	0.045	mg/L	0.025	EPA 200.8/200.2	7/9/24	7/10/24	
Sodium, Total	191	mg/L	20.0	EPA 200.7/200.2	7/9/24	7/10/24	
Thallium, Total	ND	mg/L	0.0100	EPA 200.8/200.2	7/9/24	7/10/24	
Zinc, Total	250	mg/L	5.00	EPA 200.8/200.2	7/9/24	7/10/24	

Appendix C

Leak Detection

Q2 LEAK DETECTION DISCHARGE

Apr.	Totalizer Q (gal/day)		May	Totalizer Q (gal/day)		Jun.	Totalizer Q (gal/day)	
Date	gal./day	Day Count	Date	gal./day	Day Count	Date	gal./day	Day Count
4/1/2024	0		5/1/2024	0		6/1/2024	187	1
4/2/2024	0		5/2/2024	108	1	6/2/2024	198	1
4/3/2024	22	1	5/3/2024	120	1	6/3/2024	209	1
4/4/2024	0		5/4/2024	124	1	6/4/2024	220	1
4/5/2024	0		5/5/2024	0		6/5/2024	225	1
4/6/2024	0		5/6/2024	0		6/6/2024	234	1
4/7/2024	0		5/7/2024	139	1	6/7/2024	0	
4/8/2024	0		5/8/2024	0		6/8/2024	0	
4/9/2024	0		5/9/2024	0		6/9/2024	0	
4/10/2024	0		5/10/2024	0		6/10/2024	0	
4/11/2024	26	1	5/11/2024	149	1	6/11/2024	240	1
4/12/2024	0		5/12/2024	0		6/12/2024	244	1
4/13/2024	0		5/13/2024	0		6/13/2024	246	1
4/14/2024	0		5/14/2024	159	1	6/14/2024	0	
4/15/2024	55	1	5/15/2024	0		6/15/2024	0	
4/16/2024	58	1	5/16/2024	0		6/16/2024	0	
4/17/2024	61	1	5/17/2024	0		6/17/2024	256	1
4/18/2024	64	1	5/18/2024	0		6/18/2024	260	1
4/19/2024	0		5/19/2024	169	1	6/19/2024	265	1
4/20/2024	0		5/20/2024	174	1	6/20/2024	0	
4/21/2024	0		5/21/2024	176	1	6/21/2024	0	
4/22/2024	74	1	5/22/2024	0		6/22/2024	0	
4/23/2024	78	1	5/23/2024	0		6/23/2024	0	
4/24/2024	88	1	5/24/2024	0		6/24/2024	285	1
4/25/2024	0		5/25/2024	0		6/25/2024	0	
4/26/2024	94	1	5/26/2024	178	1	6/26/2024	0	
4/27/2024	0		5/27/2024	180	1	6/27/2024	299	1
4/28/2024	0		5/28/2024	183	1	6/28/2024	0	
4/29/2024	98	1	5/29/2024	0		6/29/2024	0	
4/30/2024	0		5/30/2024	0		6/30/2024	0	
			5/31/2024	0				

Q avg.:	65.32967
Q max:	29
Days Total:	37

Appendix D

Photos



Above & Below: ITDF-1 well during excavation to competent bedrock or subgrade at the ITDF East starter dam 5,840' raise. Well collar was initially raised ~20' from original collar height. No submersible pump installed at this time to avoid collision and damage with builders.





ITDF-1 well after some time and progress made on the ITDF 5,840’ lift. As made visible in this photo, another addition of ~10’ was added to avoid burial of the well collar addition shown in the previous two photos.



Lab Well 1 in its current state of repair. MMCU is working with the contractor to finalize repairs on the casing and submersible pumping system.



Another view of Lab Well 1 in its current state of maintenance and repair.

APPENDIX L

Air Quality

State of Utah

SPENCER J. COX
Governor

DEIDRE HENDERSON
Lieutenant Governor

Department of
Environmental Quality

Kimberly D. Shelley
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQE-GN142190005-23

October 25, 2023

Robert Covington
Milford Mining Company Utah, LLC
PO Box 827
Milford, UT 84751
robert.covington@milfordmining.com

Dear Mr. Covington:

RE: Notification of Company Name and Ownership Change from "Tamra Mining Company, LLC" to "Milford Mining Company Utah, LLC" for Approval Order DAQE-AN142190003-14, dated June 3, 2014
Project Number: N142190005

The Utah Division of Air Quality (DAQ) received your request on October 19, 2023, for a name and ownership change for the holder of the above-referenced Approval Order (AO). According to your request, we have noted in our records that the holder and party responsible for complying with the terms and conditions contained in the above-referenced AO has been changed to 'Milford Mining Company Utah, LLC'. This change took effect on the date of this letter.

As authorized by the Utah Legislature, the fee for issuing this name change is a one-time filing fee in addition to the actual time spent by the review engineer and all other staff on the project. Payment should be sent to DAQ upon receipt of the invoice.

If you have any questions, please contact Christine Bodell, who may be reached at (385) 290-2690 or cbodell@utah.gov.

Sincerely,

Bryce C. Bird
Director

Alan D. Humpherys, Manager
New Source Review Section

BCB:ADH:CB:jg

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQE-AN142190003-14

June 3, 2014

David McMullin
CS Mining, LLC
5000 North 5200 West
Milford, UT 84751

Dear Mr. McMullin:

Re: Approval Order: Modification of DAQE-AN142190002-12 to Increase Production, Add Extraction Processing Facility and Add Tailings Disposal Facility
Project Number: N14219-0003

The attached document is the Approval Order for the above-referenced project. Future correspondence on this Approval Order should include the engineer's name as well as the DAQE number as shown on the upper right-hand corner of this letter. The project engineer for this action is Nando Meli Jr., who may be reached at (801) 536-4052.

Sincerely,

Bryce C. Bird
Director

BCB:NM:sa

cc: Southwest Utah Public Health Department

STATE OF UTAH

Department of Environmental Quality

Division of Air Quality

APPROVAL ORDER: Modification of DAQE-AN142190002-12 to Increase Production, Add Extraction Processing Facility and Add Tailings Disposal Facility

Prepared By: Nando Meli Jr., Engineer
Phone: (801) 536-4052
Email: nmeli@utah.gov

APPROVAL ORDER NUMBER

DAQE-AN142190003-14

Date: June 3, 2014

CS Mining, LLC
Milford Copper Mine & Mill
Source Contact:
Ron Wunderlich, Environmental Contact
Phone: (435) 387-5053

Bryce C. Bird
Director

Abstract

CS Mining, LLC (CS Mining) (formerly Western Utah Copper) is requesting approval to modify the AO, DAQE-AN142190002-12, for the operation of the Sunrise open-pit copper mine. The mine is located in Beaver County, northwest of Milford, Utah. There will be an increase in the daily and annual throughput, and there will be new stockpiles of ore at the Sunrise Mine. The Bawana haul road will be widened. In order to process the ore that is mined, an acid leach/solvent extraction/electrowinning facility and an intermediate tailings disposal facility (ITDF) will be added. CS Mining will be adding a 349 hp emergency generator at the equipment shop.

NSPS Subpart LL, Standards of Performance for Metallic Mineral Processing Plants, NSPS Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines and NESHAP for Source Categories Subpart ZZZZ, NESHAP for Stationary Reciprocating Internal Combustion Engines apply to this site. Beaver County is an Attainment area of the NAAQS. Title V of the 1990 Clean Air Act applies to this source. The emissions (in TPY) from the mine and mill will increase as follows: PM_{10} = 23.58, $PM_{2.5}$ (subset of PM_{10}) = 3.45, NO_x = 15.50, SO_2 = 0.60, CO = 7.71, VOC = 9.63, and HAPs = 0.04. The PTE for all sources associated with the mine and mill will be as follows: PM_{10} (including $PM_{2.5}$) = 98.46, $PM_{2.5}$ (subset of PM_{10}) = 17.15, NO_x = 31.09, SO_2 = 1.34, CO = 71.06, VOC = 27.80, HAPs = 0.01 and CO_2e = 14,144.

The project has been evaluated and found to be consistent with the requirements of the Utah Administrative Code Rule 307 (UAC R307). A public comment period was held in accordance with UAC R307-401-7 and no comments were received. This air quality AO authorizes the project with the following conditions, and failure to comply with any of the conditions may constitute a violation of this order. This AO is issued to, and applies to the following:

Name of Permittee:

CS Mining, LLC
5000 North 5200 West
Milford, UT 84751

Permitted Location:

Milford Copper Mine & Mill
5000 North 5200 West
Milford, UT 84751

UTM coordinates: 316,671 m Easting, 4,258,280 m Northing, UTM Zone 12
SIC code: 1021 (Copper Ores)

Section I: GENERAL PROVISIONS

I.1 All definitions, terms, abbreviations, and references used in this AO conform to those used in the UAC R307 and 40 CFR. Unless noted otherwise, references cited in these AO conditions refer to those rules. [R307-101]

I.2 The limits set forth in this AO shall not be exceeded without prior approval. [R307-401]

I.3 Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved. [R307-401-1]

I.4 All records referenced in this AO or in other applicable rules, which are required to be kept by the owner/operator, shall be made available to the Director or Director's representative upon request, and the records shall include the two-year period prior to the date of the request. Unless otherwise specified in this AO or in other applicable state and federal rules, records shall be kept for a minimum of two (2) years. [R307-401-8]

I.5 At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this AO, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded. [R307-401-4]

I.6 The owner/operator shall comply with R307-150 Series. Inventories, Testing and Monitoring. [R307-150]

I.7 The owner/operator shall comply with UAC R307-107. General Requirements: Breakdowns. [R307-107]

Section II: SPECIAL PROVISIONS

II.A The approved installations shall consist of the following equipment:

II.A.1 **Plant wide**

Copper mine and mill operations

II.A.2 **Primary Crusher**

Manufacturer	JCL
Maximum Capacity	208 tons per hour

II.A.3 **Secondary Crusher**

Manufacturer	Nordbert
Maximum Capacity	208 tons per hour

II.A.4 **Tertiary Crusher**

Manufacturer	JCL
Maximum Capacity	208 tons per hour

II.A.5 **Copper Ore Dryer**

Burner Manufacturer	Hauck Manufacturing
Fuel Type	Propane
Maximum Rating	28 MMBTU/hr
Emissions Control	Fabric filter baghouse

II.A.6 **Disk Filter**

Quantity	Two
Maximum Capacity	38 tons per hour, each
Emissions Control	Process filter

II.A.7 **Concentrate Bin**

Maximum Capacity	1.75 tons per hour
Emissions Control	Fabric filter baghouse

II.A.8 **Super Sack Loader**

Maximum Capacity	1.75 tons per hour
Emissions Control	Fabric filter baghouse

II.A.9 **Conveyors**

Various conveyors

II.A.10 **Radial Stacker**

Stacker for crushers

II.A.11 **Crushing Generator**

Manufacturer	Caterpiller
Fuel Type	Diesel
Maximum output	911 horsepower (hp)
680 kilowatts (kW)	

II.A.12 **Crushing Generator**

Manufacturer	Caterpiller
Fuel Type	Diesel
Maximum output	436 horsepower (hp)
325 kW	

II.A.13 **Process Generator**

Manufacturer	John Deere
Fuel Type	Diesel
Maximum output	286 hp
213 kW	

II.A.14 **Process Generator**

Manufacturer	Whisperwatt
Fuel Type	Diesel
Maximum output	236 hp
176 kW	

II.A.15 **Emergency Generator**

Manufacturer	Caterpiller
Fuel Type	Diesel
Maximum output	349 horsepower (hp)

II.A.16 **Miscellaneous Equipment**

Welders
Power plant for vehicle block heater
Emergency generator with a maximum rating of 100 kW

II.A.17 **Acid Leach Facility**

Acid leach/solvent extraction/electrowinning facility

II.A.18 **Intermediate Tailings Disposal Facility (ITDF)**

Tailings ponds for the CCD and SX/EW operation (herein referred to as the ITDF will be located in two small canyons east of the current milling operations.

II.B Requirements and Limitations

II.B.1 **Limitations and Tests Procedures**

II.B.1.a CS Mining shall notify the Director in writing when the installation of the equipment listed in Conditions II.A.11 thru II.A.15, II.A.17 and II.A.18 has been completed and is operational. To ensure proper credit when notifying the Director, send your correspondence to the Director, attn: Compliance Section.

AOs issued by the Director in accordance with the provisions of R307-401 will be reviewed 18 months after the date of issuance to determine the status of construction, installation, modification, relocation or establishment. In 18 months from the date of this AO, the Director shall be notified in writing on the status of the plant construction and installation of the equipment. If a continuous program of construction, installation, modification, relocation or establishment is not proceeding, the Director may revoke the AO.

[R307-401]

II.B.1.b Visible emissions from the following emission points shall not exceed the following values:

A. Crushers and screens - 10% opacity

B. All conveyor transfer points and stackers - 10% opacity

C. Drilling - 10% opacity

D. All truck loading and unloading - 10% opacity

E. All other points except as defined in other conditions of this AO - 10% opacity

F. Diesel-fired generators - 20% opacity

Opacity observations of emissions from stationary sources shall be conducted according to 40 CFR 60, Appendix A, Method 9.

For sources that are subject to NSPS, opacity shall be determined by conducting observations in accordance with 40 CFR 60.11(b) and 40 CFR 60, Appendix A, Method 9.

[R307-201]

II.B.1.c The following production, emission and/or hours of operation limits shall not be exceeded:

A. Total material moved (ore and waste) shall not exceed 40,000 tons per calendar day.

B. Total material moved (ore and waste) shall not exceed 6,445,454 tons per 12-month period.

C. Maximum daily total mileage for all haul trucks shall not exceed 1,316 miles.

D. Maximum total mileage for all haul trucks shall not exceed 321,569 miles per 12-month period.

E. Minimum design payload per haul truck shall not be less than 60 tons.

F. Maximum number of wheels per haul truck shall not exceed 6 wheels.

G. The combined surface area of the ore and waste piles shall not exceed 1,200 ft^2.

H. The surface area of the tailings pond shall not exceed 500 ft^2.

Compliance with the 12-month period limits shall be determined on a rolling 12-month total. CS Mining shall calculate a new 12-month total by the twentieth day of each month using data from the previous 12 months. Records of throughput and daily total mileage shall be kept for all periods when the mine is in operation. Total material moved shall be determined by daily haulage reports. Fuel consumption shall be determined by mine records of diesel fuel oil purchased. Daily total mileage shall be determined by daily mileage reports. A copy of how the daily mileage reports are calculated is attached as Appendix A. The records of total material moved and daily total mileage shall be kept on a daily basis.

[R307-401]

II.B.2 **Roads and Fugitive Dust**

II.B.2.a CS Mining shall abide by a FDCP acceptable to the Director for control of all dust sources associated with the Milford copper mine. The FDCP shall be updated and submitted on an annual basis to the Director by February 1 of every year. This plan shall contain sufficient controls to prevent an increase in PM_{10} emissions above those modeled for this AO. The limitations and conditions in the FDCP shall not be changed without prior approval by the Director.

The haul road length or speed or any other parameters used to calculate the emissions that would change the emissions if changed shall not be increased above the limitations set in the FDCP without prior approval in accordance with R307-401, UAC.

[R307-205]

II.B.2.b The facility shall abide by all applicable requirements of UAC R307-205 for Fugitive Emission and Fugitive Dust sources. The provisions of R307-205 shall not apply to any sources for which limitations for fugitive dust or fugitive emissions are assigned pursuant to R307-401 nor shall they apply to agricultural or horticultural activities. [R307-205]

II.B.2.c Visible emissions caused by fugitive dust from the tailings site shall not exceed 20% opacity. The FDCP shall utilize the fugitive dust control strategies listed in UAC R307-309. Opacity observations of emissions from stationary sources shall be conducted according to R307-309-5(3). [R307-309]

Monitoring:

A visual opacity survey of the tailings pond, tailings embankment and tailings service roads shall be performed on a weekly basis by an individual trained on the observation procedures of 40 CFR 60, Appendix A, Method 9. The individual is not required to be a certified visible emissions observer (VEO). If visible emissions other than steam are observed from an emission unit, an opacity determination of that emission unit shall be performed by a certified VEO in accordance with 40 CFR 60, Appendix A, Method 9 within 24 hours of the initial survey. If no visible emissions are observed for eight consecutive weeks, the observation frequency shall be reduced to a monthly basis. If visible emissions are observed during any monthly observation the frequency shall revert back to a weekly basis.

Minor natural gas combustion sources (<5 MMBtu/hr), cold solvent degreasers, organic liquid storage tanks (<19,812 gallons), cooling towers, and units equipped with a continuous opacity monitor are not affected emission units subject to this condition.

Recordkeeping:

A log of the visual opacity survey(s) shall be maintained in accordance with Condition I.4 of this permit. If an opacity determination is indicated, a notation of the determination will be made in the log. All data required by 40 CFR 60, Appendix A, Method 9 shall also be maintained in accordance with Condition I.4 of this permit.

[R307-401-8]

II.B.2.d Control of disturbed or stripped areas is required at all times (24 hours per day every day) for the duration of the project/operation until the area is reclaimed. Records of treatment and/or reclamation shall be kept for all periods when the plant is in operation. [R307-205]

II.B.2.e Visible fugitive dust emissions from haul-road traffic and mobile equipment in operational areas shall not exceed 20% opacity. Visible fugitive dust emissions from haul-road traffic and mobile equipment in operational areas shall not exceed the above opacity limit at any point. Visible emission determinations shall use procedures similar to Method 9. The normal requirement for observations to be made at 15-second intervals over a six-minute period, however, shall not apply. Visible emissions shall be measured at the densest point of the plume but at a point not less than 1/2 vehicle length behind the vehicle and not less than 1/2 the height of the vehicle. [R307-205]

II.B.2.f Water sprays or chemical dust suppression sprays shall be installed at the following points that are not enclosed or have baghouses to control fugitive emissions:

A. All crushers

B. All screens

C. All conveyor unenclosed transfer points from the primary crusher to the mill

D. All stackers

The sprays shall operate to maintain compliance with opacity requirements, or whenever dry conditions warrant or as determined necessary by the Director.

[R307-205]

II.B.2.g All uncovered storage piles shall be sprayed with water or dust suppressants to minimize generation of fugitive dusts, as dry conditions warrant or as determined necessary by the Director. Records of water and/or chemical treatment shall be kept for all periods when the plant is in operation. [R307-205]

II.B.2.h CS Mining shall provide to the Director for approval a plan to keep opacity on active waste slopes at less than 20% opacity. Average opacity emissions from the active waste dump push slopes shall not exceed 20%. To ensure that 20% opacity is not exceeded, the waste dump slopes shall be monitored by the owner/operator.

If the 20% opacity limitation cannot be met on any waste dump slope, action shall be initiated to prevent excesses of 20% opacity by applying additional and/or alternate control measures, as defined in the FDCP, as approved by the Director.

Opacity observations shall be conducted in accordance with 40 CFR 60, Appendix A, Method 9.

[R307-205]

II.B.2.i If CS Mining, the operator or the Director determines that the opacity is being exceeded and existing alternate control measures have been exhausted, the owner/operator shall meet with the Director, or the Director's staff, to discuss additional or modified fugitive dust controls/ operational practices and an implementation schedule for such within five (5) working days after verbal notification by either party. [R307-205]

II.B.2.j CS Mining and/or the operator shall use frequent watering and approved chemical dust suppressant to control road dust from all trafficked roads and areas in the mine. CS Mining and/or the operator shall submit an annual road dust control report, in conjunction with the FDCP, by February 1 of each calendar year, containing as a minimum the following:

A. A description of what dust control measures are planned for the coming year

B. A report of what dust control measures were actually completed during the past year

C. Specific elements of the report will include:

1) A map of all trafficked areas and roads associated with the mine, indicating which areas are planned for treatments with water and/or approved chemical dust suppressant.

2) A description of what chemical dust suppressant will be used and how it will be applied (application rate, application frequency, dilution rate, special application procedure, scarification, etc.).

3) A list of equipment dedicated either full or part time to work area and road dust control (# of water trucks, water capacity, # graders, etc.).

4) A quantification of how much dust suppressant (gallons, tons) was applied the previous year, and when and where it was applied.

5) A quantification of how much watering was accomplished the previous year (gallons, water truck operating hours).

[R307-205]

II.B.2.k Wet drilling shall be performed for all blast holes. [R307-205]

II.B.2.l The moisture content of all ore being loaded, unloaded or processed shall be maintained at a minimum of 6.0% by weight. The moisture content of ore being processed in the mill shall be maintained at a minimum of 10.0% by weight. The moisture content shall be tested at least once a week using the appropriate American Society of Testing and Methods (ASTM) method. Records shall be kept on a weekly basis. [R307-205]

II.B.3 **Fuels**

II.B.3.a The sulfur content of any fuel oil burned in the boilers shall not exceed 15 ppm. The sulfur content shall be determined by ASTM Method D-4294-89 or approved equivalent. Certification of fuel oil sulfur content shall be either by CS Mining's own testing or test reports from the fuel marketer. [R307-401]

Section III: APPLICABLE FEDERAL REQUIREMENTS

In addition to the requirements of this AO, all applicable provisions of the following federal programs have been found to apply to this installation. This AO in no way releases the owner or operator from any liability for compliance with all other applicable federal, state, and local regulations including UAC R307.

NSPS (Part 60), A: General Provisions
NSPS (Part 60), LL: Standards of Performance for Metallic Mineral Processing Plants
NSPS (Part 60), IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
MACT (Part 63), A: General Provisions
MACT (Part 63), ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

PERMIT HISTORY

This AO is based on the following documents:

Incorporates	Additional Information dated April 3, 2014
Incorporates	Additional Information dated April 2, 2014
Incorporates	Additional Information dated March 31, 2014
Incorporates	Additional Information dated February 13, 2014

Incorporates	Additional Information dated February 11, 2014
Is Derived From	Notice of Intent dated December 6, 2013
Supersedes	DAQE-AN142190002-12 dated August 2, 2012

ADMINISTRATIVE CODING

The following information is for UDAQ internal classification use only:

Beaver County
CDS B
MACT (Part 63), Attainment Area, NSPS (Part 60)

ACRONYMS

The following lists commonly used acronyms and associated translations as they apply to this document:

40 CFR	Title 40 of the Code of Federal Regulations
AO	Approval Order
BACT	Best Available Control Technology
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CDS	Classification Data System (used by EPA to classify sources by size/type)
CEM	Continuous emissions monitor
CEMS	Continuous emissions monitoring system
CFR	Code of Federal Regulations
CMS	Continuous monitoring system
CO	Carbon monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent - 40 CFR Part 98, Subpart A, Table A-1
COM	Continuous opacity monitor
DAQ	Division of Air Quality (typically interchangeable with UDAQ)
DAQE	This is a document tracking code for internal UDAQ use
EPA	Environmental Protection Agency
FDCP	Fugitive dust control plan
GHG	Greenhouse Gas(es) - 40 CFR 52.21 (b)(49)(i)
GWP	Global Warming Potential - 40 CFR Part 86.1818-12(a)
HAP or HAPs	Hazardous air pollutant(s)
ITA	Intent to Approve
LB/HR	Pounds per hour
MACT	Maximum Achievable Control Technology
MMBTU	Million British Thermal Units
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOI	Notice of Intent
NO_x	Oxides of nitrogen
NSPS	New Source Performance Standard
NSR	New Source Review
PM_{10}	Particulate matter less than 10 microns in size
$PM_{2.5}$	Particulate matter less than 2.5 microns in size
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
R307	Rules Series 307
R307-401	Rules Series 307 - Section 401
SO_2	Sulfur dioxide
Title IV	Title IV of the Clean Air Act
Title V	Title V of the Clean Air Act
TPY	Tons per year
UAC	Utah Administrative Code
UDAQ	Utah Division of Air Quality (typically interchangeable with DAQ)
VOC	Volatile organic compounds

FUGITIVE DUST CONTROL PLAN FOR COPPER MILL AND MINE



5000 NORTH 5200 WEST
MILFORD, UTAH 84751

May 2012

Prepared by:

SLR International Corp
22118 20th Avenue SE, Suite G202
Bothell, Washington 98021

SLR Ref: 109.0244.00004

Fugitive Dust Control Plan for Copper Mill and Mine

Prepared for:

CS Mining, LLC
1208 South 200 West
Milford, Utah 84751

Ron Wunderlich
Operations Manager

Date

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APPENDICES
Appendix A SAmple Fugitive Dust Plan Deviation or Dust Episode Report Form
Appendix B Sample Recordkeeping Form
Appendix C Unpaved Haul Road Network Drawing

1. SOURCE INFORMATION

C.S. Mining will be operating an open-pit copper mining and milling operation located northwest of Milford, Utah. An application for approval in accordance with UAC R307-401, *Permit: New and Modified Sources* has already been submitted to Utah Division of Air Quality. This Fugitive Dust Control Plan has been prepared for the C.S. Mining operation to set guidelines and procedures that control and prevent fugitive dust emissions from becoming airborne.

SOURCE INFORMATION	
Name of Operation	C.S. Mining
Address of Operation	5000 NORTH 5200 WEST Milford, Utah 84751
Latitude/Longitude of Operation	38.454° N, 113.101° W
Fugitive Dust Sources	Material Handling, Crushing, Material Storage, Mining, Exploration Drilling, Haul Roads
Amount of Material Processed	At most: 110 tons per hour of ore processed, 38 tons per hour of Magnetite, 2 tons per hour of Concentrate, 736 tons per hour of Waste mined
Responsible Official	Ron Wunderlich Operations Manager Office: 435-387-5053 Cell: 435-691-2601
Other companies that may, or will, be responsible for dust control on-site	No other companies will be responsible for fugitive dust control.

1.1 PROCESS DESCRIPTION

Copper mineral processing involves the mining of ore from the open pit and the crushing, grinding, and separation of copper mineral from matrix rock in the milling operation. The following sections give detailed descriptions of the mining and milling operations.

1.1.1 MINING

First the top soil and overburden are removed from the pit. Then, the ore mining operation is carried out in four phases: drilling, blasting, loading and hauling. Drilling and blasting will be conducted using outside contractors with 25,000-40,000 pound pull-down hammer drills. Blast holes will be 6.75 inches in diameter; explosives will be ammonia nitrate/fuel oil (ANFO) based. Loose shoot material will be loaded and removed from the pit with 12-cubic yard front-end loaders and 60-100 ton trucks. A track hoe may be used from time to time to separate ore from waste prior to loading. Ore from the pit will be trucked to the milling facility located about 4-5 miles to the northwest. If the mill is not operational or about to become overloaded, the ore is transported to the transfer station near the Hidden Treasure Pit and moved to the mill later.

1.1.2 MILLING

The milling operation consists of crushing, grinding, and a flotation process. Haul trucks dump the ore onto an ore pile near the crushers. The primary crusher reduces the large rocks to approximately 6 inches in size. The primary crusher is a conventional jaw crusher. The coarse ore travels by conveyor to secondary and tertiary crushers where it is reduced to about ¼". The secondary and tertiary crushers are cone crushers. A radial stacker moves the crushed ore onto the fine ore stockpile located adjacent to the mill building and is covered by a roof.

The fine ore is fed by conveyors into two (2) ball mills loaded with three and a half inch round steel balls, and water in order to grind it to a size which will "liberate" the copper bearing mineral from the host rock. This grinding is performed with ore/water slurry, the particulate matter (PM) emissions are expected to be negligible. Each ball mill has a capacity of 600 to 1,200 tons per day of dry ore. After the ball mills, the ground ore goes through three magnetic separators to remove iron mineral from the process. The magnetite is de-watered in a thickener and then pumped to a vacuum disk filter. Most of the water is separated from the magnetite in the de-watering/filtration process and then loaded to over-the-road semi trucks with a loader (FEL).

After magnetite is removed, the remaining material goes through the flotation process. In the flotation process, the ore/water slurry is divided into rougher cell and cleaner cell sections. In the rougher cell, collector & frothing agents are added to the ground ore in the flotation water suspension; and this mixture is agitated to entrain air. Ore minerals then float on the small air bubbles, and waste minerals sink. The sunken waste minerals, also known as tailings, are collected and partially dewatered in two thickeners. The tailings flow via a 14 inch high density polyethylene Pipeline to the tailings repository just south of the mill.

A "rough" float is made in the flotation process, thus the name rougher. Then two more cleaning floats are made to produce a concentrate, which is about 30 percent copper. The copper concentrate flows into a small thickener. The purpose of the thickener is to allow the solids (concentrate) to settle to the bottom and be drawn out as slurry while clear water is recovered and reused in the milling process.

The final copper concentrate is then pumped to a disc filter for filtration process. Most of the water is separated from the copper concentrate in the filtration process. The copper concentrate is loaded into a propane-fueled dryer to further reduce the moisture. A fully enclosed auger conveys the concentrate to a bin which feeds super sacks for transport via over the road semi trucks to an off-site smelter where it is processed into copper metal.

2. GENERAL PROCEDURES

Responsible Official is responsible for implementation and maintenance of this Fugitive Dust Control Plan. General control procedures that apply to all sources are outlined in the sections below. Sections 4 to 9 provide descriptions of the fugitive dust sources, control measures, and recordkeeping requirements for each source type.

C.S. Mining staff will perform daily visual inspections for all fugitive dust sources to determine when controls will be applied. If a visible fugitive dust plume exits the property boundary, C.S. Mining staff will identify the source and perform the control measures outlined in this plan if the source of the fugitive dust is a result of C.S. Mining activities. Each dust episode will be recorded in the report specified in Section 2.3 below.

The control measures are divided into primary and contingency measures. If the primary control measure is unsuccessful in controlling fugitive dust from the source, the contingency control measure will be applied. During extreme conditions (high wind, dry conditions, extreme heat), C.S. Mining will reduce traffic and material throughput and limit the number of blasts or holes drilled to a level that ensures fugitive dust is controlled.

2.1 METHOD OF APPLICATION

C.S. Mining will maintain two 40,000 gallon water trucks for the application of water and chemical dust suppressant for all sources except crushing. The crusher equipment is equipped with its own water spray system.

2.2 OFF-HOURS

Personnel are on-site at all times for security purposes. During off-hours, these personnel will conduct visual inspections of the fugitive dust sources and contact the C.S. Mining Responsible Official if fugitive dust is observed.

2.3 RECORDKEEPING

C.S. Mining will record any dust episode or deviations from this Fugitive Dust Control Plan. Records will indicate if any modification of the dust plan is necessary. A sample Fugitive Dust Control Plan Deviation/Dust Episode Report Form is provided in Appendix A.

Further recordkeeping requirements are specified under each of the following sections. All records will be kept onsite for a period of three years and provided to the Utah Department of Air Quality upon request. A sample recordkeeping form for haul roads is provided in Appendix B.

2.4 TRAINING

As part of the implementation of the Fugitive Dust Control Plan, C.S. Mining will provide appropriate training for all personnel involved in implementing the plan. This training will be conducted by the Responsible Official or personnel deemed qualified.

The training will cover the control techniques in place for managing dust and how to maintain them, how to conduct a fugitive dust visual inspection and fill out the associated paperwork, what to do in the case of an unexpected fugitive dust release, and who to notify in case of any concerns or problems pertaining to fugitive dust. Refresher training will be provided on an annual basis. C.S. Mining will maintain records of these trainings indicating the date and personnel attending.

3. MATERIAL HANDLING

Material transfer emissions occur from transfer points between the conveyor coming out of the ore crusher to the radial stacker and the radial stacker to the crushed ore pile under the mill building roof. Fugitive dust is also generated as a loader loads the haul truck or feeder bin and when the haul trucks unload the ore or waste.

Fugitive Dust Sources	• Transfer Crushed Ore from Crusher Conveyor to Radial Stacker 1 • Transfer Crushed Ore from Radial Stacker 1 to Crushed Ore Pile • Loading Ore or Waste from Pit to Haul Truck • Loading Ore from Transfer Station Pile to Haul Truck • Loading Ore from Ore Pile to Crusher Feeder • Loading Magnetite from pile to Over the Road Semi • Loading from Previously Processed Tailings Pile to Haul Truck • Loading Ore from existing Stock Piles to Haul Truck • Unloading Ore from Haul Truck to Ore Pile • Unloading Ore from Haul Truck to Transfer Station Pile • Unloading Waste from Haul Truck to Waste Dump at each Mining Area
Primary Controls	• Inherent high moisture content of the material • Minimize drop distances as far as practicable
Contingent Controls	• Water spray, if fugitive dust is observed, during non-freezing conditions
Recordkeeping	• No records required

4. CRUSHING

C.S. Mining will be using primary, secondary, and tertiary crushers for this operation. The primary crusher is a jaw impact crusher that reduces the large rocks to approximately ¾ inches in size. The coarse ore travels by conveyor to secondary and tertiary crushers where it is reduced from about ¾" to ¼". The secondary and tertiary crushers are cone crushers.

Fugitive Dust Sources	• Primary Crusher • Secondary Crusher • Tertiary Crusher
Primary Controls	• Inherent high moisture content of the material • Minimize drop distances as far as practicable • Water spray during non-freezing conditions
Contingent Controls	• Increase application of water
Recordkeeping	• No records required

5. MATERIAL STORAGE

Material storage includes the stock piling of materials when they are not in use. C.S. Mining stores ore, magnetite, concentrate, and mine waste.

Fugitive Dust Sources	• Hidden Treasure Ore Stockpile (2.97 acres) • Transfer Station Ore Stockpile (4.36 acres) • Previously Processed Tailings Pile (3.83 acres) • Mill Ore Stockpile (0.69 acres) • Mining Waste Dumps (~0.23 acres of disturbed area for each mining pit) • Crushed Ore Stockpile (0.34 acres)
Primary Controls	• Inherent high moisture content of the material • Minimize drop distances as far as practicable
Contingent Controls	• Water spray, if fugitive dust is observed, during non-freezing conditions
Recordkeeping	• No records required

6. MINING

Fugitive dust is generated from mining activities such as drilling, blasting, and overburden removal within each pit or mining area. C.S. Mining will use ammonium nitrate fuel oil explosive to blast the rock in the pits.

Fugitive Dust Sources	• Sunrise Pit • Bawana Pit • OK Pit • Hidden Treasure Pit • Cactus Pit • Maria Pit • Copper Ranch Pit • Candy B Pit
Primary Controls	Drilling and Blasting: • Wet drilling for all blast holes Disturbed Areas: • Water application when fugitive dust is observed • After the area has been mined, revegetate the area where possible • Reduce time between disturbance of soil and revegetating
Contingent Controls	• Increase application of water • Reduce mining operation until fugitive dust is controlled
Recordkeeping	• Number of blasts performed annually

7. EXPLORATION DRILLING

C.S. Mining expects to drill two holes per day for exploration of mining areas.

Fugitive Dust Sources	• Exploration Drilling
Primary Controls	• Wet drilling for all holes • Minimize disturbed area • Revegetate the area where possible
Contingent Controls	• Reduce drilling operation until fugitive dust is controlled
Recordkeeping	• Number of holes drilled annually

8. HAUL ROADS

Hauling traffic includes rock trucks hauling ore to the mill, rock trucks hauling waste to the waste dump, and over the road semi trucks hauling product (concentrate and magnetite) offsite. Other heavy and medium-duty vehicles including water, fuel, oil, and mechanic trucks, also travel on the haul roads. C.S. Mining has 17.3 miles of roads and the maximum annual vehicle miles travelled (VMT) will be 283,733 miles per year. The average speed of truck travel will be approximately 20 miles per hour. A drawing of the unpaved road network labeled by segment letter is provided in Appendix C.

Fugitive Dust Sources	• Offsite to Truck Shop (Segment A, 0.9 mi, 12,577 VMT) • Truck Shop to Candy B (Segment B, 1.3 mi, 6,522 VMT) • Candy B to Maria (Segment C,0.2 mi,1,153 VMT) • Maria to Hidden Treasure (Segment D,0.6 mi, 14,290 VMT) • Maria to Bawana (Segment E,0.4 mi,7,912 VMT) • Bawana to Bawana Pit Edge (Segment F,0.1 mi,629 VMT) • Sunrise to Bawana (Segment G,0.7 mi,14,598 VMT) • Hidden Treasure to Copper Ranch (Segment H,1.9 mi, 68,819 VMT) • "Y" to Mill Entrance (Segment I,1.6 mi, 76,254 VMT) • Mill Entrance to Mill Ore Stockpile (Segment J,0.1 mi, 3,509) • Mill to Mill Entrance (Segment K,0.05 mi, 705 VMT) • "Y" to Truck Shop (Segment N,3.4 mi, 48,941 VMT) • Pit Ramps (0.2 to 0.9 mi depending on pit, ~3.9 mi total) • Pit to Waste Piles (0.1 to 0.9 mi depending on pit, ~2.1 mi total)
Primary Controls	On-site • Application of chemical dust suppressant and water (frequency and amount of water is adjusted depending on weather conditions) • Application of chemical dust suppressant based on vendor specifications • Crushed and screened rock added to the road surface to minimize fugitive dust generation • Maintain water capacity to control entire length of travelled roads, including backup in the event of breakdown, to control dust during the peak season (June – August) Off-site • Remove debris from track-out areas immediately • Wash track-out areas with water as necessary • Trucks hauling material off-site will be covered
Contingent Controls	• Increase application of primary controls • Reduced travel until fugitive dust is controlled

Recordkeeping	• Maintain records of water and dust suppressant application rate and application frequency

APPENDIX A

SAMPLE FUGITIVE DUST PLAN DEVIATION OR DUST EPISODE RECORD FORM

Fugitive Dust Plan Deviation or Dust Episode Record Form

Instruction: If visible fugitive dust is observed at the property boundary or a deviation of the Fugitive Dust Control Plan occurs, notify the Responsible Official and fill out this form.

1. Name and address of dust source

   C.S. Mining
   5000 NORTH 5200 WEST
   Milford, Utah 84751

2. Time and duration of dust episode

3. Meteorological conditions during the dust episode

4. Total number and type of fugitive dust activities and dust producing equipment operating during the dust episode or deviation of the dust control plan. If no change has occurred from the existing dust control plan, the source should state that activities/equipment are the same.

5. Fugitive dust activities that caused a dust episode or deviation of the sources' dust control plan

6. Reasons for failing to control dust from the dust generating activity or equipment

7. New and/or additional fugitive dust control strategies to achieve compliance

NAME: _____ SIGNATURE: _____

TITLE: _____ DATE: _____

APPENDIX B

SAMPLE RECORDKEEPING FORM

Mining

NAME	DATE	TIME	LOCATION	NUMBER OF BLASTS

Exploration

NAME	DATE	TIME	LOCATION	NUMBER OF HOLES DRILLED

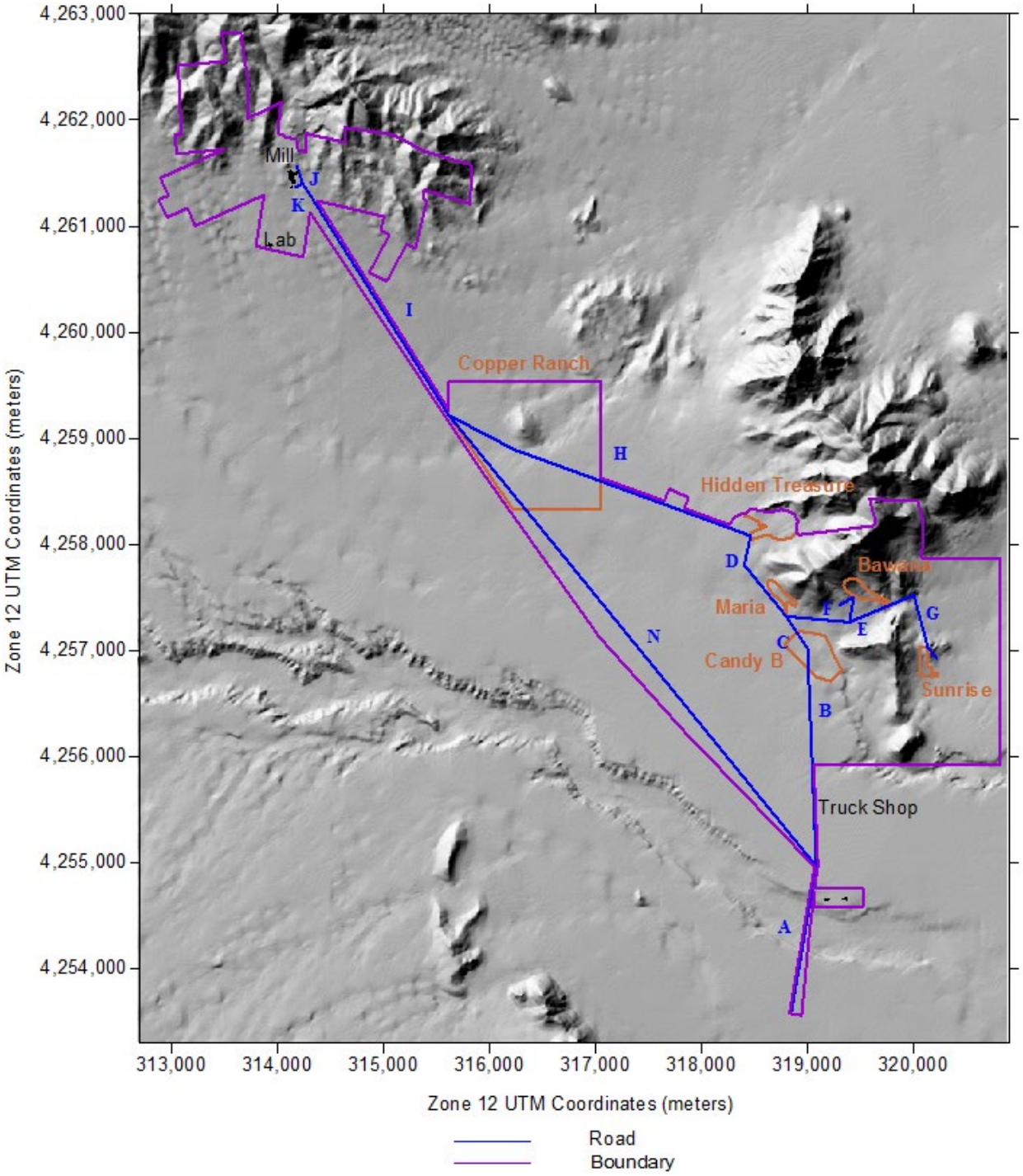
Haul Roads

NAME	DATE	TIME	ROAD SEGMENT	WATER APPLICATION RATE	CHEMICAL SURPRESSANT NAME AND DILUSION	CHEMICAL SURPRESSANT APPLICATION RATE

APPENDIX C

UNPAVED HAUL ROAD NETWORK DRAWING

Haul Road Segments and Boundary



APPENDIX M

Surety & Bonding

Table of Contents	Revision: 2.1
1. Introduction **2. Cost Summary** **3. Indirects and Escalation** **4. Fleet, Productivity, and Cost** **5. Demolition** **6. Pit with no Fill (Template)** Bawana Pit Maria Pit Copper Ranch Pit **7. Pit with Fill (Template)** Sunrise Pit Hidden Treasure Pit **8. Dumps Regrade (Template)** Sunrise Dump Bawana Dump Maria Dump Hidden Treasure Dump Copper Ranch Dump Copper Ranch Mini Dump OK Dump **9. FTP** **10. EITDF** **11. Mill Site** **12. Truck Shop PNT1** **13. Haul Roads** **14. Revision Table** **15. Dozer Production Table** **16. Loader Production Table** **17. Truck Production Table**	Authors:

The Purpose of the Surety Calc Sheet is to outline and calculate the Surety and Bonding Requirements for Tamra Mining.

This document is **NOT** a stand-alone document. This document is supported by Tamra Mining's 2019 NOI Submission and the Pit and Dump Slope Analysis document found in the 2019 NOI Appendix.

The Surety Calc Sheet is designed to be a living document, and should be updated on a frequent basis to match the changing site conditions.

The Surety Calc Sheet is Separated into 18 sections (Tabs) outlined in the table below:

#	Section Headers (Orange)	Description
1	Introduction	Introduction to the sheet and how to use
2	Cost Summary	The summery of Demolition, and Reclamation costs with the current bond posted.
3	Indirects	Costs that support the reclamation and demolition
4	Fleet, Productivity & Cost	The main costing and productivity assumptions used for all earthwork.
5	Demolition	The demolition of all structures, ponds, and support equipment. Contains no earthwork.
6	Pit with no Fill	Pits whose slope angles are less than 45 degrees and require no backfill.
7	Pit with Fill	Pits whose slope angles are greater than 45 degrees and require backfill.
8	Dumps with no Fill	Dumps whose slopes are 2.5:1 or greater and require no slope regrading.
9	Dumps with Fill	Dumps that have slopes that are less than 2.5:1 and require regrading.
10	FTP	Float Tails Pond Reclamation Earthwork
11	EITDF	East Intermediate Tails Disposal Facility Reclamation Earthwork
12	Mill Site	Mill Site Reclamation Earthwork
13	Truck Shop PNT1	Truck Shop and PNT 1 Reclamation Earthwork
14	Hual Roads	Reclaimation of Hual Roads
15	Revision Table	Table of Revisions
16	Dozer Production Table	Dozer Production and Source Tables
17	Loader Production Table	Loader Production and Source Tables
18	Truck Production Table	Truck Production and Source Tables

Section Headers (Designated by Orange Tabs) may be blank as they are used as a template for future expansions.

Where applicable costing has been sourced from *Heavy Construction Costs w/RSMeans Data 2019 33rd Edition by Derrick Hal*e (ISBN-13 978-1946872593). The RS Means Number is listed next to the costing data for reference.

Other Sources for costing have been utilized, such as over the phone quotes, these have been noted when used.

In most cases aerial photographs have been provided as a reference, and are only as accurate as the date flown.

Task/Region	Amount
Bawana	**$ 101,142**
Copper Ranch	**$ 202,236**
Maria	**$ 149,824**
Hidden Treasure	**$ 376,820**
Sunrise	**$ 243,455**
OK	**$ 10,052**
FTP	**$ 336,563**
ITDF	**$ 519,011**
Mill Site	**$ 434,923**
Truck Shop PNT1	**$ 10,019**
Haul Roads	**$ 55,309**
Total Earthwork	**$ 2,439,356**
Demolition	**$ 2,058,525**
Total Direct	$ 4,497,881
Indirects	$ 1,179,344
Escalation due to Inflation	$ 683,612
Total	$ 6,360,838
Total Bond Posted	$ 5,915,000
Difference	$ (445,838)

Indirects Assumptions	Percentage	Value						Comment
Total Directs Cost	N/A	$ 4,497,881.23						See Cost Summery
MOB/DEMOB fee	10.0%	$ 449,788.12						Dee Table Below
Management Indirects	2.5%	$ 112,447.03						
Engineering, Design, and Construction	2.5%	$ 112,447.03	1	11	31	30	800	
Contingency	5.0%	$ 224,894.06						
Insurance	0.6%	$ 27,886.86	1	31	13	30	250	
Main Office	5.6%	$ 251,881.35	1	31	13	40	200	
Total Indirects Cost		$ 1,179,344.46						

MOB/DEMOB	Units	Scale	Miles	Rate	Cost	Comment
Dozer	1	D10	209	$ 15.00	$ 6,270.00	See 2018 CAT Wheeler Rental Rates
Loader	1	988	209	$ 13.00	$ 5,434.00	Handbook
Hauler	2	773	209	$ 7.45	$ 80,000.00	
Grader	1	14M	209	$ 8.60	$ 3,594.80	**DOGM REQUIRES 10% OF DIRECT COSTS**
Total					$ 95,298.80	**FOR MOB**

Escalation	
Years since DOGM acceptance	5
Current Inflation Rate	2.3%
Total Costs	$ 5,677,225.69
Total Escalation	$ 683,612.21
*Total escalation uses compounded interest	

Major Equipment	UoM	Production	Comments	Monthly (hrs)	Daily (hrs)	RSM Means Ref #	DOGM O&P	Monthly Rent	Daily Operation	Operating w/O&P	Labor	Equipment w/O&P	Total
Dozer - Push Down Dumps/Stockpiles (100ft)	LCY/hr	1524	500 HP Dozer, CAT D10	176	8	1 54 33 4370		$ 34,565	$ 1,683	$ 231.36	$ 55.10	$ 216.03	$ 0.33
Dozer - Push Topsoil/Dump Fill/Waste Rock (100ft)	LCY/hr	1524	500 HP Dozer, CAT D10	176	8	1 54 33 4370		$ 34,565	$ 1,683	$ 231.36	$ 55.10	$ 216.03	$ 0.33
Dozer - Ripping	BCY/hr	2573	500 HP Dozer, CAT D10	176	8	1 54 33 4370	10%	$ 34,565	$ 1,683	$ 231.36	$ 55.10	$ 216.03	$ 0.20
Loader	LCY/hr	1522	CAT988 12Cy	176	8	1 54 33 4870		$ 19,780	$ 1,071	$ 147.22	$ 55.10	$ 123.63	$ 0.21
Truck - Short haul (2500 ft)	LCY/hr	1522	CAT773 65t	176	8	1 54 33 5620		$ 77,900	$ 4,184	$ 575.30	$ 220.40	$ 486.88	$ 0.84
Safety Berm	LCY/hr	1557	CAT992 14 CY	176	8	31 23 23 15 4870		$ 23,600	$ 2,625	$ 328.13	$ 55.10	$ 134.09	$ 0.33
Safety Signs	ft/sign	150				1 56 26 50 600				$ 1.46	$ 2.00		$ 50.00
Seeding Cost	acre/hr												$ 111.36
Neutralize Ponds	$/tn		Cost per ton LKD										$ 34.00
Evaporate Ponds	gal/hr	6070	From prev estimations							$ 7.21	$ 30.58		$ 0.0062
Place Geotextile Liner	SY/day	2400				31 32 19 16 1510							$ 2.36
Lime Slaker	GPH	36000	Spray lime slurry over ponds		8		10%	$5,000	$388.43	$ 53.41	$ 30.58		$ 0.0023

*Monthly and Daily rates taken from Equipment Watch sourced 10-4-2019. Assumes 10hr Day.

*Click on text to be taken to Productivity Tabs for the selected Equipment.

Species (Pure Live Seed)	Lbs/Acre	Cost/Lbs	Cost/Acre
Intermediate Wheatgrass (Elymus hispidus)	2.00	$ 5.50	$ 11.00
Bottlebrush squirreltail (Elymus elymoides)	0.67	$ 10.72	$ 7.18
Great Basin Wildrye (Elymus cinereus)	1.34	$ 14.74	$ 19.75
Indian Ricegrass (Achnatherum hymenoides)	1.34	$ 8.04	$ 10.77
Yellow Sweet Clover (Melilotus officinalis)	0.67	$ 1.68	$ 1.13
Hycrest crested wheatgrass (Agropyron cristatum X A. desertorum)	2.00	$ 8.00	$ 16.00
Palmer Penstemon (Penstemon palmeri)	0.35	$ 11.20	$ 3.92
Forage Kochia (Kochia prostrata)	0.67	$ 12.06	$ 8.08
Wyoming Big Sagebrush (Artemisia tridentata)	0.13	$ 5.46	$ 0.71
Four-Wing Saltbush (Atriplex canescens)	1.34	$ 20.10	$ 26.93
Rubber Rabbitbrush (Chrysothamnus nauseosus)	0.35	$ 16.80	$ 5.88
Total all Species PLS			**$ 111.36**

Initial Seed verse Re-Seeding Costs
The Initial Seeding is assumed to be done by a broadcast seeder on the back of the dozer as it places the final layer of topsoil. Intial seed equipment cost is assumed to be combined with the equipment cost accruded during the placement of topsoil. The cost of the initial seeding per acre is added to the cost of top soil placement. In the event of a reseed, it is assumed to be done by the same dozer. Area for ripping and seed costs as assumed to be 50% of original costs.

Constants	
Building Debris / Building Volume Conversion Factor	0.2
Waste Material Conversion Factor for C&D Ferrous Metal (lbs/cy)	1000

RSM Means Ref #	Costing Table	
2 41 16 13 20	Steel	$0.36
2 41 16 17 2500	Concrete (Cy)	$49.71
2 41 16 17 400	Concrete (Sy)	$8.10
2 41 16 13 100	Mix Material	$0.39
2 41 16 13 100	Fiber Glass	$0.39
02 41 16 13 700 - 650	Wood & Masonary	$0.39
	Liner Removal	

Additional Disposal	Basic Question
Clean Har	Yes
Nuetralize	No
Drain	Not Applicab

Measurement Unit
CF
CY
SY
Each
Hours
SY/hr
Hour
SY/Hour
Miles
Tons
Count
Trip
Lbs
Ft
Gallons

Primary Material
Steel
Concrete (Cy)
Concrete (Sy)
Fiber Glass
Mixed Material
Wood & Masonary
Other
Liner

Density Units
lb/Cf

Sheet Constants, Menus and References

Total Cost for Demolition of MCO	**$2,058,525**
Mill, Mill Equipment, and Supporting Facilities	**$944,960**

Ref.	Description	Interior Walls? Yes/No/Not Applicable	Primary Material	Description	Means Reference Number (Heavy Construction Cost Data 2019)	Unit Cost $	Adjusted Cost $	Unit	Length (ft)	Width (ft)	Height (ft)	Diameter	Area (sf)	Volume (cf)	Additional Disposal?	Density	Time	Number	Unit	Gallon	Total Quantity	Unit	Cost
	Mill Building																						
1	Level 1 - Crushing, Grinding and Ore Storage. No Interior Walls	No	Steel	Structure Demolition, Large Projects, Steel	02 41 16 13 0020	$0.360	$0.180	CF	150	100	33.5		15,000	502,500							502,500	CF	$90,450
	Level 2 - Ball Mill and Flotation No Interior Walls	No	Steel	Structure demolition, Large Projects, Steel	02 41 16 13 0020	$0.360	$0.180	CF	60	100	66		6,000	396,000							396,000	CF	$71,280
2	Level 3 - Flotation Column Cells No Interior Walls	No	Steel	Structure demolition, Large Projects, Steel	02 41 16 13 0020	$0.360	$0.180	CF	30	100	32		3,000	96,000							96,000	CF	$17,280
3	Level 4 - Mill and Recovery Building No Interior Walls	No	Steel	Structure demolition, Large Projects, Steel	02 41 16 13 0020	$0.360	$0.180	CF	180	100	32		18,000	576,000							576,000	CF	$103,680
4	Bag House No Interior Walls	No	Steel	Structure demolition, Large Projects, Steel	02 41 16 13 0020	$0.360	$0.180	CF	40	18	25		720	18,000							18,000	CF	$3,240
1	Derrick Steel Structure No Interior Walls	No	Steel	Structure demolition, Large Projects, Steel	02 41 16 13 0020	$0.360	$0.180	CF	49	8	25		392	9,878							9,878	CF	$1,778
	All levels Concrete Floor Demolition. *Assumes Concrete is Buried on Site as Per NOI*	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	2 41 16 17 400	$8.100	$8.100	SY	258	100	0.5		25,800	12,900							2,867	SY	$23,220
	All levels Concrete Footings and Foundations Demolition (8"x48" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	2 41 16 17 2500	$49.710	$49.710	CY	916	4.67	1		4,278	4,278							158	CY	$7,876
	Derrick Screen Structure All levels Concrete Floor Demolition. *Assumes Concrete is Buried on Site as Per NOI*	Not Applicable	Concrete (Cy)	Building Demolition Concrete to 8" thick	2 41 16 17 2500	$49.710	$49.710	CY	49	25	0.67		1,225	821				2	Count		61	CY	$3,022
	Derrick Screen Structure All levels Concrete Footings and Foundations Demolition	Not Applicable	Concrete (Cy)	Two rows of footings, 4.5'x1.3'x20 and 2.6'x1.3'x20	2 41 16 17 2500	$49.710	$49.710	CY	See Cell S29 >>>>>>					185				2	Count		14	CY	$1,359
5	MCC 1 - Block Building (Name Update)	Not Applicable	Wood & Masonary	Structure demolition, Masonry	02 41 16 13 0650	$0.390	$0.390	CF	42	28	16		1,176	18,816							18,816	CF	$7,338
	Floor Demolition using trackhoes, loaders, etc	Not Applicable	Concrete (Sy)	Building Demolition Concrete 0" to 6" thick	2 41 16 17 400	$8.100	$8.100	SY	42	28	0.5		1,176	588							131	SY	$1,058
	Footings and Foundations Demolition (8"x24" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	2 41 16 17 2500	$49.71	$49.71	CY	42	28	1			1,176							44	CY	$2,165
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 16 19 3080	$24.00	$24.00	CY	Load and Disposal of Mill Buildings, Darrick Screen Structure, and MMC #1					11,979						11,979	CY	$287,501
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip	Building Debris to Building Volume Conversion Factor Applied									14	CY		856	Trip	$11,859
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons	Volume Units are in CY							1000			Lbs		5,990	Tons	$71,875
	Mill Equipment & Derrick Screen Equip																						
	Derrick Flow Divider	Not Applicable	Steel	Steel 5x6 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			5	6	28	141							141	CF	$51
	Derrick Screens (16.5x11.3.2)	Not Applicable	Mixed Material	Mixed Material	02 41 16 13 0100	$0.390	$0.390	CF	17	11	3.2		182	581							581	CF	$227
1	Ball Mill (8x12') (Dimension Correction)	Not Applicable	Steel	Ball Mills 1 & 2 8x12 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			8	12	113	905				2	Count		1,810	CF	$651
	Ball Mill (5x8) (Dimension Correction)	Not Applicable	Steel	Ball Mill 3 5x8 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			5	8	50	251				1	Count		251	CF	$90
6	Ball Mill (8'x20'x8') (Dimension Correction)	Not Applicable	Steel	Ball Mill 4 7x8 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			7	8	50	352				1	Count		352	CF	$127
2	Rougher Cell 1 (12'x12'x30')	Not Applicable	Steel	Demensions (12'x12'x30') 5 Banks In total	02 41 16 13 0100	$0.360	$0.360	CF	12	12	30		144	4,320				5	Count		21,600	CF	$7,776
	Copper Con Thickener (Demension Corrections)	Not Applicable	Steel	9.5 x 6 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			18	10	79	1,414	Drain						1,414	CF	$509
4	Mag Con Thickener (Dimension Update)	Not Applicable	Steel	12 x 8 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			12	8	50	603	Drain						603	CF	$217
7	North Thickener (Name Update) (Dimension Update)	Not Applicable	Steel	24x12 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			24	12	113	2,714	Drain						2,714	CF	$977
8	South Thickener (Name Update) (Dimension Update)	Not Applicable	Steel	20x11.5 (Cylinder)	02 41 16 13 0100	$0.360	$0.360	CF			20	11.5	104	2,077	Drain						2,077	CF	$748
9	Transformers (Costs of Installtion assumed to be the cost of removal)	Not Applicable	Other	1000kVa Transformer	26 12 19 10 0500		$41,100	Each	Not Applicable									3	Count		3	Each	$123,300
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 16 19 3080	$24.00	$24.00	CY	Load and Disposal of Derrick Screens, Ball Mills, Roughner Cells, Thickeners					99						99	CY	$2,375
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip	Building Debris to Building Volume Conversion Factor Applied									14	CY		7	Trip	$98
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons	Volume Units are in CY							1000			Lbs		49	Tons	$594
	Mill Water Tanks and Material Storage Areas																						
10	OK Boneyard (Dimensional Update)	Not Applicable	Mixed Material	OK Boneyard Area - 92,552sf Volume of Material - 6,812cf (Aerial Survey)		$0.390	$0.39	CF	Volume and Area Measurement were Performed using Pix4D and 1-14-2019 Aerial Survey				96,552	6,812							6,812	CF	$2,657

Reference Photo for Mill - Mill Equipment - Supporting Facilities (Excludes North and South Water Tanks and Boneyards.

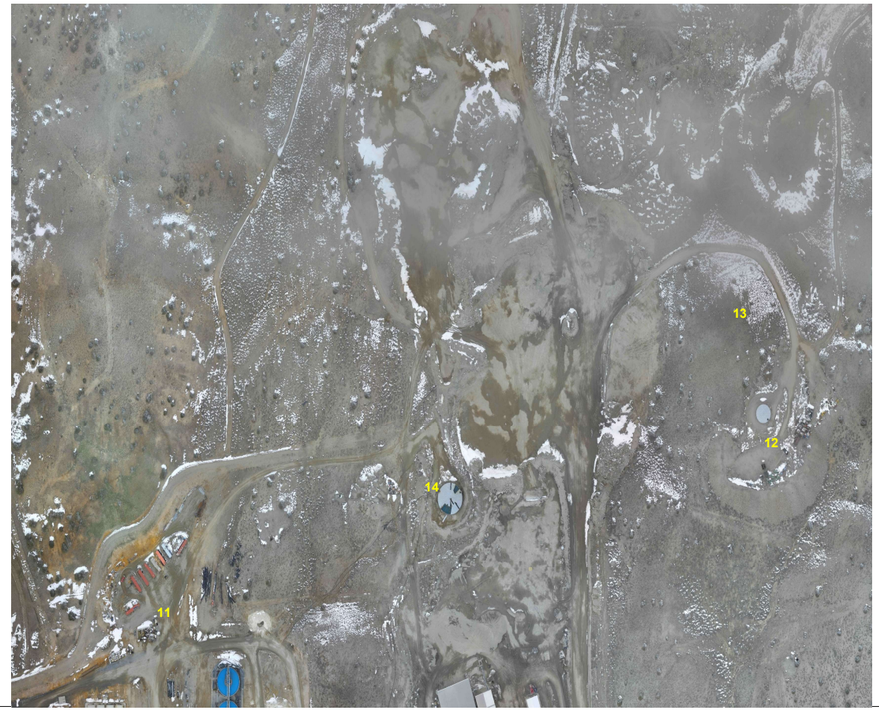


Date Flown 1-14-2019

Reference Photo for Water Tanks - Bone Yards



11	Mill Laydown Yard (Name Update) (Dimensional Update)	Not Applicable	Mixed Material	ML Area - 86,697sf Volume of Material - 30,007cf (Aerial Survey)		$0.390	$0.39	CF	Volume and Area Measurement were Performed using PlwD and 1-14-2019 Aerial Survey				86,697	30,007							11,407	CF	$4,449
12	Freshwater Boneyard (New Addition)	Not Applicable	Steel	FW Boneyard Area - 45,036sf Volume of Material - 11,406cf (Aerial Survey)		$0.360	$0.36	CF					45,036	11,407							13,854	CF	$4,988
13	Fresh Water Tank (As per NOI tank will be left for beneficial use)	Not Applicable	Steel	10x42 (Cylinder)		$0.360	$0.36	CF			10	42	1,385	13,854							13,854	CF	See Comment
14	Process Water Tank	Not Applicable	Steel	10x72 (Cylinder)		$0.360	$0.36	CF			10	72	4,072	40,715	Drain						40,715	CF	$14,657
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of OK Boneyard, Mill Laydown Yard, Freshwater Boneyard Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				659								659	CY	$15,812
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip									14	CY			47	Trip	$652
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		329	Tons	$3,953
	Mill Office (Phase 1) & PNT 3																													
15	Wood Structure Demolition	Yes	Wood & Masonary	Structure Demolotion, Wood Framing	02 41 16 13 0700	$0.390	$0.390	CF	70	30	10		2,100	21,000							21,000	CF	$8,190
	Foundation Slab Demo	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.100	$8.100	SY	70	30	0.5		2,100	1,050							233	SY	$1,890
	Foundation Footings, Wall, ect.	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	02 41 13 17 5400	$49.710	$49.710	CY	70	30	1		2,100	2,100							78	CY	$3,866
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Mill Office Building Debris to Building Volume Conversion Factor Applied Volume Units are in CY				156								156	CY	$3,733
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip									14	CY			11	Trip	$154
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		78	Tons	$933
N/A	Portable Non Trailer (PNT) 3	Yes	Other	66x25x15 Demob		$8,000	$8,000	Each	70	25	14		1,750	24,500							1	Each	$8,000
	Mill Clarifier - (Formerly Called Mill Thickener)																													
16	Mill Clarifier (Name Change) (Dimension Update)	Not Applicable	Steel	20x64x26	02 41 16 13 0100	$0.360	$0.360	CF	20	64	26		1,280	33,280	Drain						33,280	CF	$11,981
	Mill Clarifier Foundation (Addition) Assumes Concrete is Buried on Site as Per NOI	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	02 41 13 17 5400	$49.710	$49.710	CY	35	90.5	1		3,168	3,168							117	CY	$5,832
	Mill Clarifier Foundation Slab (Addition) Assumes Concrete is Buried on Site as Per NOI	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.100	$8.100	SY	35	90.5	0.5		3,168	1,584							352	SY	$2,851
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Mill Clarifier Building Debris to Building Volume Conversion Factor Applied Volume Units are in CY				247								247	CY	$5,916
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip									14	CY			18	Trip	$244
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		123	Tons	$1,479
		Not Applicable	Steel			$0.360	$0.360	CY													0	CY	$0
		Not Applicable	Steel			$0.360	$0.360	CY													0	CY	$0



Date Flown 1-14-2019

Leach, Solvent Extraction (SX), Electrowinning (EW) Facilities — $493,787

Ref.	Description	Interior Walls? (Yes/No/Not Applicable)	Primary Material	Description	Means Reference Number (Heavy Construction Cost Data	Unit Cost $	Adjusted Cost $	Unit	Length (ft)	Width (ft)	Height (ft)	Diameter	Area (sf)	Volume (cf)	Additional Disposal?	Density	Time	Number	Unit	Gallon	Total Quantity	Unit	Cost
	Leach Circuit																						
1	Acid Storage Tank 1	Not Applicable	Steel	30x55 (Cylinder)		$0.39	$0.39	CF			55	30	707	38,877	Nuetralize			1	Each	290,822	38,877	CF	$15,162
2	Acid Storage Tank 1	Not Applicable	Steel	30x55 (Cylinder)		$0.39	$0.39	CF			55	30	707	38,877	Nuetralize			1	Each	290,822	38,877	CF	$15,162
3	Leach Tank 2	Not Applicable	Fiber Glass	Cylinder 26x24.4		$0.39	$0.39	CF			26	24.4	468	12,157	Nuetralize					90,944	12,157	CF	$4,741
4	Leach Tank 3	Not Applicable	Fiber Glass	Cylinder 26x24.4		$0.39	$0.39	CF			26	24.4	468	12,157	Nuetralize					90,944	12,157	CF	$4,741
5	Leach Tank 4	Not Applicable	Fiber Glass	Cylinder 26x24.4		$0.39	$0.39	CF			26	24.4	468	12,157	Nuetralize					90,944	12,157	CF	$4,741
6	Retaining Wall Demolition	Not Applicable	Concrete (Cy)	Barrier wall, grading down from 8'x0.5' to 2'x0.67'	02 41 13 90 0100	$16.20	$16.20	Ft	See Cell S97 >>>>>>					361							361	Ft	$5,848
	Retaining Wall Demolition	Not Applicable	Concrete (Cy)	Retaining wall 2'x1' around spill containment area	02 41 13 90 0100	$16.20	$16.20	Ft	289	1	2		289	578							289	Ft	$4,682
	All levels Concrete Footings and Foundations Demolition (12"x48" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	33' diameter x 2' thick min. concrete pad under each circuit tank	02 41 13 17 5400	$49.71	$49.71	CY			2	33	855	1,711				4	Count		253	CY	$12,598
	Cutting and folding of HDPE liner under leach circuit, drainage from SX, and under booster station.	Not Applicable	Liner	Estimates of leach circuit liner & removal rate assuming 2 Laborers		$47.45	$94.90	Hour	80	80			6,400					750	SY/Hour		0.9	Hour	$90
		Not Applicable	Liner	Estimates of SX drainage channel & removal rate assuming 2 Laborers		$47.45	$94.90	Hour	320	50			16,000					750	SY/Hour		2.4	Hour	$225
		Not Applicable	Liner	Estimates of booster station liner & removal rate assuming 2 Laborers		$47.45	$94.90	Hour	160	110			17,600					750	SY/Hour		2.6	Hour	$247
		Not Applicable	Other	Trackhoe (similar to CAT 325); Includes operator, rental, operation, plus 10%.	01 54 33 20 0200	$141.12	$141.12	Hours										7	Hours		7	Hours	$988
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Acid Storage Tanks and Leach Tanks Building Debris to Building Volume Conversion Factor Applied Volume Units are in CY				846								846	CY	$20,307
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip									14	CY			60	Trip	$838
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		423	Tons	$5,077
													0	0							#REF!	####	
	CCD Circuit																						
7	CCD 1	Not Applicable	Steel	9.75x92 (Cylinder) Tank Capacity (Gal) >250k <1M Removal Cost $18,150		$0.36	$0.36	CF			9.75	92	6,648	64,814	Nuetralize			1	Count	484,844	64,814	CF	$23,333
8	CCD 2	Not Applicable	Steel	9.75x68 (Cylinder) Tank Capacity (Gal) >250k <1M Removal Cost $18,150		$0.36	$0.36	CF			9.75	68	3,632	35,409	Nuetralize			1	Count	264,877	35,409	CF	$12,747
9	CCD 3	Not Applicable	Steel	9.75x68 (Cylinder) Tank Capacity (Gal) >250k <1M Removal Cost $18,150		$0.36	$0.36	CF			9.75	68	3,632	35,409	Nuetralize			1	Count	264,877	35,409	CF	$12,747
10	CCD 4	Not Applicable	Steel	9.75x68 (Cylinder) Tank Capacity (Gal) >250k <1M Removal Cost $18,150		$0.36	$0.36	CF			9.75	68	3,632	35,409	Nuetralize			1	Count	264,877	35,409	CF	$12,747
11	CCD Control Building (PNT 4)	Not Applicable	Other	(60x24x13.5) Demob		$8,000	$8,000	Each	60	24	13.5		1,440	19,440							1	Each	$8,000
	Cutting and folding of HDPE liner	Not Applicable	Liner	Liner removal under CCD Circuit assuming 2 Laborers		$47.450	$94.90	Hour	380	140			53,200					750	SY/Hour		8	Hour	$748

Reference Photo for Leach, SX, and EW Facilities



N/A	under leach circuit, drainage from SX, and under booster station.	Not Applicable	Other	Trackhoe (similar to CAT 325); Includes operator, rental, operation, plus 10%.	01 54 33 20 0200	$141.12	$141.12	Hour												8	Hours		8	Hour	$1,129
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of CCD 1-4 & CCD Control Building Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY						1,411								1,411	CY	$33,863
	Load Building debris 36 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip											14	CY		101	Trip	$1,397
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons									1000			Lbs		705	Tons	$8,466
		Not Applicable				FALSE	FALSE	CY					0	0								0	CY	$0
	SX Circuit and Containment																							
12	SX Feed Tank	Not Applicable	Fiber Glass	12x10 (Cylinder)		$0.390	$0.390	CF			12	10	79	942	Clean Harbor					7,050	942	CF	$368
13	E1 Settler	Not Applicable	Fiber Glass	23.1x45.13x3.67		$0.390	$0.390	CF	23.1	45.13	3.67		1,043	3,826	Clean Harbor					28,620	3,826	CF	$1,492
14	E2 Settler	Not Applicable	Fiber Glass	23.1x45.13x3.67		$0.390	$0.390	CF	23.1	45.13	3.67		1,043	3,826	Clean Harbor					28,620	3,826	CF	$1,492
15	S1 Settler	Not Applicable	Fiber Glass	23.1x45.13x3.67		$0.390	$0.390	CF	23.1	45.13	3.67		1,043	3,826	Clean Harbor					28,620	3,826	CF	$1,492
16	W1 Settler	Not Applicable	Fiber Glass	23.1x45.13x3.67		$0.390	$0.390	CF	23.1	45.13	3.67		1,043	3,826	Clean Harbor					28,620	3,826	CF	$1,492
17	E1 Primary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
	E1 Secondary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
18	E2 Primary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
	E2 Secondary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
19	W Primary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
	W Secondary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
20	S1 Primary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
	S2 Secondary Mix Tank	Not Applicable	Fiber Glass	7x9.75 (Cylinder)		$0.390	$0.390	CF			7	9.75	75	523	Clean Harbor					3,910	523	CF	$204
21	Wash Water Tank	Not Applicable	Fiber Glass	4x4.67 (Cylinder)		$0.390	$0.390	CF			4	4.67	17	69	Clean Harbor					513	69	CF	$27
22	Organic Treatment Tank	Not Applicable	Fiber Glass	8.58x7.5 (Cylinder)		$0.390	$0.390	CF			8.58	7.5	44	379	Clean Harbor					2,836	379	CF	$148
23	Clay Mixing Tank	Not Applicable	Fiber Glass	5.83x5.0 (Cylinder)		$0.390	$0.390	CF			5.83	5	20	114	Clean Harbor					856	114	CF	$45
		Not Applicable				FALSE	FALSE	CY					0	0								0	CY	$0
N/A	Floor Demolition using trackhoes, loaders, etc	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.10	$8.10	SY	159	90	0.5		14,310	7,155								1,590	SY	$12,879
	Concrete Footings and Foundations Demolition (12"x48" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	3'x0.5' concrete wall running on all sides except reagent offload side	02 41 13 17 5400	$49.71	$49.71	CY	497	0.5	3.5		249	870								32	CY	$1,601
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of SX Facility Tanks Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY						155								155	CY	$3,731
	Load Building debris 36 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip											14	CY		11	Trip	$154
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons									1000			Lbs		78	Tons	$933
		Not Applicable				FALSE	FALSE	CY					0	0								0	CY	$0
	Tank Farm & Containment																							
24	Fuel Oil Tank	Not Applicable	Steel	32x8 (Cylinder)		$0.360	$0.360	CF	32.0			8.0	50	1,608	Clean Harbor					12,032	1,608	CF	$579
25	Diluent Tank	Not Applicable	Steel	32x8 (Cylinder)		$0.360	$0.360	CF	32.0			8.0	50	1,608	Clean Harbor					12,032	1,608	CF	$579
26	Loaded Organic Tank	Not Applicable	Fiber Glass	14.0x21.5 (Cylinder)		$0.39	$0.390	CF			14.0	21.5	363	5,083	Clean Harbor					38,021	5,083	CF	$1,982
27	Rich Electrolyte Tank	Not Applicable	Steel	14.0x20.5 (Cylinder)		$0.360	$0.360	CF			14.0	20.5	330	4,621	Clean Harbor					34,567	4,621	CF	$1,664
28	Electrolyte Recirc Tank	Not Applicable	Steel	12.0x27.0 (Cylinder)		$0.360	$0.360	CF			12.0	27.0	573	6,871	Clean Harbor					51,396	6,871	CF	$2,473
29	Crud Holding Tank	Not Applicable	Fiber Glass	14.0x22.2 (Cylinder)		$0.390	$0.390	CF			14.0	22.2	386	5,404	Clean Harbor					40,428	5,404	CF	$2,108
30	Filtered Electrolyte Tank	Not Applicable	Steel	16.0x13.4 (Cylinder)		$0.360	$0.360	CF			16.0	13.4	141	2,248	Clean Harbor					16,816	2,248	CF	$809
31	Filtered Backwash Tank	Not Applicable	Steel	12.0x15.5 (Cylinder)		$0.360	$0.360	CF			12.0	15.5	189	2,264	Clean Harbor					16,938	2,264	CF	$815
		Not Applicable				FALSE	FALSE	CF					0	0								0	CF	$0
N/A	Floor Demolition using trackhoes, loaders, etc	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.10	$8.10	SY	312	90	0.5		28,080	14,040								3,120	SY	$25,272
	Retaining Wall Demolition	Not Applicable	Concrete (Cy)	1'x0.5' wall running the length of the Tank farm	02 41 13 90 0100	$16.20	$16.20	Ft	804	0.5	1		402	402								402	Ft	$6,512
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Tank Farm and Containment Tanks Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY						220								220	CY	$5,281
	Load Building debris 36 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip											14	CY		16	Trip	$218
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons									1000			Lbs		110	Tons	$1,320
		Not Applicable				FALSE	FALSE	CF					0	0								0	CF	$0
		Not Applicable				FALSE	FALSE	CF					0	0								0	CF	$0
	Boiler Building and Equipment																							
32	Boiler Building	No	Steel	Structure Demolition, Large Projects, Steel	02 41 16 13 0020	$0.36	$0.18	CF	100	100	30		10,000	300,000								300,000	CF	$54,000
	Floor Demolition using trackhoes, loaders, etc Assumes Concrete is Buried on Site as Per NOI	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.10	$8.10	SY	100	100	0.5		10,000	5,000								1,111	SY	$9,000
33	Boiler Building Storage	No	Steel	Structure Demolition, Large Projects, Steel	02 41 16 13 0020	$0.36	$0.18	CF	25	25	18		625	11,250								11,250	CF	$2,025
	Floor Demolition using trackhoes, loaders, etc Assumes Concrete is Buried on	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.10	$8.10	SY	25	25	0.5		625	313								69	SY	$563
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Boiler Building and Boiler Biulding Storage Building Debris to Building Volume Conversion Factor Applied Volume Units are in CY						2,343								2,343	CY	$56,222
	Load Building debris 36 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip											14	CY		167	Trip	$2,319
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons									1000			Lbs		1,171	Tons	$14,056
	Cornstarch Mix Tank	Not Applicable	Mixed Material	6.46x5.3 (Cylinder)		$0.39	$0.39	CF			6.46	5.3	22	143	Drain				1	Each	1,066	143	CF	$56
	Cornstarch Holding Tank	Not Applicable	Mixed Material	6.46x5.3 (Cylinder)		$0.39	$0.39	CF			6.46	5.3	22	143	Drain				1	Each	1,066	143	CF	$56



Date Flown 1-14-2019

32	OTG Filters	Not Applicable	Fiber Glass	12x10.5 (Cylinder)		$0.39	$0.39	CF			12	10.5	87	1,039	Clean Harbor			2	Count	15,546	2,078	CF	$810
	RO Tank	Not Applicable	Mixed Material	13.33x11.74 (Cylinder)		$0.39	$0.39	CF			13.33	11.74	108	1,443	Drain			1	Each	10,794	1,443	CF	$563
	RO Reject Tank	Not Applicable	Mixed Material	8.9x7.92 (Cylinder)		$0.39	$0.39	CF			8.9	7.92	49	438	Clean Harbor			1	Each	3,280	438	CF	$171
	Boilers 1&2	Not Applicable	Steel	16x8 (Cylinder)		$0.36	$0.36	CF	16			8	50	804	Drain			2	Each	12,032	1,608	CF	$579
N/A	Load of Non Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Boiler Building Tanks and Equipment Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				30							30	CY		$713
	Load Non Building debris 36 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		2	Trip	$29
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		15	Tons	$178
	PLS, Raffinate, and Maintenance Ponds																							
34	Pond suction pipe	Not Applicable	Other	14"diameter standard weight 316 SS pipe	02 41 13 40 0120	$3.97	$3.97	Ft	7											7	Ft	$28
	Leak detection pipe	Not Applicable	Other	6"diameter HDPE SDR-17 pipe	02 41 13 38 1700	$3.93	$3.93	Ft	55											55	Ft	$216
	Cutting and folding of HDPE liner for PLS and Raffinate Ponds	Not Applicable	Liner	Estimates of leach circuit liner & removal rate assuming 2 Laborers		$47.45	$94.90	Hour	240	110			26,400					750	SY/Hour		3.9	Hour	$371
		Not Applicable	Liner	Estimates of leach circuit liner & removal rate assuming 2 Laborers		$47.45	$94.90	Hour	320	250			80,000					750	SY/Hour		11.9	Hour	$1,125
		Not Applicable	Liner	Estimates of leach circuit liner & removal rate assuming 2 Laborers		$47.45	$94.90	Hour	320	250			80,000					750	SY/Hour		11.9	Hour	$1,125
		Not Applicable	Other	Trackhoe (similar to CAT 325); Includes operator, rental, operation,	01 54 33 20 0200	$141.12	$141.12	Hours										27.6	Hours		28	Hours	$3,897
	Electrowinning Facility																							
35	EW Building (Addition)	No	Steel	Structure Demolition, Large Projects, Steel	02 41 16 13 0020	$0.360	$0.180	CF	216	44	11.75		9,504	111,672						111,672	CF	$20,101
	Floor Demolition Assumes Concrete is Buried on Site as Per NOI	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 8" thick	02 41 13 17 5400	$8.100	$8.100	CY	90	45	0.67		4,050	2,714						101	CY	$814
	Cutting and folding of HDPE liner under EW	Not Applicable	Liner	Estimates of EW liner & removal rate assuming 2 Laborers		$47.45	$94.90	Hour	140	45			6,300					750	SY/Hour		0.9	Hour	$89
		Not Applicable	Other	Trackhoe (similar to CAT 325); Includes operator, rental, operation,	01 54 33 20 0200	$141.12	$141.12	Hours										7	Hours		7	Hours	$988
	EW Cells	Not Applicable	Fiber Glass	4.25x13.42x5 Expoxy Concrete Similar to Fiberglass		$0.390	$0.390	CF	4.25	13.42	5		57	15,399				54	Count		15,399	CF	$6,006
	Cathode Wash Tank	Not Applicable	Steel	4.5x13x5		$0.360	$0.360	CF	4.5	13	5		59	293							293	CF	$105
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of EW Facility Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				847							847	CY	$20,335
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		61	Trip	$839
	Milford Landfill fee	Not Applicable	Other	Assumes SWCE's waste material conversion factor of 2600 lb debris /	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		424	Tons	$5,084
N/A	Load of Non Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of EW Cells and Cathode Wash Tank Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				116							116	CY	$2,790
	Load Non Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Round Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		8	Trip	$115
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		58	Tons	$697
													0	0										
	Mine Facilities - Including Truck Shop																						**$211,710**	
	Truck Shop																							
1	Truck Shop Steel Building (120'x60'x40'H)	No	Steel	120'x60'x40'	02 41 16 13 0020	$0.360	$0.180	CF	120	60	40		7,200	288,000						288,000	CF	$51,840
	Floor Demolition using trackhoes, loaders, etc (Concrete to be buried as per NOI)	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.100	$8.100	SY	120	60	40		7,200	288,000						800	SY	$6,480
	Footings and Foundations Demolition (8"x48" foundation wall over 12"x24" footing typical) (Concrete to be buried as per NOI)	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	02 41 13 17 5400	$49.710	$49.710	CY	360	4.67	1		1,681	1,681						62	CY	$3,095
2	Truck Shop Warehouse (Name Update)	Not Applicable	Wood & Masonary	60x20x10	02 41 16 13 0700	$0.390	$0.390	CF	60	20	10		1,200	12,000						12,000	CF	$4,680
3	Truck Shop Transformer	Not Applicable	Other	3 Phase 1000kVA	26 12 19 10 0500		$41,100	Each												41,100	Each	$41,100
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Truckshop & Truckshop Warehouse Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				2,222							2,222	CY	$53,333
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		159	Trip	$2,200
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		1,111	Tons	$13,333
4	Truck Shop Fuel Tanks	Not Applicable	Steel	25x8 (Cylinder)		$0.360	$0.360	CF	25			8	50	1,257	Clean Harbor			2	Count	18,801	2,513	CF	$905
5	Truck Shop Fuel Tanks	Not Applicable	Steel	20x8 (Cylinder)		$0.360	$0.360	CF	20			8	50	1,005	Clean Harbor			2	Count	15,040	2,011	CF	$724
6	Truck Shop Boneyard	Not Applicable	Mixed Material	TS Boneyard Area - 23,465sf TS Boneyard Volume - 7,191cf (Aerial Survey)		$0.390	$0.390	CF					23,465	7,191						7,191	CF	$2,804
7	Truck Shop Water Tank (Addition)	Not Applicable	Steel	42x15 (Cylinder)		$0.360	$0.360	CF			15	42	1,385	20,782	Drain					155,457	20,782	CF	$7,481
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Truck Shop Fuel Depot & Boneyard Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				224							224	CY	$5,375
	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Round Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		16	Trip	$222
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		112	Tons	$1,344
						FALSE	FALSE	CY													0	CY	$0
	PNT 1 & 2 and Guard Shack																							
8	Portable Non Trailer (PNT) 1	Yes	Other	66x25x15 Demob		$8,000	$8,000	Each	66	25	15		1,650	24,750						1	Each	$8,000
N/A	Portable Non Trailer (PNT) 2	Yes	Other	40x23x14 Demob		$8,000	$8,000	Each	40	23	14		920	12,880						1	Each	$8,000
9	Guard Shack	Yes	Mixed Material	66x25x15	02 41 16 13 0100	$0.390	$0.390	CF	20	8	8		160	1,280						1,280	CF	$499
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Guard Shack Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				9							9	CY	$228
	Load Building debris 36 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 36 Mile Round Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		1	Trip	$9

Reference Photo for Mine, Guard Shack and Truck Shop



	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		5	Tons	$57
						FALSE	FALSE	CY													0	CY	$0
						FALSE	FALSE	CY													0	CY	$0
						FALSE	FALSE	CY													0	CY	$0
						FALSE	FALSE	CY													0	CY	$0
Lab Facilities																														**$74,632**
Lab Building including Addition																														
1	Wood Frame Building (50'x20'x9'H)	Yes	Wood & Masonary	Structure Demolotion, Wood Framing	02 41 16 13 0700	$0.390	$0.390	CF	50	20	9		1,000	9,000							9,000	CF	$3,510
	Floor Demolition using trackhoes, loaders, etc	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.100	$8.100	SY	50	20	1		1,000	1,000							111	SY	$900
	Footings and Foundations Demolition (8"x24" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	02 41 13 17 5400	$49.710	$49.710	CY	50	20	1		1,000	1,000							37	CY	$1,841
	Wood Frame Building (120'x30'x14'H)	Yes	Wood & Masonary	Structure Demolotion, Wood Framing	02 41 16 13 0700	$0.390	$0.390	CF	120	30	14		3,600	50,400							50,400	CF	$19,656
	Floor Demolition using trackhoes, loaders, etc	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.100	$8.100	SY	120	30	1		3,600	3,600							400	SY	$3,240
	Concrete Footings and Foundations Demolition (8"x48" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	02 41 13 17 5400	$49.710	$49.710	CY	120	30	1		3,600	3,600							133	CY	$6,628
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Lab Building & Lab Addition Building Debris to Building Volume Conversion Factor Applied Volume Units are in CY					440							440	CY	$10,560
N/A	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Round Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		31	Trip	$436
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		220	Tons	$2,640
Lab Boneyard and Storage Area's																														
2	Lab Boneyard and Storage Area's	Not Applicable	Mixed Material	LB Boneyard Area - 27448.9sf LB Boneyard Volume - 40,709.36cf (Aerial Survey)		$0.390	$0.390	CF					27,449	40,709							40,709	CF	$15,877
N/A	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Lab Boneyard & Storage Areas Building Debris to Building Volume Conversion Factor Applied Volume Units are in CY					302							302	CY	$7,237
N/A	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Trip	02 41 16 13 5100	$0.77	$13.86	Trip										14	CY		22	Trip	$299
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		151	Tons	$1,809
																					0		$0
																					0		$0
																					0		$0
																					0		$0
																					0		$0
																					0		$0
																					0		$0
Water Line, Wells, Power Lines, Storage Container (Totes, 55 Gallon Drum, Ect)																														**$333,436**
Water and Monitoring Wells																														
	Water Well Reclamation - Mobilization	Not Applicable	Other	OGM Reference to Exploration and Small Mining Activities - 2012 Cost Estimate for Wells from 800' to 1600' Deep.		$10,000	$10,000	Each										1	Count		1	Each	$10,000
	Concrete Caps at Water Well #3, #6, and Caps at 6 Monitor Wells (As per NOI WW#3 North Well will be Left for Post Mining Benificial Use)	Not Applicable	Other	OGM Reference - 2012 Cost per Hole for Concrete Capping		$210	$210	Each										7	Count		7	Each	$1,470
	Water Well # 3 - Cost for Hole Reclamation of 680' Well (As per NOI WW#3 North Well will be Left for Post Mining Benificial Use)	Not Applicable	Other	OGM Reference - 2012 Cost per Foot for holes less than 800' Deep.		$4.25	$4.25	Ft										680	Ft		Not Included	Ft	Not Included
	Water Well # 6 - Cost for Hole Reclamation of 580' Well	Not Applicable	Other	OGM Reference - 2012 Cost per Foot for holes less than 800' Deep.		$4.25	$4.25	Ft										580	Ft		580	Ft	$2,465
	Truck Shop Well - Cost for Hole Reclamation of 835' Well	Not Applicable	Other	OGM Reference - 2012 Cost per Foot for holes less than 800' Deep.		$4.25	$4.25	Ft										835	Ft		835	Ft	$3,549
	ITDF monitor Wells (Two wells approximately 500' in depth)	Not Applicable	Other	OGM Reference - 2012 Cost per Foot for holes less than 800' Deep.		$4.25	$4.25	Ft										800	Ft		800	Ft	$3,400
	Water monitor Wells (Four wells approximately 200' in depth)	Not Applicable	Other	OGM Reference - 2012 Cost per Foot for holes less than 800' Deep.		$4.25	$4.25	Ft										800	Ft		800	Ft	$3,400
ITDF Liner																														
	Cutting and folding of HDPE around ITDF	Not Applicable	Liner	Estimates of Liner Folding rate assuming 2 Laborers		$47.45	$94.90	Hour	6,411	10			64,113					750	SY/Hour		9.5	Hour	$901
		Not Applicable	Other	Trackhoe (similar to CAT 325); Includes operator, rental, operation, plus 10%.	01 54 33 20 0200	$141.12	$141.12	Hours										9.5	Hours		10	Hours	$1,341
Floatation Tails Pond Liner																														
	Cutting and folding of HDPE around FTP	Not Applicable	Liner	Estimates of Liner Folding rate assuming 2 Laborers		$47.45	$94.90	Hour	4,021	10			40,210					750	SY/Hour		6.0	Hour	$565
		Not Applicable	Other	Trackhoe (similar to CAT 325); Includes operator, rental, operation, plus 10%.	01 54 33 20 0200	$141.12	$141.12	Hours										8	Hours		8	Hours	$1,129
ITDF Pipeline and Decant Line																														
	Pipeline Removal	Not Applicable	Other	8" diameter HDPE pipe, above-ground	02 41 13 38 1700	$3.93	$3.93	Ft	3,100												3,100	Ft	$12,183
						FALSE	FALSE	CY													0	CY	$0
						FALSE	FALSE	CY													0	CY	$0
East ITDF & Flotation Tails Pond Fence																														
	Fence Removal - FTP	Not Applicable	Other	Fencing 3 Strand	02 41 13 60 1600	$2.31	$2.31	Ft	4,464												4,464	Ft	$10,312
	Fence Removal - East ITDF	Not Applicable	Other	Steel Chain Link 5' high	02 41 13 62 0600	$2.21	$2.21	Ft	8,605												8,605	Ft	$19,017
						FALSE	FALSE	CY													0	CY	$0
Disposal of Solvents, waste chemicals & fuels																														
	Removal of 50 % of chemicals stored on site in tanks, totes or drums thru Clean Harbors	Not Applicable	Other	Liquid pickup, vacuum truck, stainless steel tank 2 compartment, 6900 gallon bulk truck, 256 mile trip, $5 per mile. Containers are assumed at 50% fill $12 Disposal Fee Included		$1,340	$1,340	Trip										239,170	Gallons		35	Trip	$46,448
	Disposal of solvents at Clean Harbors	Not Applicable	Other	Assumes Subtitle C, solidification & disposal		$137.50	$137.50	Tons	Weight of material (lbs) using an assumed density of 62.4lbs/cf				1,995,080					998	Tons		998	Tons	$137,162
						FALSE	FALSE	CY													0	CY	$0
Power Pole Removal																														
	Demo of utility poles	Not Applicable	Other	Wood, 20-30' tall, spaced 415 ft, 30,000ft from Truck Shop area to Phase 2 area.	02 41 13 80 0100	$320	$320	Each	30,000									415	Ft		72	Each	$23,133
	Demo of cross arms	Not Applicable	Other	Wood, 4'-6' long	02 41 13 80 0300	$143	$143	Each										72	Count		72	Each	$10,337
Septic Tank and Drain Fields																														
	Septic Tank and related components Demolition	Not Applicable	Other	Precast 25,000 gal. 4 piece 5 On Site Located at PNT 1, 2, & 3 and at the MCC and Lab	02 41 13 44 0800	$6,075	$6,075	Each										5	Count		5	Each	$30,375
																							0	$0
Pump Houses & Booster Station																														



Date Flown 1-14-2019

Refercence Photo for Lab Facilities



Date Flown 1-10-2019

	Block Building - (12'x14'x9'H)	Not Applicable	Wood & Masonary	Structure Demolotion, Masonry	02 41 16 13 0080	$0.390	$0.390	CF	12	14	9		168	1,512							1,512	CF	$590
	Floor Demolition using trackhoes, loaders, etc	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.100	$8.100	SY	12	14	1		168	168							19	SY	$151
	Footings and Foundations Demolition (8"x24" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	02 41 13 17 5400	$49.710	$49.710	CY	12	14	0.5		168	84							3	CY	$155
	Booster Station	Not Applicable	Steel	Steel Demolition	02 41 16 13 0020	$0.360	$0.360	CF	65	13	18		845	15,210							15,210	CF	$5,476
	Floor Demolition using trackhoes, loaders, etc	Not Applicable	Concrete (Sy)	Building Demolition Concrete to 6" thick	02 41 13 17 5200	$8.100	$8.100	SY	12	14	1		168	168							19	SY	$151
	Footings and Foundations Demolition (8"x24" foundation wall over 12"x24" footing typical)	Not Applicable	Concrete (Cy)	Building Demolition Concrete 7" to 24" thick	02 41 13 17 5400	$49.710	$49.710	CY	12	14	0.5		168	84							3	CY	$155
	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Pump House and Booster Station Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				124								124	CY	$2,973
N/A	Load Building debris 18 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 18 Mile Round Trip	02 41 16 13 5100	$0.77	$13.86	Trip									14	CY			9	Trip	$123
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		62	Tons	$743
	Container Disposal (Drums, Totes, ect)																									
N/A	260 gal totes	Not Applicable	Mixed Material	Count includes all facilities		$0.390	$0.390	CF	3.3	4	3.8		13	8,689	Clean Harbor			170	Count	44,198	8,689	CF	$3,389
N/A	55 gal drums	Not Applicable	Steel	Count includes all facilities		$0.360	$0.360	CF			2.79	1.88	6	459	Clean Harbor			40	Count	2,232	459	CF	$179
	Load of Building debris	Not Applicable	Other	Mixture of Types. Assumes backhoe loader/operator, truck/operator, and 2 laborers.	02 41 19 19 3080	$24.00	$24.00	CY	Load and Disposal of Empty Containers Building Debris to Building Volume Converstion Factor Applied Volume Units are in CY				68								68	CY	$1,626
N/A	Load Building debris 36 miles to Milford	Not Applicable	Other	Costs are based on $0.79/cy/mile Truck volume assumption 14cy 36 Mile Round Trip	02 41 16 13 5100	$0.77	$27.72	Trip									14	CY			5	Trip	$134
	Milford Landfill fee	Not Applicable	Other	Uses debris conversion factor for C&D Ferrous Metal Disposal	Based on 7/16/2019 Quote	$12.00	$12.00	Tons								1000			Lbs		34	Tons	$407

Pit with no Fill Template

Areas	Berms
Full Acreage (acre)	
Dump Flat (acre)	
Road Acreage (acre)	
Ripping	**Signs**
Rip Depth (ft)	
Rip Volume (LCY)	
Topsoil	
Topsoil Depth (ft)	
Topsoil Volume (LCY)	
Seed	
Seed Unit Cost	
Reseed cost	
Total Seed Cost	

	NOI Reclimation Steps
1	Access roads, ramps, and pit surfaces ripped to 24inch
2	Top Soil placement on ramps and bench
3	Seeding with Seed Mix
4	Safety Berm Placement or Repair around pit
5	Safety signs placed every 150ft around pit edge
6	
7	
8	
9	
10	

	Contractor
1	$0.00
2	$0.00
3	$0.00
4	$0.00
5	$0.00
6	$0.00
7	$0.00
8	$0.00
9	$0.00
10	$0.00
Total	$0.00

Aerial Photo SITLA Ore Stockpile: Flight Date 13/13/2018

Costing Breakdown

1	Access roads, ramps, and pit surfaces ripped to 24inch			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Rip with dozer	316	0.00		$0.00
2	Top Soil placement on ramps and bench			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	0.00		$0.00
	Haul Topsoil	599	0.00		$0.00
3	Seeding with Seed Mix			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.00		$0.00
	Reseed	599	0.00		$0.00
4	Safety Berm Placement or Repair around pit			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Place Berm	316	0.00		$0.00
5	Safety signs placed every 150ft around pit edge			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Place Safety Signs	316	0.00		$0.00
6	0			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Action 1	316	0.00		$0.00
	Action 2	599			$0.00
7	0			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Action 1	316	0.00		$0.00
	Action 2	599	0.00		$0.00
8	0			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Action 1	316	0.00		$0.00
	Action 2	599	0.00		$0.00
9	0			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Action 1	316	0.00		$0.00
	Action 2	599	0.00		$0.00
10	0			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Action 1	316	0.00		$0.00
	Action 2	599	0.00		$0.00

Bawana Pit

Areas	
Full Acreage (acre)	18
Ripping	
Rip Depth (ft)	2
Assumed area (Includes ARSA)	30%
Rip Volume (BCY)	17,405
Topsoil	
Topsoil Depth (ft)	0.5
Topsoil Volume (LCY)	4,351
55ft 3-ft Berms (LCY)	500
Linear Feet	450
Spacing	150
signs	3

	NOI Reclimation Steps
1	Access roads, ramps, and pit surfaces ripped to 24inch
2	Top Soil placement on ramps and bench
3	Seeding with Seed Mix
4	Safety Berm Placement or Repair around pit
5	Safety signs placed every 150ft around pit edge
6	
7	
8	
9	
10	

	Contractor
1	$3,399
2	$6,034
3	$4,703
4	$107
5	$150
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$14,393

Aerial Photo Bawana Pit - Flight Date: 12-13-2018



Costing Breakdown

1 Access roads, ramps, and pit surfaces ripped to 24inch

	Rate	Hours	Contract Cost/BCY	Contract Cost
Rip with dozer	2573	6.76	$0.20	$3,399.00

2 Top Soil placement on ramps and bench

	Rate	Hours	Contract Cost/LCY	Contract Cost
Load Topsoil	1521.877	2.86	$0.21	$931.90
Haul Topsoil	1522		$0.84	$3,666.68
Push Topsoil	1524		$0.33	$1,435.05

3 Seeding with Seed Mix

	Rate	Hours	Seed Cost/acre	Seed Cost
Seed	2.2	8.17	$111.36	$2,002.20
Reseed			$111.36	$1,001.10
50% Ripping				$1,699.50

4 Safety Berm Placement or Repair around pit

	Rate	Hours	Contract Cost/LCY	Contract Cost
Place Berm	316	1.58	$0.21	$107.09

5 Safety signs placed every 150ft around pit edge

	Rate	Hours	Contract Cost/LF	Contract Cost
Place Safety Signs	3	1.00	$50.00	$150.00

Maria Pit

Areas	
Full Acreage (acre)	22
Ripping	
Rip Depth (ft)	2
Assumed area (Includes ARSA)	30%
Rip Volume (BCY)	21,335
Topsoil	
Topsoil Depth (ft)	0.5
Topsoil Volume (LCY)	5,334
55ft 3-ft Berms (LCY)	500.0
Linear Feet	450.0
Spacing	150
signs	3

	NOI Reclimation Steps
1	Access roads, ramps, and pit surfaces ripped to 24inch
2	Top Soil placement on ramps and bench
3	Seeding with Seed Mix
4	Safety Berm Placement or Repair around pit
5	Safety signs placed every 150ft around pit edge
6	
7	
8	
9	
10	

	Contractor
1	$4,167
2	$7,396
3	$5,765
4	$107
5	$150
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$17,584

Aerial Photo Maria Pit - Flight Date 12-13-2018



Costing Breakdown

1 Access roads, ramps, and pit surfaces ripped to 24inch

	Rate	Hours	Contract Cost/BCY	Contract Cost
Rip with dozer	2573	8.29	$0.20	$4,166.52

2 Top Soil placement on ramps and bench

	Rate	Hours	Contract Cost/LCY	Contract Cost
Load Topsoil	316	0.01	$0.21	$1,142.33
Haul Topsoil	599	0.25	$0.84	$4,494.64
Push Topsoil			$0.33	$1,759.09

3 Seeding with Seed Mix

	Rate	Hours	Contract Cost/acre	Contract Cost
Seed	316	0.00	$111.36	$2,454.31
Reseed	599	0.00	$111.36	$1,227.16
50% Ripping				$2,083.26

4 Safety Berm Placement or Repair around pit

	Rate	Hours	Contract Cost/LCY	Contract Cost
Place Berm	316	0.00	$0.21	$107.09

5 Safety signs placed every 150ft around pit edge

	Rate	Hours	Contract Cost/LF	Contract Cost
Place Safety Signs	316	0.00	$50.00	$150.00

Copper Ranch Pit

Areas	
Full Acreage (acre)	18.34
Ripping	
Rip Depth (ft)	2
Assumed area (Includes ARSA)	30%
Rip Volume (BCY)	17,753
Topsoil	
Topsoil Depth (ft)	0.5
Topsoil Volume (LCY)	4,438
55ft of 3-ft Berms (LCY)	500.0
Linear Feet	450.0
Spacing	150
signs	3

	NOI Reclimation Steps
1	Access roads, ramps, and pit surfaces ripped to 24inch
2	Top Soil placement on ramps and bench
3	Seeding with Seed Mix
4	Safety Berm Placement or Repair around pit
5	Safety signs placed every 150ft around pit edge
6	
7	
8	
9	
10	

Aerial Photo Copper Ranch Pit - Flight Date 6-19-2019



	Contractor
1	$3,467
2	$6,154
3	$4,797
4	$166
5	$150
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$14,735

Costing Breakdown

1 Access roads, ramps, and pit surfaces ripped to 24inch

	Rate	Hours	Contract Cost/BCY	Contract Cost
Rip with Dozer	2573	6.90	$0.20	$3,467.06

2 Top Soil placement on ramps and bench

	Rate	Hours	Contract Cost/hr	Contract Cost
Load Topsoil	316	0.01	$0.21	$950.56
Haul Topsoil	599	0.25	$0.84	$3,740.10
Push Topsoil			$0.33	$1,463.78

3 Seeding with Seed Mix

	Rate	Hours	Contract Cost/hr	Contract Cost
Seed	316	0.00	$111.36	$2,042.29
Reseed	599	0.00	$111.36	$1,021.15
50% Ripping				$1,733.53

4 Safety Berm Placement or Repair around pit

	Rate	Hours	Contract Cost/hr	Contract Cost
Place Berm	316	0.00	$0.33	$166.13

5 Safety signs placed every 150ft around pit edge

	Rate	Hours	Contract Cost/hr	Contract Cost
Place Safety Signs	316	0.00	$50.00	$150.00

Volumes	Areas
A - Original height	Full Acreage
A - Original width	Dump Flat
A - Stable height	Road Acreage
A - Stable width	
A - Fill Volume Difference	
A - Cycle dist	Rip Depth
	Rip Volume
B - Original height	
B - Original width	Topsoil Depth
B - Stable height	Topsoil Volume
B - Stable width	
B - Fill Volume Difference	
B - Cycle dist	Seed
	Seed Unit Cost
C - Original height	Reseed cost
C - Original width	Total Seed Cost
C - Stable height	
C - Stable width	**Berms**
C - Fill Volume Difference	
C - Cycle Dist	
D - Original height	**Signs**
D - Original width	
D - Stable height	
D - Stable width	
D - Fill Volume Difference	
D - Cycle Dist	
E - Original height	
E - Original width	
E - Stable height	
E - Stable width	
E - Fill Volume Difference	
E - Cycle Dist	

Costing Breakdown

1a	A back filled slope must be less then 2.5 to 1		
		Rate	Hours
	Load	316	0.00
	Haul	599	0.00
1b	Back Filled required ripping to 24in		
		Rate	Hours

	Rip with dozer	316	0.00
		599	0.00
1c	back filled required 6in of top soil		
		Rate	Hours
	Load Topsoil	316	0.00
	Haul Topsoil	599	0.00
1d	top soiled back fills require seeding		
		Rate	Hours
	Seed	316	0.00
	Reseed	599	0.00
2	Access roads, ramps, and pit surfaces ripped to 24inch		
		Rate	Hours
	Rip with dozer	316	0.00
		599	0.00
3	Top Soil placement on ramps and bench		
		Rate	Hours
	Load Topsoil	316	0.00
	Haul Topsoil	599	0.00
4	Seeding with Seed Mix		
		Rate	Hours
	Seed	316	0.00
	Reseed	599	0.00
5	Safety Berm Placement or Repair around pit		
		Rate	Hours
	Place Berm	316	0.00
6	Safety signs placed every 150ft around pit edge		
		Rate	Hours
	Place Safety Signs	316	0.00
7		0	
		Rate	Hours
	Action 1	316	0.00
	Action 2	599	0.00

SITLA Ore Stockpile & Topsoil Pile

	NOI Reclimation Steps
1a	A back filled slope must be less then 2.5 to 1
1b	Back Filled required ripping to 24in
1c	back filled required 6in of top soil
1d	top soiled back fills require seeding
2	Access roads, ramps, and pit surfaces ripped to 24inch
3	Top Soil placement on ramps and bench
4	Seeding with Seed Mix
5	Safety Berm Placement or Repair around pit
6	Safety signs placed every 150ft around pit edge
7	

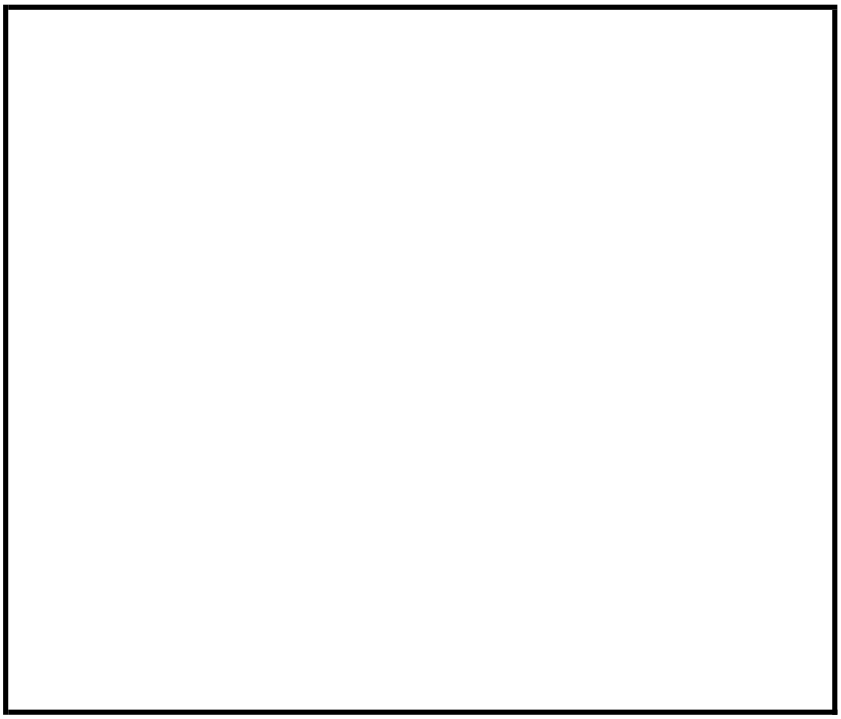
	Contractor
1a	$0.00
1b	$0.00
1c	$0.00
1d	$0.00
2	$0.00
3	$0.00
4	$0.00
5	$0.00
6	$0.00
7	$0.00
Total	$0.00

Contract Cost/hr	Contract Cost
	$0.00
	$0.00

Contract Cost/hr	Contract Cost

	$0.00
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
Contract Cost/hr	Contract Cost
	$0.00
	$0.00

Aerial Photo SITLA Ore Stockpile: Flight Date 13/13/2018



Sunrise Pit

Area	
Full Acreage (acre)	12.25
Ripping	
Rip Depth (ft)	2.0
Assumed area	30%
Rip Volume (BCY)	11,858
Top Soil	
Topsoil Depth(ft)	0.5
Topsoil Volume(LCY)	2965
55ft of 3-ft Berms (LCY)	500
Linear Feet	450.0
Spacing(ft)	150
signs	3
LCY/BCY	1.25

Regrade Volumes	
A - Original height (ft)	320
A - Original width	280
A - Stable height	320
A - Stable width	320
A - Slope Distance	425
A - Fill Volume Difference (CY)	125,926

	NOI Reclimation Steps
1	A back filled slope must be less then 2.5 to 1
2	Access roads, ramps, and pit surfaces ripped to 24inch
3	Top Soil placement on ramps and bench
4	Seeding with Seed Mix
5	Safety Berm Placement or Repair around pit
6	Safety signs placed every 150ft around pit edge
7	

	Contractor
1	$133,087
2	$2,316
3	$4,111
4	$2,046
5	$98
6	$150
7	$0
0	$0
0	$0
0	$0
Total	$141,807

Aerial Photo — Sunrise Pit - Flight Date 12-13-2018



Costing Breakdown

1	A back filled slope must be less then 2.5 to 1			Contract	Contract
		Rate	Hours	Cost/LCY	Cost
	Load	#REF!	#REF!	$0.21	$26,970.04
	Haul	#REF!	#REF!	$0.84	$106,116.59
2	Access roads, ramps, and pit surfaces ripped to 24inch			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	Rip with dozer	2573	4.61	$0.20	$2,315.78
3	Top Soil placement on ramps and bench			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316		$0.21	$634.92
	Haul Topsoil	599	4.95	$0.84	$2,498.16
	Push Topsoil			$0.33	$977.72
4	Seeding with Seed Mix			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316		$111.36	$1,364.13
	Reseed	599	0.00	$111.36	$682.06
	50% Ripping				$1,157.89
5	Safety Berm Placement or Repair around pit			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Place Berm	316	0.00	$0.20	$97.65
6	Safety signs placed every 150ft around pit edge			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Place Safety Signs	316	0.00	$50.00	$150.00

Sunrise Pit

Area	
Full Acreage (acre)	22.76
Ripping	
Rip Depth (ft)	2.0
Assumed area	30%
Rip Volume (BCY)	22,032
Top Soil	
Topsoil Depth(ft)	0.5
Topsoil Volume(LCY)	5508
55ft of 3-ft Berms (LCY)	500
Linear Feet	450.0
Spacing(ft)	150
signs	3
LCY/BCY	1.25

Regrade Volumes	
A - Original height (ft)	350
A - Original width	326
A - Stable height	350
A - Stable width	350
A - Slope Distance	478
A - Fill Volume Difference (CY)	92,944

	NOI Reclimation Steps
1	A back filled slope must be less then 2.5 to 1
2	Access roads, ramps, and pit surfaces ripped to 24inch
3	Top Soil placement on ramps and bench
4	Seeding with Seed Mix
5	Safety Berm Placement or Repair around pit
6	Safety signs placed every 150ft around pit edge
7	

	Contractor
1	$98,230
2	$4,303
3	$7,638
4	$5,953
5	$107
6	$150
7	$0
0	$0
0	$0
0	$0
Total	$116,380

Aerial Photo Hidden Treasure - Flight Date 12-13-2018



Costing Breakdown

1	A back filled slope must be less then 2.5 to 1			Contract	Contract
		Rate	Hours	Cost/LCY	Cost
	Load	#REF!	#REF!	$0.21	$19,906.27
	Haul	#REF!	#REF!	$0.84	$78,323.40
2	Access roads, ramps, and pit surfaces ripped to 24inch			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	Rip with dozer	2573	8.56	$0.20	$4,302.63
3	Top Soil placement on ramps and bench			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316		$0.21	$1,179.65
	Haul Topsoil	599	9.20	$0.84	$4,641.47
	Push Topsoil			$0.33	$1,816.56
4	Seeding with Seed Mix			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316		$111.36	$2,534.49
	Reseed	599	0.00	$111.36	$1,267.24
	50% Ripping				$2,151.32
5	Safety Berm Placement or Repair around pit			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Place Berm	316	0.00	$0.21	$107.09
6	Safety signs placed every 150ft around pit edge			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Place Safety Signs	316	0.00	$50.00	$150.00

Slopes	Areas
A - Original height	Full Acreage
A - Original width	Dump Flat
A - Stable height	Road Acreage
A - Stable width	
A - Fill Volume Difference	Ripping
A - Slope Dist	Rip Depth
	Rip Volume
B - Original height	
B - Original width	Topsoil Depth
B - Stable height	Topsoil Volume
B - Stable width	
B - Fill Volume Difference	
B - Slope Dist	
C - Original height	
C - Original width	Seed
C - Stable height	Seed Unit Cost
C - Stable width	Reseed cost
C - Fill Volume Difference	Total Seed Cost
C - Slope Dist	
D - Original height	
D - Original width	
D - Stable height	
D - Stable width	
D - Fill Volume Difference	
D - Slope Dist	
E - Original height	
E - Original width	
E - Stable height	
E - Stable width	
E - Fill Volume Difference	
E - Slope Dist	

Costing Breakdown

1	Dump Slopes steeper than 2.5:1 will be regraded to 2.5:1			Contract
		Rate	Hours	Cost/hr
	Action 1			
	Action 2			
	Action 3			
	Action 4	316	0.00	
	Action 5	599	0.00	

2	Ripping of dump slopes, surfaces, and road to 24in			Contract
		Rate	Hours	Cost/BCY
	Rip with dozer	2573	0.00	$0.20
3	Placement of 24in of fill on dump surfaces			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	
4	Placement of 6in of top soil on dump			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	
5	Seeding of dump area			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	
6	0			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	
7	0			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	
8	0			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	
9	0			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	
10	0			Contract
		Rate	Hours	Cost/hr
	Action 1	316	0.00	
	Action 2	599	0.00	

SITLA Ore Stockpile & Topsoil Pile

	NOI Reclimation Steps
1	Dump Slopes steeper than 2.5:1 will be regraded to 2.5:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 24in of fill on dump surfaces
4	Placement of 6in of top soil on dump
5	Seeding of dump area
6	
7	
8	
9	
10	

Aerial Phot

	Contractor
1	$0.00
2	$0.00
3	$0.00
4	$0.00
5	$0.00
6	$0.00
7	$0.00
8	$0.00
9	$0.00
10	$0.00
Total	$0.00

Contract Cost
$0.00
$0.00

Contract Cost
$0.00
Contract Cost
$0.00
$0.00
Contract Cost
$0.00
$0.00
Contract Cost
$0.00
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Contract Cost
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Contract Cost
$0.00
$0.00
Contract Cost
$0.00
$0.00
Contract Cost
$0.00
$0.00

:o SITLA Ore Stockpile: Flight Date 13/13/2018

Sunrise Dump

Areas		Slopes	
Dump Acreage (acre)	29	A1A2 - Original height (ft)	39.0
Topsoil Stockpile (acre)	2	A1A2 - Original width (ft)	53.0
Dump Surface (acre)	7	A1A2 - Stable height (ft)	39.0
		A1A2 - Stable width (ft)	78
Ripping		A1A2 - Slope Dist (ft)	66.0
Rip Depth (ft)	2	A1A2 - Fill Volume Difference (LCY)	1,490
Rip Volume (BCY)	93,380		
		A3A4 - Original height (ft)	72.0
Topsoil		A3A4 - Original width (ft)	107.0
Topsoil Depth	0.5	A3A4 - Stable height (ft)	72.0
Topsoil Volume	23,345	A3A4 - Stable width (ft)	144
		A3A4 - Slope Dist (ft)	129.0
Fill		A3A4 - Fill Volume Difference (LCY)	7,955
Fill height	2		
fill area	290,110	C7C8 - Original height (ft)	40.0
fill volume (CY)	21,490	C7C8 - Original width (ft)	66.0
		C7C8 - Stable height (ft)	40.0
LCY/BCY	1.25	C7C8 - Stable width (ft)	80
		C7C8 - Slope Dist (ft)	77.0
		C7C8 - Fill Volume Difference (LCY)	998
		C9C10 - Original height (ft)	15.0
		C9C10 - Original width (ft)	28.0
		C9C10 - Stable height (ft)	15.0
		C9C10 - Stable width (ft)	30
		C9C10 - Slope Dist (ft)	32.0
		C9C10 - Fill Volume Difference (LCY	22
		C11C12 - Original height (ft)	49.0
		C11C12 - Original width (ft)	88.0
		C11C12 - Stable height (ft)	49.0
		C11C12 - Stable width (ft)	98
		C11C12 - Slope Dist (ft)	101.0
		C11C12 - Fill Volume Difference (LC	1,146
		Total Fill (LCY)	11,611

	NOI Reclimation Steps
1	Dump Slopes steeper than 2:1 will be regraded to 2:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 24in of fill on dump surfaces
4	Placement of 6in of top soil on dump
5	Seeding of dump area
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	Contractor
1	$3,829
2	$18,236
3	$31,760
4	$32,372
5	$15,451
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$101,648

Aerial Photo — Sunrise Dump - Flight Date 12-13-2018



Costing Breakdown

1	**Dump Slopes steeper than 2:1 will be regraded to 2:1**			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	A1A2	1524	0.98	$ 0.33	$491.28
	A3A4	1524	5.22	$ 0.33	$2,623.62
	C7C8	1524	0.66	$ 0.33	$329.20
	C9C10	1524	0.01	$ 0.33	$7.33
	C11C12	1524	0.75	$ 0.33	$377.83
2	Ripping of dump slopes, surfaces, and road to 24in			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	Rip with dozer	2573	36.29	$0.20	$18,236.40
3	Placement of 24in of fill on dump surfaces			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Fill	316	0.00	$0.21	$4,999.87
	Haul Fill	599	2.49	$0.84	$19,672.55
	Push Fill			$0.33	$7,087.44
4	Placement of 6in of top soil on dump			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	0.41	$0.21	$4,999.87
	Haul Topsoil	599	0.24	$0.84	$19,672.55
	Push Topsoil			$0.33	$7,699.35
5	Seeding of dump area			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.13	$111.36	$4,221.55
	Reseed	599	0.03	$111.36	$2,110.78
	50% Ripping				$9,118.20

Bawana Dump

Areas		Slopes	
Dump Acreage	37.4	DD - Original height (ft)	20.0
		DD - Original width (ft)	34.0
		DD - Stable height (ft)	20.0
		DD - Stable width (ft)	40.0
Ripping		DD - Slope Dist (ft)	39.0
Rip Depth (ft)	2.0	DD - Fill Volume Difference (LCY)	108.3
Rip Volume (BCY)	120,710		
		GG - Original height (ft)	25.0
Topsoil		GG - Original width (ft)	45.0
Topsoil Depth	0.5	GG - Stable height (ft)	25.0
Topsoil Volume	30,177	GG - Stable width (ft)	50.0
		GG - Slope Dist (ft)	52.0
		GG - Fill Volume Difference (LCY)	150.5
LCY/BCY	1.25	HH - Original height (ft)	55.0
		HH - Original width (ft)	97.0
		HH - Stable height (ft)	55.0
		HH - Stable width (ft)	110.0
		HH - Slope Dist (ft)	111.0
		HH - Fill Volume Difference (LCY)	1,837.2
		II - Original height (ft)	30.0
		II - Original width (ft)	44.0
		II - Stable height (ft)	30.0
		II - Stable width (ft)	60.0
		II - Slope Dist (ft)	53.0
		II - Fill Volume Difference (LCY)	588.9
		B5B6 - Original height (ft)	35.0
		B5B6 - Original width (ft)	59.0
		B5B6 - Stable height (ft)	35.0
		B5B6 - Stable width (ft)	70.0
		B5B6 - Slope Dist (ft)	69.0
		B5B6 - Fill Volume Difference (LCY)	614.9
		B7B8 - Original height (ft)	30.0
		B7B8 - Original width (ft)	39.0
		B7B8 - Stable height (ft)	30.0
		B7B8 - Stable width (ft)	60.0
		B7B8 - Slope Dist (ft)	50.0
		B7B8 - Fill Volume Difference (LCY)	729.2
		D15D16 - Original height (ft)	20.0
		D15D16 - Original width (ft)	35.0
		D15D16 - Stable height (ft)	20.0
		D15D16 - Stable width (ft)	40.0
		D15D16 - Slope Dist (ft)	40.0
		D15D16 - Fill Volume Difference (LCY)	92.6
		F19F20 - Original height (ft)	55.0
		F19F20 - Original width (ft)	87.0
		F19F20 - Stable height (ft)	55.0
		F19F20 - Stable width (ft)	110.0
		F19F20 - Slope Dist (ft)	103.0
		F19F20 - Fill Volume Difference (LCY)	3,016.1
		G21G22 - Original height (ft)	25.0
		G21G22 - Original width (ft)	44.0
		G21G22 - Stable height (ft)	25.0
		G21G22 - Stable width (ft)	50.0
		G21G22 - Slope Dist (ft)	51.0
		G21G22 - Fill Volume Difference (LCY)	177.1
		H23H24 - Original height (ft)	55.0
		H23H24 - Original width (ft)	90.0
		H23H24 - Stable height (ft)	55.0
		H23H24 - Stable width (ft)	110.0
		H23H24 - Slope Dist (ft)	105.0
		H23H24 - Fill Volume Difference (LCY)	2,673.6
		Total Fill (LCY)	9988

195184

	NOI Reclimation Steps
1	Dump Slopes steeper than 2:1 will be regraded to 2:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 6in of top soil on dump
4	Seeding of dump area
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9	
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	Contractor
1	$3,294.23
2	$23,573.73
3	$41,846.17
4	$18,035.68
5	$0.00
6	$0.00
7	$0.00
8	$0.00
9	$0.00
10	$0.00
Total	$86,749.80

Aerial Photo — Bawana Dump - Flight Date 12-13-2018



Costing Breakdown

1 Dump Slopes steeper than 2:1 will be regraded to 2:1

	Rate	Hours	Contract Cost/BCY	Contract Cost
DD	1524	0.07	$ 0.33	$ 35.73
GG	1524	0.10	$ 0.33	$ 49.62
HH	1524	1.21	$ 0.33	$ 605.91
II	1524	0.39	$ 0.33	$ 194.22
B5B6	1524	0.40	$ 0.33	$ 202.81
B7B8	1524	0.48	$ 0.33	$ 240.49
D15D16	1524	0.06	$ 0.33	$ 30.54
F19F20	1524	1.98	$ 0.33	$ 994.73
G21G22	1524	0.12	$ 0.33	$ 58.40
H23H24	1524	1.75	$ 0.33	$ 881.78

2 Ripping of dump slopes, surfaces, and road to 24in

	Rate	Hours	Contract Cost/BCY	Contract Cost
Rip with dozer	2573	46.91	$0.20	$23,573.73

3 Placement of 6in of top soil on dump

	Rate	Hours	Contract Cost/hr	Contract Cost
Load Fill	316		$0.21	$6,463.21
Haul Fill	599	50.40	$0.84	$25,430.21
Push Topsoil			$0.33	$9,952.75

4 Seeding of dump area

	Rate	Hours	Contract Cost/hr	Contract Cost
Seed	316		$111.36	$4,165.87
Reseed	599		$111.36	$2,082.94
50% Ripping				$11,786.87

Maria Dump

Areas		Slopes	
Dump Acreage	22.04	AA - Original height (ft)	34.0
Stockpile	0.88	AA - Original width (ft)	53.0
		AA - Stable height (ft)	34.0
Ripping		AA - Stable width (ft)	68
Rip Depth (ft)	2.0	AA - Slope Dist (ft)	63.0
Rip Volume (BCY)	71,116	AA - Fill Volume Difference (LCY)	744
Topsoil		BB - Original height (ft)	30.0
Topsoil Depth	0.5	BB - Original width (ft)	50.0
Topsoil Volume	18,489	BB - Stable height (ft)	30.0
		BB - Stable width (ft)	60
		BB - Slope Dist (ft)	59.0
		BB - Fill Volume Difference (LCY)	410
LCY/BCY	1.25		
		DD - Original height (ft)	35.0
		DD - Original width (ft)	52.0
		DD - Stable height (ft)	35.0
		DD - Stable width (ft)	70
		DD - Slope Dist (ft)	63.0
		DD - Fill Volume Difference (LCY)	919
		Total Fill (LCY)	2,072

	NOI Reclimation Steps
1	Dump Slopes steeper than 2:1 will be regraded to 2:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 6in of top soil on dump
4	Seeding of dump area
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	Contractor
1	$683
2	$13,888
3	$81,257
4	$25,638
5	$10,773
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$132,240

Aerial Photo — Maria Dump - Flight Date 12-13-2018



Costing Breakdown

1 Dump Slopes steeper than 2:1 will be regraded to 2:1

	Rate	Hours	Contract Cost/BCY	Contract Cost
AA	1524	0.49	$ 0.33	$245.29
BB	1524	0.27	$ 0.33	$135.13
DD	1524	0.60	$ 0.33	$303.01

2 Ripping of dump slopes, surfaces, and road to 24in

	Rate	Hours	Contract Cost/BCY	Contract Cost
Rip with dozer	2573	27.64	$0.20	$13,888.40

3 Placement of 6in of top soil on dump

	Rate	Hours	Contract Cost/hr	Contract Cost
Load Fill	316	#REF!	$0.21	$15,231.13
Haul Fill	599	30.88	$0.84	$59,928.56
Push Fill			$0.33	$6,097.76

4 Seeding of dump area

	Rate	Hours	Contract Cost/hr	Contract Cost
Load Topsoil	316	0.00	$0.21	$3,959.82
Haul Topsoil	599	0.00	$0.84	$15,580.34
Push topsoil			$0.33	$6,097.76

5 0

	Rate	Hours	Contract Cost/hr	Contract Cost
Seed	316	0.00	$111.36	$2,552.31
Reseed	599		$111.36	$1,276.15
50% Ripping				$6,944.20

Hidden Treasure Dump

Areas	
Dump Acreage	80.76
Stockpile	1.2
SITLA SP	0.63
Dump Surface	14.8
Ripping	
Rip Depth (ft)	2.0
Rip Volume (BCY)	260,586
Topsoil Depth	
Topsoil Depth	0.5
Topsoil Volume	66,623
Fill	
Fill height	2
fill area	644,688
fill volume (CY)	47,755
LCY/BCY	1.25

Slopes	
BB - Original height (ft)	72.0
BB - Original width (ft)	135.0
BB - Stable height (ft)	72.0
BB - Stable width (ft)	144
BB - Slope Dist (ft)	153.0
BB - Fill Volume Difference (LCY)	2,295
CC - Original height (ft)	58.0
CC - Original width (ft)	95.0
CC - Stable height (ft)	58.0
CC - Stable width (ft)	116
CC - Slope Dist (ft)	111.0
CC - Fill Volume Difference (LCY)	3,130
EE - Original height (ft)	32.0
EE - Original width (ft)	49.0
EE - Stable height (ft)	32.0
EE - Stable width (ft)	64
EE - Slope Dist (ft)	59.0
EE - Fill Volume Difference (LCY)	656
FF - Original height (ft)	40.0
FF - Original width (ft)	77.0
FF - Stable height (ft)	58.0
FF - Stable width (ft)	116
FF - Slope Dist (ft)	87.0
FF - Fill Volume Difference (LCY)	7,347
GG - Original height (ft)	46.0
GG - Original width (ft)	75.0
GG - Stable height (ft)	46.0
GG - Stable width (ft)	92
GG - Slope Dist (ft)	88.0
GG - Fill Volume Difference (LCY)	1,593
HH - Original height (ft)	50.0
HH - Original width (ft)	75.0
HH - Stable height (ft)	50.0
HH - Stable width (ft)	100
HH - Slope Dist (ft)	90.0
HH - Fill Volume Difference (LCY)	2,604
A1A2 - Original height (ft)	72.6
A1A2 - Original width (ft)	103.0
A1A2 - Stable height (ft)	72.6
A1A2 - Stable width (ft)	145.254
A1A2 - Slope Dist (ft)	126.0
A1A2 - Fill Volume Difference (LCY)	8,951
B5B6 - Original height (ft)	72.0
B5B6 - Original width (ft)	135.0
B5B6 - Stable height (ft)	72.0
B5B6 - Stable width (ft)	144
B5B6 - Slope Dist (ft)	153.0
B5B6 - Fill Volume Difference (LCY)	2,295
C7C8 - Original height (ft)	58.0
C7C8 - Original width (ft)	95.0
C7C8 - Stable height (ft)	58.0
C7C8 - Stable width (ft)	116
C7C8 - Slope Dist (ft)	111.0
C7C8 - Fill Volume Difference (LCY)	3,130
E11E12 - Original height (ft)	32.0
E11E12 - Original width (ft)	49.0
E11E12 - Stable height (ft)	32.0
E11E12 - Stable width (ft)	64
E11E12 - Slope Dist (ft)	58.0
E11E12 - Fill Volume Difference (LCY)	644
F13F14 - Original height (ft)	40.0
F13F14 - Original width (ft)	77.0
F13F14 - Stable height (ft)	40.0
F13F14 - Stable width (ft)	80
F13F14 - Slope Dist (ft)	87.0
F13F14 - Fill Volume Difference (LCY)	242
G15G16 - Original height (ft)	50.0
G15G16 - Original width (ft)	75.0
G15G16 - Stable height (ft)	50.0
G15G16 - Stable width (ft)	100
G15G16 - Slope Dist (ft)	90.0
G15G16 - Fill Volume Difference (LCY)	2604.1667
Total Fill (LCY)	35,489

	NOI Reclimation Steps
1	Dump Slopes steeper than 2:1 will be regraded to 2:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 24in of fill on dump surfaces
4	Placement of 6in of top soil on dump
5	Seeding of dump area
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10	

	Contractor
1	$11,705
2	$50,891
3	$66,220
4	$92,384
5	$39,241
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$260,440

Aerial Photo Hidden Treasure Dump - Flight Date 12-13-2018



Aerial Photo SITLA Ore Stockpile: Flight Date 13/13/2018



Costing Breakdown

1	Dump Slopes steeper than 2:1 will be regraded to 2:1			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	BB	1524	1.51	$ 0.33	$ 756.91
	CC	1524	2.05	$ 0.33	$ 1,032.16
	EE	1524	0.43	$ 0.33	$ 216.21
	FF	1524	1.05	$ 0.33	$ 2,422.99
	GG	1524	1.05	$ 0.33	$ 525.37
	HH	1524	1.71	$ 0.33	$ 858.88
	A1A2	1524	5.87	$ 0.33	$ 2,951.98
	B5B6	1524	1.51	$ 0.33	$ 756.91
	C7C8	1524	2.05	$ 0.33	$ 1,032.16
	E11E12	1524	0.42	$ 0.33	$ 212.54
	F13F14	1524	0.16	$ 0.33	$ 79.70
	G15G16	1524	1.71	$ 0.33	$ 858.88

2	Ripping of dump slopes, surfaces, and road to 24in			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	Rip with dozer	2573	101.28	$0.20	$50,890.53

3	Placement of 24in of fill on dump surfaces			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Fill	316	#REF!	$0.21	$10,227.80
	Haul Fill	599	111.28	$0.84	$40,242.41
	Push Fill			$0.33	$15,749.88

4	Placement of 6in of top soil on dump			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	151.12	$0.21	$14,268.82
	Haul Topsoil	599	1076.81	$0.84	$56,142.23
	Push Topsoil			$0.33	$21,972.67

5	Seeding of dump area			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.00	$111.36	$9,196.99
	Reseed	599		$111.36	$4,598.50
	50% Ripping				$25,445.26

Copper Ranch Dump

Areas		Slopes	
Dump Acreage	36.9	B - Original height (ft)	65.0
Dump Surface	4.7	B - Original width (ft)	95.0
		B - Stable height (ft)	65.0
		B - Stable width (ft)	130
Ripping		B - Slope Dist (ft)	114.0
Rip Depth (ft)	2.0	B - Fill Volume Difference (LCY)	6,003
Rip Volume (BCY)	119,064		
		C - Original height (ft)	113.0
Top Soil		C - Original width (ft)	195.0
Topsoil Depth	0.5	C - Stable height (ft)	113.0
Topsoil Volume	33,557	C - Stable width (ft)	226
		C - Slope Dist (ft)	225.0
Fill		C - Fill Volume Difference (LCY)	18,245
Fill height	2		
fill area	204,732	D - Original height (ft)	137.0
fill volume (CY)	15,165	D - Original width (ft)	230.0
		D - Stable height (ft)	137.0
LCY/BCY	1.25	D - Stable width (ft)	274
		D - Slope Dist (ft)	268.0
		D - Fill Volume Difference (LCY)	37,396
		F - Original height (ft)	137.0
		F - Original width (ft)	250.0
		F - Stable height (ft)	137.0
		F - Stable width (ft)	274
		F - Slope Dist (ft)	285.0
		F - Fill Volume Difference (LCY)	21,692
		A1A2 - Original height (ft)	65.0
		A1A2 - Original width (ft)	87.0
		A1A2 - Stable height (ft)	65.0
		A1A2 - Stable width (ft)	130
		A1A2 - Slope Dist (ft)	109.0
		A1A2 - Fill Volume Difference (LCY)	7,052
		A3A4 - Original height (ft)	55.0
		A3A4 - Original width (ft)	85.0
		A3A4 - Stable height (ft)	55.0
		A3A4 - Stable width (ft)	110
		A3A4 - Slope Dist (ft)	101.0
		A3A4 - Fill Volume Difference (LCY)	3,215
		B5B6 - Original height (ft)	65.0
		B5B6 - Original width (ft)	89.0
		B5B6 - Stable height (ft)	65.0
		B5B6 - Stable width (ft)	130
		B5B6 - Slope Dist (ft)	110.0
		B5B6 - Fill Volume Difference (LCY)	6,786
		B7B8 - Original height (ft)	60.0
		B7B8 - Original width (ft)	90.0
		B7B8 - Stable height (ft)	60.0
		B7B8 - Stable width (ft)	120
		B7B8 - Slope Dist (ft)	108.0
		B7B8 - Fill Volume Difference (LCY)	4,500
		C9C10 - Original height (ft)	15.0
		C9C10 - Original width (ft)	26.0
		C9C10 - Stable height (ft)	15.0
		C9C10 - Stable width (ft)	30
		C9C10 - Slope Dist (ft)	30.0
		C9C10 - Fill Volume Difference (LCY)	42
		C11C12 - Original height (ft)	45.0
		C11C12 - Original width (ft)	63.0
		C11C12 - Stable height (ft)	45.0
		C11C12 - Stable width (ft)	90
		C11C12 - Slope Dist (ft)	78.0
		C11C12 - Fill Volume Difference (LCY)	2,194
		C13C14 - Original height (ft)	70.0
		C13C14 - Original width (ft)	79.0
		C13C14 - Stable height (ft)	70.0
		C13C14 - Stable width (ft)	140
		C13C14 - Slope Dist (ft)	105.0
		C13C14 - Fill Volume Difference (LCY)	10,378
		D15D16 - Original height (ft)	65.0
		D15D16 - Original width (ft)	90.0
		D15D16 - Stable height (ft)	65.0
		D15D16 - Stable width (ft)	130
		D15D16 - Slope Dist (ft)	111.0
		D15D16 - Fill Volume Difference (LCY)	6,681
		D17D18 - Original height (ft)	80.0
		D17D18 - Original width (ft)	114.0
		D17D18 - Stable height (ft)	80.0
		D17D18 - Stable width (ft)	160
		D17D18 - Slope Dist (ft)	139.0
		D17D18 - Fill Volume Difference (LCY)	11,841
		Total Fill (LCY)	136024

	NOI Reclimation Steps
1	Dump Slopes steeper than 2:1 will be regraded to 2:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 24in of fill on dump surfaces
4	Placement of 6in of top soil on dump
5	Seeding of dump area
6	
7	
8	
9	
10	

	Contractor
1	$44,862
2	$23,252
3	$21,029
4	$46,533
5	$17,790
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$153,466

Aerial Photo — Copper Ranch Dump - Flight Date 6-19-2019



111,248.26
44,861.76

Costing Breakdown

1	Dump Slopes steeper than 2:1 will be regraded to 2:1			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	B	1524	3.94	$ 0.33	$ 1,979.99
	C	1524	11.97	$ 0.33	$ 6,017.28
	D	1524	24.54	$ 0.33	$ 12,333.48
	F	1524	14.24	$ 0.33	$ 7,154.09
	A1A2	1524	4.63	$ 0.33	$ 2,325.87
	A3A4	1524	2.11	$ 0.33	$ 1,060.23
	B5B6	1524	4.45	$ 0.33	$ 2,238.04
	B7B8	1524	2.95	$ 0.33	$ 1,484.14
	C9C10	1524	0.03	$ 0.33	$ 13.74
	C11C12	1524	1.44	$ 0.33	$ 723.52
	C13C14	1524	6.81	$ 0.33	$ 3,422.90
	D15D16	1524	4.38	$ 0.33	$ 2,203.30
	D17D18	1524	7.77	$ 0.33	$ 3,905.17

2	Ripping of dump slopes, surfaces, and road to 24in			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	Rip with dozer	2573	46.27	$0.20	$23,252.36

3	Placement of 24in of fill on dump surfaces			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Fill	316	#REF!	$0.21	$3,248.02
	Haul Fill	599	56.05	$0.84	$12,779.68
	Push Fill			$0.33	$5,001.65

4	Placement of 6in of top soil on dump			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	#REF!	$0.21	$7,187.10
	Haul Topsoil	599	25.33	$0.84	$28,278.45
	Push Topsoil			$0.33	$11,067.48

5	Seeding of dump area			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.00	$111.36	$4,109.08
	Reseed	599		$111.36	$2,054.54
	50% Ripping				$11,626.18

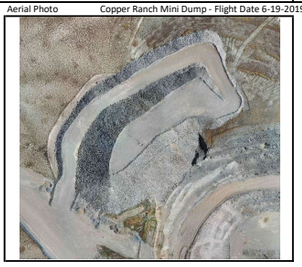
Copper Ranch Mini Dump

Areas		Slopes	
Dump Acreage (acre)	9	B3B4 - Original height (ft)	28.0
Stockpiles (acre)	10	B3B4 - Original width (ft)	50.0
		B3B4 - Stable height (ft)	28.0
		B3B4 - Stable width (ft)	56
Ripping		B3B4 - Slope Dist (ft)	57.0
Rip Depth (ft)	2	B3B4 - Fill Volume Difference (LCY)	222
Rip Volume (BCY)	59,726		
		B5B6 - Original height (ft)	14.0
Topsoil		B5B6 - Original width (ft)	22.0
Topsoil Depth	0.5	B5B6 - Stable height (ft)	14.0
Topsoil Volume	6,905	B5B6 - Stable width (ft)	28
		B5B6 - Slope Dist (ft)	26.0
		B5B6 - Fill Volume Difference (LCY)	51
		C7C8 - Original height (ft)	81.0
		C7C8 - Original width (ft)	121.0
		C7C8 - Stable height (ft)	81.0
LCY/BCY	1.25	C7C8 - Stable width (ft)	162
		C7C8 - Slope Dist (ft)	146.0
		C7C8 - Fill Volume Difference (LCY)	11,224
		C9C10 - Original height (ft)	23.0
		C9C10 - Original width (ft)	35.0
		C9C10 - Stable height (ft)	23.0
		C9C10 - Stable width (ft)	46
		C9C10 - Slope Dist (ft)	42.0
		C9C10 - Fill Volume Difference (LCY)	246

	NOI Reclimation Steps
1	Dump Slopes steeper than 2:1 will be regraded to 2:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 6in of top soil on dump
4	Seeding of dump area
5	
6	
7	
8	
9	
10	

	Contractor
1	$3,873
2	$11,664
3	$9,575
4	$8,924
5	$0
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$34,035

Aerial Photo — Copper Ranch Mini Dump - Flight Date 6-19-2019



Costing Breakdown

1 Dump Slopes steeper than 2:1 will be regraded to 2:1

	Rate	Hours	Contract Cost/BCY	Contract Cost
B3B4	1524	0.15	$0.33	$73.11
B5B6	1524	0.03	$0.33	$16.67
C7C8	1524	7.37	$0.33	$3,701.68
C9C10	1524	0.16	$0.33	$81.12

2 Ripping of dump slopes, surfaces, and road to 24in

	Rate	Hours	Contract Cost/BCY	Contract Cost
Rip with dozer	2573	23.21	$0.20	$11,663.99

3 Placement of 6in of top soil on dump

	Rate	Hours	Contract Cost/hr	Contract Cost
Load Topsoil	316	0.00	$0.21	$1,478.88
Haul Topsoil	599	0.37	$0.84	$5,818.83
Push Topsoil			$0.33	$2,277.35

4 Seeding of dump area

	Rate	Hours	Contract Cost/hr	Contract Cost
Seed	316	0.08	$111.36	$2,061.22
Reseed	599	0.27	$111.36	$1,030.61
50% Ripping				$5,831.99

OK Dump

Areas		Slopes	
Dump Acreage OK (acre)	2.9	A1A2 - Original height (ft)	23.0
Dump Acreage Boneyard (acre)	3.0	A1A2 - Original width (ft)	39.0
		A1A2 - Stable height (ft)	23.0
		A1A2 - Stable width (ft)	46
Ripping		A1A2 - Slope Dist (ft)	46.0
Rip Depth (ft)	2.0	A1A2 - Fill Volume Difference (LCY)	171
Rip Volume (BCY)	19037		
		B3B4 - Original height (ft)	33.0
Topsoil		B3B4 - Original width (ft)	64.0
Topsoil Depth	0.5	B3B4 - Stable height (ft)	33.0
Topsoil Volume	2339	B3B4 - Stable width (ft)	66
		B3B4 - Slope Dist (ft)	72.0
		B3B4 - Fill Volume Difference (LCY)	110
		C5C6 - Original height (ft)	28.0
		C5C6 - Original width (ft)	42.0
		C5C6 - Stable height (ft)	28.0
LCY/BCY	1.25	C5C6 - Stable width (ft)	56
		C5C6 - Slope Dist (ft)	51.0
		C5C6 - Fill Volume Difference (LCY)	463

	NOI Reclimation Steps
1	Dump Slopes steeper than 2:1 will be regraded to 2:1
2	Ripping of dump slopes, surfaces, and road to 24in
3	Placement of 6in of top soil on dump
4	Seeding of dump area
5	
6	
7	
8	
9	
10	

	Contractor
1	$245
2	$3,718
3	$3,244
4	$2,844
5	$0
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$10,052

Aerial Photo OK Dump - Flight Date 12-10-2018



Costing Breakdown

1	Dump Slopes steeper than 2:1 will be regraded to 2:1			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	A1A2	1524	0.11	$0.33	$56.54
	B3B4	1524	0.07	$0.33	$36.28
	C5C6	1524	0.30	$0.33	$152.63
2	Ripping of dump slopes, surfaces, and road to 24in			Contract	Contract
		Rate	Hours	Cost/BCY	Cost
	Rip with dozer	2573	7.40	$0.20	$3,717.86
3	Placement of 6in of top soil on dump			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	0.00	$0.21	$501.02
	Haul Topsoil	599	0.29	$0.84	$1,971.33
	Push Topsoil			$0.33	$771.53
4	Seeding of dump area			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.23	$111.36	$657.01
	Reseed	599	0.09	$111.36	$328.50
	50% Ripping				$1,858.93

Floatation Tails Pond (FTP)

Areas		Evaporation (mil Gallons)	
FTP Bonded Acreage	32.0	FTP volume	12.5
Decant	2.8		
Pond Surface Area (Acres)	21.7	Geotextile area (SY)	52,514
		Geotextile coverage	50%
Ripping			
Rip Depth (ft)	2.0		
Rip Volume (BCY)	42,269		
Topsoil			
Topsoil Depth(ft)	0.5		
Topsoil Volume(CY)	28,072		
Waste Rock			
Waste Depth(ft)	1		
Waste Volume(CY)	56,144		

	NOI Reclimation Steps
1	Freestanding water will be neutralized
2	Freestanding water will be evaporated from the ponds
3	1ft of waste rock will be placed
4	Geotextile placement (if needed)
5	6in Top Soil Placement
6	Area's around tails pond to be ripped to 24in
7	Seeding
8	
9	
10	

Aerial Photo — Float Tails Pond - Flight Date 6-12-2019



	Contractor
1	$0
2	$77,811
3	$77,853
4	$123,933
5	$38,927
6	$8,255
7	$9,784
8	$0
9	$0
10	$0
Total	$336,563

Costing Breakdown

1 Freestanding water will be neutralizated

	Rate	Hours	Contract Cost/hr	Contract Cost
Neutralize	316	0.00		$0.00

2 Freestanding water will be evaporated from the ponds

	Rate	Hours	Contract Cost/gal	Contract Cost
Evaporate	316	0.00	$0.01	$77,810.96

3 1ft of waste rock will be placed

	Rate	Hours	Contract Cost/hr	Contract Cost
Load Waste Rock	316	0.00	$0.21	$12,024.58
Haul Waste Rock	599	0.00	$0.84	$47,312.02
Push Waste Rock			$0.33	$18,516.75

4 Geotextile placement (if needed)

	Rate	Hours	Contract Cost/hr	Contract Cost
Place	316	0.00	$2.36	$123,933.04

5 6in Top Soil Placement

	Rate	Hours	Contract Cost/hr	Contract Cost
Load Topsoil	316	0.00	$0.21	$6,012.29
Haul Topsoil	599	0.00	$0.84	$23,656.01
Push Topsoil			$0.33	$9,258.37

6 Area's around tails pond to be ripped to 24in

	Rate	Hours	Contract Cost/hr	Contract Cost
Rip with dozer	316	0.00	$0.20	$8,254.90

7 Seeding

	Rate	Hours	Contract Cost/hr	Contract Cost
Seed	316	0.00	$111.36	$3,875.23
Reseed	599		$111.36	$1,781.72
50% Ripping				$4,127.45

East Intermediate Tails Disposal Facility (EITDF)

Areas		Evaporation (mil gallons)	
ITDF Bonded Acreage	65.5	ITDF volume	12.5
Topsoil SP	5.8		
Pond Surface Area (Acres)	28.3	Geotextile area (SY)	68,510
		Geotextile coverage	50%
Ripping			
Rip Depth (ft)	2.0		
Rip Volume (BCY)	120,000		
Topsoil			
Topsoil Depth (ft)	0.5		
Topsoil Volume (CY)	52,837		
Waste Rock			
Waste Depth (ft)	1		
Waste Volume (CY)	115,031		

	NOI Reclimation Steps
1	Freestanding water will be neutralizated
2	Freestanding water will be evaporated from the ponds
3	1ft of waste rock will be placed
4	Geotextile placement (if needed)
5	6in Top Soil Placement
6	Area's around tails pond to be ripped to 24in
7	Seeding
8	
9	
10	

	Contractor
1	$0
2	$77,811
3	$159,510
4	$161,684
5	$73,267
6	$23,435
7	$23,304
8	$0
9	$0
10	$0
Total	$519,011

Aerial Photo — Intermediate Tails Disposal Facility - Flight Date 6-24-2019



Costing Breakdown

1	Freestanding water will be neutralizated			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Neutralize	316	0.00		$0.00
2	Freestanding water will be evaporated from the ponds			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Evaporate	316	0.00	$0.01	$77,810.96
3	1ft of waste rock will be placed			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Waste Rock	316	0.00	$0.21	$24,636.56
	Haul Waste Rock	599	0.00	$0.84	$96,935.25
	Push Waste Rock			$0.33	$37,938.04
4	Geotextile placement (if needed)			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Place	316	0.00	$2.36	$161,684.07
5	6in Top Soil Placement			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	0.00	$0.21	$11,316.23
	Haul Topsoil	599	0.00	$0.84	$44,524.96
	Push Topsoil			$0.33	$17,425.96
6	Area's around tails pond to be ripped to 24in			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Rip with dozer	316	0.00	$0.20	$23,435.10
7	Seeding			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.00	$111.36	$7,939.77
	Reseed	599		$111.36	$3,646.95
	50% Ripping				$11,717.55

Mill Site including Lab Facilities

Areas		Neutralization (mil gallons)	
Mill Acreage *excludes FTP	87.6	PLS	7.5
E Tails stockpile	11.1	Raffinate	7.5
W Tails stockpile	5.2	CCD	1.5
		final pH	2.0
Ripping			
Rip Depth (ft)	2.0	lbs/gal LKD	0.3
Rip Volume (BCY)	282,624	tons/mil gal	150
		total tons	2,475
Topsoil			
Topsoil Depth	0.5		
Topsoil Volume	79,570		
		Evaporation (mil gallons)	
		Total	16.5

	NOI Reclimation Steps
1	Freestanding water will be neutralizated
2	Freestanding water will be evaporated from the ponds
3	Rip area to 24in
4	Place 6in topsoil
5	Seed
6	
7	
8	
9	
10	

	Contractor
1	$122,643
2	$102,710
3	$55,194
4	$110,337
5	$44,039
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$434,923

Aerial Photo Mill Site - Flight Date 12-10-2018



Aerial Photo East Tails Stockpile - Flight Date 12-10-2018



Aerial Photo West Tails Stockpile - Flight Date 12-10-2018



Costing Breakdown

1	Freestanding water will be neutralizated			Contract	Contract
		Rate	Hours	Cost/ton	Cost
	Neutralize	316		$34.00	$84,150.00
	Slaker Rate			$0.0023	$38,492.51
2	Freestanding water will be evaporated from the ponds			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Evaporate	316		$0.01	$102,710.46
3	Rip area to 24in			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Rip with dozer	316	0.00	$0.20	$55,194.42
4	Place 6in topsoil			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	0.00	$0.21	$17,041.73
	Haul Topsoil	599	0.00	$0.84	$67,052.55
	Push Topsoil			$0.33	$26,242.70
5	Seed			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.00	$111.36	$11,564.45
	Reseed	599		$111.36	$4,876.89
	50% Ripping				$27,597.21

SITLA Ore Stockpile & Topsoil Pile

Areas	
Full Acreage	5.23
Ripping	
Rip Depth (ft)	2.0
Rip Volume (BCY)	16,875
Topsoil	
Topsoil Depth(ft)	0.5
Topsoil Volume(CY)	4,219

	NOI Reclimation Steps
1	Rip area to 24in
2	Place 6in topsoil
3	Seed
4	
5	
6	
7	
8	
9	
10	

	Contractor
1	$3,296
2	$5,850
3	$874
4	$0
5	$0
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$10,019

Aerial Photo — Truck Shop & PNT 1 - Flight Date 1-10-2019



Costing Breakdown

1	Rip area to 24in			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Rip with dozer	316	0.00	$0.20	$3,295.66
2	Place 6in topsoil			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Load Topsoil	316	0.00	$0.21	$903.57
	Haul Topsoil	599	0.00	$0.84	$3,555.20
	Push Topsoil			$0.33	$1,391.42
3	Seed			Contract	Contract
		Rate	Hours	Cost/hr	Cost
	Seed	316	0.00	$111.36	$582.40
	Reseed	599		$111.36	$291.20
	50% Ripping				$1,647.83

SITLA Ore Stockpile & Topsoil Pile

Areas

Haul Road Length (ft)	33325
Haul Current Width (ft)	65
Roads Full Acreage	49.73

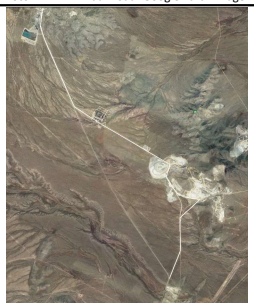
Ripping

Rip Depth (ft)	2.0
Rip Volume (BCY)	160,454

	NOI Reclimation Steps
1	Rip area to 24in
2	Seed
3	
4	
5	
6	
7	
8	
9	
10	

	Contractor
1	$31,335
2	$23,974
3	$0
4	$0
5	$0
6	$0
7	$0
8	$0
9	$0
10	$0
Total	$55,309

Aerial Photo — Hual Road- Google Earth Image - Circa 2013



Costing Breakdown

1 Rip area to 24in

	Rate	Hours	Contract Cost/hr	Contract Cost
Rip with dozer	316	0.00	$0.20	$31,335.48

2 Seed

	Rate	Hours	Contract Cost/hr	Contract Cost
Seed	316	0.00	$111.36	$5,537.50
Reseed	599		$111.36	$2,768.75
50% Ripping				$15,667.74

Revisions Ta

Rev #	Date	Editors Name	
1.0	8/26/2019	Jared Haehnel	1. Creation of the sheet and the intial submission to DO
2.0	10/3/2019	Jared Haehnel	1. Added separate surface area measurements for pond 32.0 acres to 21.7 on the FTP and from 65 Acres to 28.3 ITDF. 2. Added 'Dozer Production Tables' sheet, linked produc sheet. Soil Seimic Density Change from 1.5km/s to .75kr 3. Added DOGM's Required 10% for O+P on the Equipm 4. Fixed ripping cost for ITDF and FTP. Previous values w 5. Reseed was adjusted to include 50% reseed, and 50% reseed using a Farm Tractor. 6. Adjusted Contingency from 2.5% to 5.0% to align with 7. Adjusted inflation rate from 1.8% to 2.3% and added 8. Changed MOB/DEMOB to be 10% of direct costs as D 2018 Rental Rates Handbook. 9. Made many minor formatting changes and correction 10. Added Loader and Truck Production Tables. Changed 988 with 10cy bucket to 992 with 14cy bucket. Changed haul. Changed assumed truck speed to 20 MPH from 13 11. Added lime slaker to the 4. Fleet, Productivity Cost, i Mill. Previously the slaker was not factored into the nue 12. Update Table of Contents to include the links for tab
2.1	10/23/2019	Jared Haehnel	1. Changed Ripping Estimates to reflect a theoretical pro reccomendation provided by Brian Larson on 10/21/201 ~2700bcy to 3101bcy. 2. Cross Section data for the dumps were updated to ref This applies to all dumps and replaces the target approa requirement from 2.5:1 to 2:1 the volume of material m 3. Added regrade volumes for CRI Mini and OK Dumps. N 4. Made minors formatting changes and corrections.

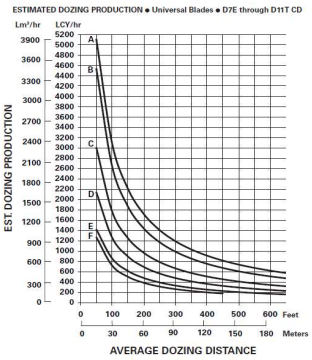
ble

Comments	Approval Date
GM	
foot prints for ITDF and FTP. This changes the pond area from . Corrected the coversion error from /27 to /9 for both FTP and tivity for all dozer related activities to the Dozer Production Table n/s. Applied CAT Formula for Productivity Rates. ent Op cost and Rental Cost ere 0$ for both. additional ripping across all areas. Removed costs associated with DOGM requirements. 5 year escalation. Previously no esclation was assumed. OGM Requires. Previously MOB/DEMOB was estimated using CAT s aimed at reducing paper use. fleet to 70 Ton Trucks from 65 Ton Trucks, Changed loader from assumed haul length from 1000ft to 2500ft. Removed 4000ft .8MPH. incorperated a per gallon rate into nuetralization costs for the tralization costs. s 16., 17., and 18.	
oduction rates from a multishank ripper. This is based on CAT's 9. Email is included as a reference. Ripping Estimates went from flect each slope being regraded from existing to a 2:1 Minimum. ched used in previous drafts. Due to changes in the slope oved was reduced from ~280,000cy to 200,000cy. No regrade was previously assumed.	

Return to Fleet and Productivity Costs

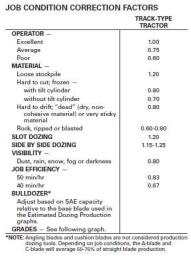
Production Calculation (Dump Regrading)		
Uncorrected Max Production (LCy/hr)	1800	*100ft Avg push
Modifiers		
Operator	0.75	*Avg. Operator
Material Composition	0.80	*Blasted Rock
Job Efficiency	0.83	*50 Min/hr
Material Density Correction	1.06	*2650lb/Cy would be 1.00
Grade Correction	1.6	* <30% In most Areas
Corrected Production (LCy/hr)	1524	
Other Inputs		
Material Density (Lb/Cy)	2494.61	*Based on lab measurements

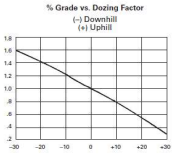
Excerpt Taken from CAT Production Handbook 48th Edition.



KEY
A — D11T CD
B — D11T
C — D10T2
D — D9T
E — D8T
F — D7E

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.





ESTIMATING DOZER PRODUCTION OFF-THE-JOB

Example problem:

Determine average hourly production of a D8T/8SU (with tilt cylinder) moving hard-packed clay an average distance of 45 m (150 feet) down a 15% grade, using a slot dozing technique.

Estimated material weight is 1600 kg/Lm³ (2650 lb/LCY). Operator is average. Job efficiency is estimated at 50 min/hr.

Uncorrected Maximum Production — 458 Lm³/h (600 LCY/hr) (example only)

Applicable Correction Factors:

Hard-packed clay is "hard to cut" material 0.80
Grade correction (from graph) 1.30
Slot dozing. 1.20
Average operator 0.75
Job efficiency (50 min/hr) 0.83
Weight correction. . . . . (2300/2650) 0.87

Production = Maximum Production × Correction Factors
= (600 LCY/hr) (0.80) (1.30) (1.20) (0.75) (0.83) (0.87)
= 405.5 LCY/hr

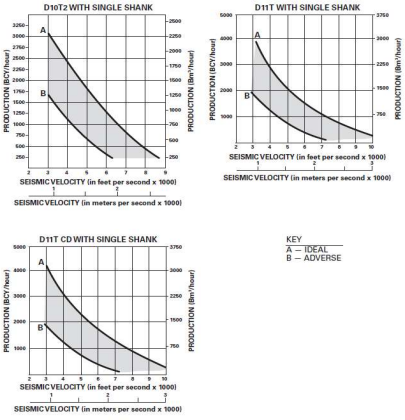
To obtain production in metric units, the same procedure is used substituting maximum uncorrected production in Lm³.

= 458 Lm³/h × Factors
= 309.6 Lm³/h

Production Calculation (Ripping)		
Uncorrected Max Production (BCy/hr)	3100	*.75km/s Seismic Wave Velocity
Modifiers		
Job Efficiency	0.83	*50 Minutes/hr
Corrected Production (LCy/hr)	2573	

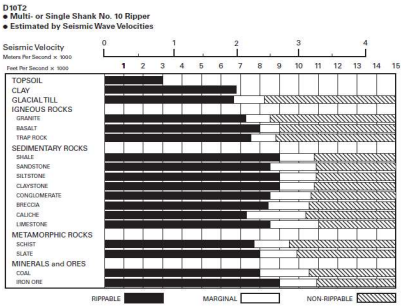
Excerpt Taken from CAT Production Handbook 48th Edition.

Rippers | Estimated Ripper Production Graphs
● D10T2 ● D11T ● D11T CD



KEY
A — IDEAL
B — ADVERSE

Rippers | Ripper Performance
● D10T2



Return to Fleet and Productivity Costs

Production Calculation (Dump Regrading)		
Bucket Size	12	14cy Bucket
Loader Cycle Time (min)	0.57	*986H to 990K Loaders
Number of Passes Per 70tn Truck	4.30	*See Material density below
Fill Factor	1.00	*Rocky Soil Fill
Job Efficency	0.83	*50 out 60 minutes
Production (LCy/hr)	1522	
Other Inputs		
Material Density (Lb/Cy)	2494.61	*Based on lab measurements

Excerpt Taken from CAT Production Handbook 48th Edition.

Machine Selection
- Truck Loading
- Bucket Fill Factors

Wheel Loaders
Integrated Toolcarriers

	Minutes added (+) or Subtracted (−) From Basic Cycle
Machine	
— Material handler	−.05
Materials	
— Mixed	+.02
— Up to 3 mm (1/8 in)	+.02
— 3 mm (1/8 in) to 20 mm (3/4 in)	−.02
— 20 mm (3/4 in) to 150 mm (6 in)	.00
— 150 mm (6 in) and over	+.03 and Up
— Bank or broken	+.04 and Up
Pile	
— Conveyor or Dozer piled 3 m (10 ft) and up	.00
— Conveyor or Dozer piled 3 m (10 ft) or less	+.01
— Dumped by truck	+.02
Miscellaneous	
— Common ownership of trucks and loaders	Up to −.04
— Independently owned trucks	Up to +.04
— Constant operation	Up to −.04
— Inconsistent operation	Up to +.04
— Small target	Up to +.04
— Fragile target	Up to +.05

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\frac{\text{Cycles per hour at } 100\% \text{ Efficiency}}{} = \frac{60 \text{ min}}{\text{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for bathroom breaks and other work interruptions.

$$\text{Cycles per hour at 50 minutes per hour (83\% effciency)} = \text{Cycles per hour at 100\% efficiency} \times \frac{\text{50 min time}}{\text{60 min hour}}$$

TRUCK LOADING

Average loader cycle times

910K–962H	0.45-0.50 min
966H-980H	0.50-0.55 min
986H-990K	0.55-0.60 min
992K–994K	0.60-0.70 min

3. Required Payload Per Cycle

Required payload per cycle is determined by dividing required hourly production by the number of cycles per hour.

4. Bucket Selection

After required payload per cycle has been calculated, the payload should be divided by the loose cubic yard (meter) material weight to determine number of loose cubic yards (meters) required per cycle.

The bulk of material handled does not weigh 1800 kg/m³ (3000 lb/yd³), so a reasonable knowledge of material weight is necessary for accurate production estimates. The Tables Section has average weight for certain materials when actual weights are not known.

The percentage of rated capacity a bucket carries in various materials is estimated below. The bucket size required to handle the required volume per cycle is found with the aid of the percentage of rated bucket capacity called "Bucket Fill Factor."

The bucket size needed is determined by dividing loose cubic meters (or yards) required per cycle by the bucket fill factor.

$$\text{Bucket size} = \frac{\text{Volume Required/Cycle}}{\text{Bucket Fill Factor}}$$

BUCKET FILL FACTORS

The following indicates the approximate amounts of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

Loose Material	Fill factor
Mixed moist aggregates	95-100%
Uniform aggregates up to 3 mm (1/8 in)	95-100
3 mm (1/8 in) to 9 mm (3/8 in)	90-95
12 mm (1/2 in) to 20 mm (3/4 in)	85-90
24 mm (1.0 in) and over	85-90
Blasted Rock	
Well blasted	80-95%
Average	75-90
Poor	60-75
Other	
Rock dirt mixtures	100-120%
Moist loam	100-110
Soil, boulders, roots	80-100
Cemented materials	85-95

NOTE: Fill factors on wheel loaders are affected by bucket penetration, breakout force, rack back angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

Example:

12 mm (1/2 in) material and 3 m³ (4 yd³) bucket.
0.90 × 3 m³ = 2.75 Loose m³ delivered per cycle.
0.90 × 4 yd³ = 3.6 Loose yd³ delivered per cycle.

NOTE: Check the static tipping load on the specific machine to determine if bucket load is in fact a safe operating load.

Bucket Selection

$$\text{Tons Required/Cycle} = \frac{\text{Tons Required/Hour}}{\text{Cycles/Hour}}$$

$$\text{Kg (Pounds) Required/Cycle} = \text{Tons Required/Cycle} \times 907 \text{ kg (2000 lb.)}$$

$$\text{Volume Required/Cycle} = \frac{\text{kg (Pounds) Cycle}}{\text{Material Weight kg/m}^3 \text{ (lb/yd}^3\text{)}}$$

Always select a machine with a greater capacity than the calculated required operating capacity. For most applications, payload above recommended and excessive counterweight can hinder machine performance and reduce dynamic stability and machine life.

For optimum performance in fast cycling situations such as truck loading, operating loads should not exceed the recommended capacity. To provide extra stability, calcium chloride ($CaCl_2$) ballast may be desired when operating at recommended operating load, see SAE Louder rating pages in this section. For specific stability data and optional tire sizes, see the "Performance Data" pages in this section.

When selecting special application buckets, such as multi-purpose and side dump the additional bucket weight must be deducted from recommended capacity.

Specific circumstances may involve other conditions which would also affect loader capacity. Because of the greatly varied applications and conditions, your Cat dealer should be contacted for guidance.

Example problem:

JOB CONDITIONS

Application	Truck loading
Production Required	450 metric ton (496 Tons) per hour
Material	9 mm (3/8") gravel in 6 m (20 ft) high stockpile
Density	1660 kg/m³ (2800 lb/yd³)

Trucks are 6-9 m³ (8-12 yd³) capacity and are owned by three contractors. Loading is constant. Hard level surface for loader maneuvering.

1. *PRODUCTION REQUIRED:* Given

2. *CYCLE TIME:* Assume loader size between 910K and 962H for initial choice of basic cycle.
(Refer to Cycle Time Factors in this section)

Independent trucks	.04 min
Basic Cycle	.50 min
Material	−.02 min
Independent trucks	+.04 min
Constant operation	−.02 min
Total Cycle	.50 min

NOTE: Load and carry times not required in total cycle.

$$\text{Cycles/hr at } 83\% \text{ efficiency} = 120 \text{ cycles/hr} \times \frac{\text{50 min actual work time}}{\text{60 min per hr}} = 100 \text{ cycles/hr}$$

3. *VOLUME REQUIRED PER CYCLE*
(Density in tons)
Density in this example was given. When not given, refer to Tables Section to obtain an estimated density for the material being handled.

$$\textit{Metric:} \quad \frac{1660 \text{ kg/m}^3}{1000 \text{ kg/ton}} = 1.66 \text{ ton/m}^3$$

$$\textit{English:} \quad \frac{2800 \text{ lb/yd}^3}{2000 \text{ lb/ton}} = 1.4 \text{ tons/yd}^3$$

Excerpt Taken from CAT Production Handbook 48th Edition.

Return to Fleet and Productivity Costs

Production Calculation (Dump Regrading)		
Truck Capacity 65tn Truck (Cy)	52.11	*CAT 773
Modifiers		
Loader Cycle Time (min)	0.57	*988H to 990K Loaders
Number of Passes Per 65tn Truck	4.30	*See Loader Bucket Size
Fill Factor	1.00	*Rocky Soil Fill
Job Efficency	0.83	*50 out 60 minutes
Dump Time	1.10	*Typical Range 1.0-1.2 minutes
Spotting Time	0.70	*Typical 0.6 to 0.8 minutes
Haul Distance (Ft)	2500	
Haul Speed Average (MPH)	20	
Haul Time (1 Way) (Min)	1.420	
Full Cycle Time (Minutes)	8.01	
Number of Cycles per Hour	7.49	
Single Truck Production (Cy/hr)	390	
Number of Trucks	4	
Fleet Production (Cy/hr)	1562	
Not Used for Reference only		
Material Density (Lb/Cy)	2494.61	*Based on lab measurements

Excerpt Taken from CAT Production Handbook 48th Edition.

USE OF BRAKE PERFORMANCE CURVES

The speed that can be maintained when the machine is descending a grade with retarder applied can be determined from the retarder curves in this section when gross machine weight and total effective grade are known.

Select appropriate grade distance chart that covers total downhill haul; don't break haul into individual segments.

To determine brake performance: Read from gross weight down to the percent effective grade. (Effective grade equals actual % grade *minus* 1% for each 10 kg/metric ton (20 lb/U.S. ton) of rolling resistance.) From this weight-effective grade point, read horizontally to the curve with the highest obtainable speed range, then down to maximum descent speed brakes can safely handle without exceeding cooling capacity. When braking, engine RPM should be maintained at the highest possible level without overspeeding. If cooling oil overheats, reduce ground speed to allow transmission to shift to next lower speed range.

Brake Performance Curves are made in compliance with ISO 10268 and applicable to Sea Level and 32° C (90° F) temperature. Contact Factory for Application Specific Performance.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

For best results, use Caterpillar Fleet Production and Cost Analysis (FPC) to simulate cycle time, fuel burn, and production for Application Specific Performance inquiries. Contact Factory Representative or visit catminer.cat.com/stb for more information.

(See Wheel Tractor Scraper Section)

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example —

With a favorable grade of 20% and rolling resistance of 50 kg/metric ton (100 lb/U.S. ton), find Total Effective Grade.

(50 kg/metric ton) = 50 − 10 = 5% Effective Grade (from Rolling Resistance)
100 lb/ton = 100 − 20 = 5% Effective Grade
20% (grade) – 5% (resistance) =
15% Total Effective Grade

TYPICAL FIXED TIMES FOR HAULING UNITS

Wait time, delays and operator efficiency all impact cycle time. Minimizing truck exchange time can have a significant effect on productivity.

Fixed time for hauling units include:
1. Truck load time (various with loading tool)
2. Truck maneuver in load area (Truck exchange) (Typically 0.6-0.8 min.)
3. Maneuver and dump time at dump point (Typically 1.0-1.2 min.)

Total cycle time is the combination of:
1. The above fixed time
2. Hauling time (Loaded)
3. Return time (Empty)

Example — assume load tool spots hauler with full bucket

		988F	5130B
cycle times		.60	.45
First pass	(dump time)	.10 min.	.05 min.
2 passes	(full cycle)	.70	.50
3 passes	"	1.30	.95
4 passes	"	1.90	1.40
5 passes	"	2.50	1.85
6 passes	"	3.10	2.30
7 passes	"	3.70	2.75
8 passes	"	4.30	3.20
9 passes	"	4.90	3.65
10 passes	"	5.40	4.10

NOTE: Other sizes of loading tools will have different cycle times. See Wheel Loader section for **average** cycle times for truck loading.

Excerpt Taken from CAT Production Handbook 48th Edition.

APPENDIX N

BLM EA's & NEPA

United States Department of the Interior
Bureau of Land Management

Environmental Assessment
DOI-BLM-UT-C010-2014-0061-EA

February 26, 2015

CS Mining, LLC
Milford Operations Area Project Expansion

Location:
Beaver County, Utah

Applicant/Address:
CS Mining, LLC
1208 South 200 West
Milford, UT 84751

Cedar City Field Office
176 East DL Sargent Drive
Cedar City, Utah 84721
435-865-3000

BLM

CS Mining, LLC Milford Operations Area Proposed Expansion

DOI-BLM-UT-C010-2014-0061-EA

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CS Mining, LLC Milford Operations Area Proposed Expansion
DOI-BLM-UT-C010-2014-0061-EA

1.0 PURPOSE & NEED

1.1 Introduction

This Environmental Assessment (EA) has been prepared to disclose and analyze the environmental consequences of the Milford Operations Area (MOA) Project Expansion as proposed by CS Mining, LLC (CSM). The EA is a site-specific analysis of potential impacts that could result with the implementation of a proposed action or alternatives to the proposed action. The EA assists the BLM in project planning and ensuring compliance with the National Environmental Policy Act (NEPA), and in making a determination as to whether any "significant" impacts could result from the analyzed actions. "Significance" is defined by NEPA and is found in regulation 40 CFR 1508.27. An EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a statement of "Finding of No Significant Impact" (FONSI). If the decision maker determines that this project has "significant" impacts following the analysis in the EA, then an EIS would be prepared for the project. If not, a Decision Record may be signed for the EA approving the selected alternative, whether the proposed action or another alternative. A Decision Record (DR), including a FONSI statement, documents the reasons why implementation of the selected alternative would not result in "significant" environmental impacts (effects) beyond those already addressed in Pinyon Management Framework Plan, approved June 10, 1983.

1.2 Background

The CSM MOA is located approximately seven miles northwest of Milford in Beaver County, Utah (**Figure 1.2-1**), on a mixture of public lands administered by the Bureau of Land Management (BLM), Utah School and Institutional Trust Lands Administration (SITLA) lands, and private lands owned by CSM. The CSM MOA consists of parts of Sections 5-8, 15-17, 20-23, 26-28, and 34 in Township 27 South, Range 11 West, Salt Lake Base Meridian (SLBM), and part of Section 31 in Township 26 South, Range 11 West, SLBM (**Figure 1.2-1**). The mineral proposed for extraction from this area is copper, which generally occurs with iron, molybdenum, gold, and silver in oxidized pipes and skarn deposits.

CSM proposes to increase the life expectancy of its operations by expanding mining in the existing three open pits (Hidden Treasure, Bawana, and Sunrise), as well as by opening new pits within the boundary of the MOA. CSM also proposes to conduct exploration activities on known ore bodies in the MOA.

1.3 Purpose and Need for the Proposed Action

CSM has submitted a Plan of Operations for the Milford operations area in order to explore, mine, and process mineral resources. Copper is the third most used metal, behind iron and aluminum, in the United States and the world. The metal has diverse and well established uses on which modern society relies heavily. Total copper demand in the United States in 2011 was estimated at 3.92 billion pounds. While 35 percent of this demand is being met by scrap

recovery and recycling, the remainder must be extracted from naturally occurring deposits of copper-containing minerals. The proposed action has the ultimate goal of supporting the extraction and recovery of known deposits of copper mineralization from private and BLM lands in the permit area.

With regard to the activities proposed and regulated under the applicable 43 CFR 3809 regulations, consistent with section 2 of the Mining and Policy Act of 1970 and section 102(a)(7), (8), and (12) of the Federal Land Policy and Management Act, it is the policy of the Department of the Interior to encourage the development of Federal mineral resources and reclamation of disturbed lands. Under the mining laws, a person has statutory right, consistent with Departmental regulations, to go upon the open Federal lands for the purpose of mineral prospecting, exploration, development, extraction, and uses reasonably incident thereto.

1.4 Conformance with BLM Land Use Plan(s)

The Proposed Action is subject to the Pinyon Management Framework Plan, approved June 10, 1983. Although the Proposed Action is not specifically mentioned in the plan, it is clearly consistent with the objectives, goals, and decisions of the approved plan. It has been determined that the proposed action would not conflict with other decisions throughout the plan.

1.5 Relationship to Statutes, Regulations, or Other Plans

To date, there have been six EAs prepared by the BLM in concurrence with the expanding and evolving operations. The EAs are:

- DOI-BLM-UT-C010-2013-0053-EA December 2013 – Hidden Treasure Mine – Amendment 3
- DOI-BLM-UT-C010-2012-0020-EA September 2012 - Hidden Treasure Mine
- DOI-BLM-UT-C010-2009-0054-EA September 2009 - Sunrise Exploration Project
- DOI-BLM-UT-C010-2009-0061-EA August 2009 - Bawana Stockpile Removal
- DOI-BLM-UT-C010-2009-0027 January 2009 - Copper Ranch Exploration
- EA UT-040-06-34 September 2008 - Candy B Exploration

The Proposed Action is consistent with federal, state and local laws, regulations, and plans to the maximum extent possible, including the following:

- Section 2 of the Mining and Policy Act of 1970 and section 102(a)(7), (8), and (12) of the Federal Land Policy and Management Act, it is the policy of the Department of the Interior to encourage the development of Federal mineral resources and reclamation of disturbed lands. Under the mining laws, a person has statutory right, consistent with Departmental regulations, to go upon the open Federal lands for the purpose of mineral prospecting, exploration, development, extraction, and uses reasonably incident thereto Taylor Grazing Act of 1934
- Utah Standards and Guidelines for Rangeland Health
- Federal Land Policy and Management Act of 1976
- Section 106 of the National Historic Preservation Act of 1966, as amended
- Memorandum of Understanding Between the BLM Cedar City Field Office (CCFO) and Paiute Indian Tribe of Utah

- 1962 Bald and Golden Eagle Protection Act
- Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), as amended.
- Migratory Bird Treaty Act
- Utah Comprehensive Wildlife Conservation Strategy (CWCS)
- Utah Partners in Flight Avian Conservation Strategy Version 2.0.
- Birds of conservation concern 2002
- Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds
- IM 2008-050, Migratory Bird Treaty Act - Interim Management Guidance
- Best Management Practices for Raptors and Their Associated Habitats in Utah (IM: 2006-096)

Utah's Standards for Rangeland Health address upland soils, riparian/wetlands, desired and native species and water quality. These resources are either analyzed later in this document or, if not impacted, are listed in the attached Interdisciplinary Team NEPA Checklist (**Appendix A**).

1.6 Identification of Issues

Public notification was initiated by entering the project information on the Environmental Notification Bulletin Board (ENBB), a BLM environmental information site on October 8, 2014. To date, no comments have been received concerning the project.

The proposed action was reviewed by an interdisciplinary team. How resources in the area might be affected were identified. The results of this review are contained in the Interdisciplinary Team Checklist, **Appendix A**. Resource which might be affected include cultural resources, invasive weeds, livestock grazing, mineral resources, socio-economics, soils, vegetation and wildlife.

1.7 Issues Considered but Eliminated from Further Analysis

No other issues have been considered for analysis.

1.8 Summary

This chapter has presented the purpose and need of the proposed project, as well as the relevant issues, i.e., those elements of the human environment that could be affected by the implementation of the proposed project. In order to meet the purpose and need of the proposed project in a way that resolves the issues, the BLM has considered and/or developed a range of action alternatives. These alternatives are presented in Chapter 2. The potential environmental impacts or consequences resulting from the implementation of each alternative considered in detail are analyzed in Chapter 4 for each of the identified issues.

2.0 DESCRIPTION OF ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2.1 Introduction

This environmental assessment focuses on the Proposed and No Action alternatives. Other alternatives were not considered because the issues identified during scoping did not indicate a need for additional alternatives or mitigation beyond those contained in the proposed action. The no action alternative is considered and analyzed to provide a baseline for comparison of the impacts of the proposed action.

2.2 Alternative A – Proposed Action

The Proposed Action is for the BLM to consider approval of CSM's proposal for further development related to surface mining and processing activities within the MOA, as outlined throughout this section. Due to the relatively small and scattered nature of the copper deposits within the MOA, CSM proposes to continue to conduct mining, processing, and reclamation activities on the currently active areas, while concurrently developing new exploration targets for new open pit development, and improving existing infrastructure.

The Proposed Action would include two main types of operation:

- Exploration
- Mining Future Pits

In addition, there would be associated ancillary/support facilities or components, such as haul roads, fencing, signing, runoff control features, and monitoring wells. CSM also proposes to improve existing infrastructure such as power lines and water lines for better efficiency on an as-needed basis. These are described after the two types of operation. Approximate acreages of proposed disturbance are listed in **Table 2.2-1** below.

Mining is anticipated to be completed in stages: concurrent development of new mines while existing mines are in the process of being reclaimed. As is described in **Mining Activities** below, many of the current or proposed pits will be backfilled with waste rock from future pits.

Table 2.2 –1 General Disturbances for the MOA Project Expansion

Operation Area/acres	Project Component	BLM Lands (acres)	Private Lands (acres)	SITLA Lands (acres)	Total Disturbance (acres)
Proposed Open Pits and Dumps	Hidden Treasure Expansion	40	10	0	50
	Sunrise Expansion	60	30	0	90
	Copper Ranch	145	40	50	235

Operation Area/acres	Project Component	BLM Lands (acres)	Private Lands (acres)	SITLA Lands (acres)	Total Disturbance (acres)
	Candy B/Maria	130	40	0	170
	Crossroads	20	0	0	20
	Niagara/Copper Hill	0	60	0	60
Proposed Exploration Targets	Big Wash	80	0	0	80
	Crossroads	60	0	0	60
Proposed Ancillary Facilities	Haul roads	60	40	20	120
	Power Lines	50	50	N/A	100
	Water Lines	70	70	N/A	140
	Miscellaneous ancillary facilities	50	50	N/A	100
TOTALS		765	390	70	1225

Exploration

The MOA has numerous targets for potential copper ore bodies, as discovered during a magnetic survey of the area by CSM in 2009 (Emerson GIS 2009). Currently, CSM is proposing exploration plans for two additional targets: Big Wash and Crossroads (**Figure 2.2-1**). In addition, many of the approved exploration targets that have been analyzed in the six EAs written to date could expand to include further drill holes if ore bodies are encountered during initial drilling. CSM will provide the necessary agencies with updated drill plans prior to expanding exploration operations. Upon completion of the exploration projects, any disturbed lands will be ripped and prepared for seeding during the upcoming fall season.

Big Wash Exploration

The Big Wash Exploration project area is located in Sections 27, 28, 33 and 34, T. 27 S., R 11 W., SLBM. The area has a high magnetic anomaly with similarities to the known skarn ore deposits in the immediate area. No known drilling has been performed to characterize the possibility of an additional ore deposit. CSM is proposing to drill an initial 8 drill holes to identify possible resources. Additional drill holes would follow depending on the results of the initial 8 drill holes. The defined exploration area is approximately 400 acres in size, all located on BLM land. Of those 400 acres, approximately 80 acres are proposed to be disturbed for exploration and condemnation purposes. At any given time during the exploration project, however, roads and pads will only be prepared for six holes; three for current drilling, and three prepared for immediate mobilization to the next area. Once the initial three holes have been completed, the area will be ripped and prepared for seeding during the upcoming fall season. So although the overall disturbance is anticipated to be 80 acres, due to concurrent reclamation, only 20 acres are anticipated to be left un-reclaimed at any given time.

Crossroads Exploration
The Crossroads Exploration project area is located in Sections 7, 17 and 18, T. 27 S., R. 11 W., SLBM. The initial proposed exploration would be the drilling of 42 holes on 200 foot centers. It is anticipated that an additional 500 drill holes would be drilled depending on the initial drilling results. The project area is approximately 295 acres located completely on lands administered by BLM. Of those 295 acres, approximately 60 acres are proposed to be disturbed for exploration and condemnation purposes. At any given time during the exploration project, however, roads and pads will only be prepared for six holes; three for current drilling, and three prepared for immediate mobilization to the next area. Once the initial three holes have been completed, the area will be ripped and prepared for seeding during the upcoming fall season. So although the overall disturbance is anticipated to be 60 acres, due to concurrent reclamation, only 20 acres are anticipated to be left un-reclaimed at any given time.

Mining Activities

CSM proposes to develop four more open pits, each with their own respective waste dump and topsoil stockpile: Niagara/Copper Hill, Copper Ranch, Candy B/Maria, and Crossroads. CSM would conduct mining in proposed pits by use of open pit mining methods. CSM would utilize such mining methods as drilling and blasting, loading material via loader or track hoe, and hauling material to their respective areas (waste dump or process facilities) with 60-ton or 100-ton haul trucks. For all proposed pits and associated dumps, available topsoil from the areas would be salvaged and stockpiled prior to commencement of mining. The topsoil stockpiles would be seeded with an interim seed mix provided in CSM's Utah Division of Oil, Gas and Mining (UDOGM) Notice of Intent (NOI) to help minimize erosion and the encroachment of noxious weeds. A complete copy of CSM's UDOGM NOI can be found online.

Concurrent reclamation of the pits, dumps, and haul roads would be performed as mining in new areas commence. Reclamation for all new disturbances would be performed according to standards set by UDOGM and the BLM, and would follow similar guidelines as the currently approved areas of disturbance.

Hidden Treasure and Sunrise Expansion
Both the Hidden Treasure and the Sunrise open pits are proposed to be expanded beyond their currently approved footprint. The expansion of the Hidden Treasure pit would follow the Hidden Treasure vein to the northwest on BLM land. The proposed timeline for expanding the Hidden Treasure pit would occur between the years 2016 and 2017, after the Candy B/Maria pit has been extended to the south and southeast. The reason for the timing is so the waste material from the Hidden Treasure Expansion can be used to backfill the north end of the Candy B/Maria pit. Backfilling of the Candy B/Maria pit would continue as allowable by the extension of the Candy B/Maria pit to the south and southeast.

The approximate acreage associated with the expansion of the Hidden Treasure mine is 30 acres for the pit, and 20 acres for the dump, since waste material from the initial layback of the Maria pit would be deposited on the Hidden Treasure Dump. Forty acres of the new disturbance related to the Hidden Treasure expansion would occur on BLM land.

The expansion of the Sunrise pit would encompass the Old Hickory pit, which is a historic pit located northwest of the Sunrise pit (**Figure 2.2-1**). As the Sunrise pit expanded to the north, the

southern portion of the existing pit would begin to be backfilled with waste material. Although backfilling of the southern portion of the Sunrise pit would occur concurrently with extension to the north, the waste dump would also be expanded to include any remaining waste material. The approximate acreage associated with the expansion of the Sunrise mine is 50 acres for the pit, and 40 acres for the mine waste dump, for a total new disturbance of 90 acres. Approximately 60 acres of the new disturbance related to the Sunrise mine and dump expansion would occur on BLM land. Expansion of the Sunrise pit and dump would likely occur between the years 2015 and 2017, depending on finalizing logistics and obtaining necessary permits.

Niagara/Copper Hill Pit and Waste Dump

The Niagara/Copper Hill deposit is located directly north of the currently approved Bawana pit. The proposed open pit and related haulage roads for the Niagara/Copper Hill deposit would encompass 60 acres of private land. The waste rock from the Niagara/Copper Hill mine is proposed to be used to completely backfill the Bawana Pit. Any remaining waste that is encountered during mining of the Niagara/Copper Hill deposit would be placed as lifts on the existing Bawana waste dump. The total footprint of the Niagara/Copper Hill waste dump would be within existing disturbance related to the Bawana waste dump, so no additional acreage would be disturbed. Commencement of mining operations in the Niagara/Copper Hill pit would likely occur between the years 2014 and 2015, depending on finalizing logistics and obtaining necessary permits.

Copper Ranch Pit and Waste Dump

Under UDOGM exploration permit E/001/0159, CSM has drilled 354 holes to explore and delineate the ore reserve near the Copper Ranch Knoll. The average drill hole depth is 295 feet with the deepest single hole at 845 feet. CSM is proposing to develop an open pit mine and dump to be located on BLM, private, and SITLA lands located in Sections 16 and 17, T. 27 S., R. 11 W., SLBM (**Figure 2.2-1**). The pit would be 80 acres with 40 acres located on BLM, 40 acres on private and 5 acres on SITLA lands. The dump would be 150 total acres with 105 acres located on BLM and 45 acres on SITLA lands. Commencement of mining operations in the Copper Ranch Pit would likely occur between the years 2014 and 2017, depending on finalizing logistics and obtaining necessary permits.

Candy B/Maria Pit and Waste Dump

Under UDOGM exploration permit E/001/0152, CSM's predecessor, Western Utah Copper Company (WUCC) drilled 35 holes to explore and delineate the ore reserve near the Candy B and C patented mining claims. The average drill hole depth is 573 feet with the deepest single hole at 985 feet. CSM is proposing to develop an open pit mine and dump on BLM and private lands located in Sections 22, 23, 26 and 27, T. 27 S., R. 11 W., SLB&M (**Figure 2.2-1**). The pit would encompass the existing Maria pit and disturbance, which totals 30 acres of existing disturbed area. The proposed Candy B/Maria pit would be a total of 100 acres of new disturbance, with 60 acres located on BLM land and 40 acres located on private land. The initial waste material from the Candy B/Maria pit would be placed as lifts on the exiting Hidden Treasure waste dump. Once the Hidden Treasure waste dump has reached capacity without extending beyond its current footprint, waste material would be placed in a proposed waste dump located on the western flank of the southern end of the Rocky Range (**Figure 2.2-1**). The dump would be 70 acres, all of which would be located on BLM land. Commencement of mining

operations in the Candy B/Maria Pit would likely occur between the years 2014 and 2015, depending on finalizing logistics and obtaining necessary permits.

Crossroads Pit and Waste Dump

There has been limited drilling in the vicinity of the proposed Crossroads pit. A known copper deposit is exposed on the surface of a proposed small pit. The Crossroads pit and dump would total 20 acres, all on BLM lands located in Section 7, T. 27 S., R. 11 W., SLBM. Commencement of mining operations in the Crossroads Pit would likely occur in the year 2016, depending on finalizing logistics and obtaining necessary permits.

Processing Facilities

There are no proposed process facilities related to the MOA project expansion at this time. In the future, if CSM decides to add additional process facilities, an amended plan would be submitted to the appropriate agencies.

Tailings Facilities

There would be no new tailings facilities related to the MOA project expansion at this time. In the future, if CSM decides to add an additional tailings facility, an amended plan would be submitted to the appropriate agencies.

Ancillary Features

Ancillary facilities include new haul roads, realignment of existing haul roads, power lines, water lines, and other small features that assist in the mining and processing of copper ore. Ancillary facilities would most likely be located on a mixture of private, state, and public land. CSM would like to request an allotment of 230 acres of BLM land for ancillary facilities as outlined in this section.

Haul Road Re-alignment

CSM would need to re-align their existing haul road because two of the identified ore bodies lie directly under the haul road. The Candy B/Maria pit and the Copper Ranch pit would eliminate the existing haul road when the ore deposits were mined. The proposed alignment would run from the Candy B/Maria pit location in the NW1/4 of Section 22, through the NE1/4 of Section 21 until it intersects SITLA land in Section 16, a distance of 0.85 miles. Thence through the SW1/4 of Section 16 (0.70 miles); through private patented land (0.23 miles) and then through BLM lands (1.36 miles) where it would intersect with the existing haul near the proposed Crossroads pit.

The new haul road alignment would be approximately 16,579 feet (3.14 miles) in length and 100 feet wide for a total of approximately 40 acres. A total of 27 acres would be on BLM lands, 10 acres on SITLA lands, and 3 acres on private patented lands. Other proposed disturbances related to haul road improvements, such as widening existing haul roads, or creating new haul roads for proposed pit and dump expansions, would potentially impact an additional 33 acres of BLM land.

Water Line, Power Line, and Miscellaneous Ancillary Facilities and Disturbances

Associated with the MOA project expansion would be installation of improved power and water lines. Although the details of the power and water line routes are not fully known, the most

likely course of action would be for any new or improved route to either follow existing routes, right-of-ways (ROWs), or parallel existing haul roads. If a new route is later proposed on undisturbed land, not within any haul road or power line easement or existing route, CSM would submit the revised plan to the BLM for review.

Miscellaneous ancillary facilities and disturbances that might occur in conjunction with the MOA project expansion include: temporary construction laydown areas, storm water control features (such as berms, ditches, turn-outs, and sumps); and pads for temporary structures such as portable office trailers or storage containers.

Design Features to Minimize Impacts

Design features proposed by CSM to minimize impacts are contained in **Appendix B.**

Reclamation

At the conclusion of current and proposed operations, CSM would reclaim the MOA using standards outlined in **Appendix B**, and in more detail in CSM's UDOGM NOI. If at any time the BLM would like reclamation of disturbances within the MOA to be performed differently than what is specified in the UDOGM NOI, CSM would work with all applicable Federal and State agencies on a revised reclamation plan that meets the agencies' standards.

2.3 Alternative B – No Action

The no action alternative would not allow the proposed disturbances to occur on BLM lands. The no action alternative could be chosen if the proposed action would result in undue and unnecessary degradation of public lands. The proposed action could also be revised so that exploration and mining could be completed without causing unnecessary or undue degradation.

Under the mining laws, the project proponent has the statutory right to enter and conduct exploration, mining and mining related activity, subject to applicable laws and regulations. The Federal Land Policy and Management Act of Oct. 21, 1976 directed the Secretary of the Interior to take any action necessary by regulation or otherwise to prevent undue and unnecessary degradation of the public lands. With respect to surface disturbances associated with unpatented mining claims, the Secretary of the Interior has implemented the 43 CFR 3809 regulations to accomplish this mandate. Undue and unnecessary degradation is currently defined in the regulations as a failure to comply with the performance standards of 43 CFR 3809.420, a failure to follow the terms and conditions of an approved plan of operations, a failure to comply with other State and Federal laws related to environmental protection and the protection of cultural resources and a failure to demonstrate that the operations are reasonably incident to prospecting, mining, or processing operations.

2.4 Alternatives Considered, but Eliminated from Further Analysis

No other alternatives were considered because impacts would not likely be fewer using other locations or facilities.

3.0 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter presents the potentially affected existing environment (i.e., the physical, biological, social, and economic values and resources) of the impact area as identified in the Interdisciplinary Team Checklist found in **Appendix A** and presented in Chapter 1 of this assessment. This chapter provides the baseline for comparison of impacts/consequences described in Chapter 4.

3.2 General Setting

Current approved disturbance for the CSM MOA is approximately 456 acres of a mixture of Federal (BLM), State, and private land (**Table 3.2-1**). This disturbance includes open pits, waste dumps, topsoil stockpiles, process facilities, ancillary facilities, and tailings dams. CSM currently mines copper and magnetite ore from three pits: Hidden Treasure, Bawana, and Sunrise. Material extracted from the pits are either placed in the respective mine waste dumps, or hauled to the process facilities located northwest of the pits. The life expectancies of the pits under CSM's currently approved mine plan are: six months for the Hidden Treasure Pit; two months for the Bawana Pit; and two months for the Sunrise Pit. The total life expectancy of the MOA at the time this report was written is a little less than one year.

Table 3.2-1 Currently Approved Disturbance for the CSM MOA

Type of Operations	Public Land (BLM) Disturbance (acres)	Private Land Disturbance (acres)	State Land Disturbance (acres)	Total Approved Disturbance (acres)
Open Pits	27.18	28.13	0	55.31
Waste Dumps	139.97	12.94	0	152.91
Topsoil/Ore Stockpiles	7.2	10.5	6.1	23.8
Access and Haul Roads	19.6	9.9	4.9	34.4
Process Facilities	0	96.3	0	96.3
Intermediate tailings disposal facility (ITDF)	0	89.6	0	89.6
Ancillary Facilities	2.7	1.1	0	3.8
TOTAL DISTURBANCE	**196.65**	**248.47**	**11**	**456.12**

A description of the existing exploration and mining disturbances is contained in **Appendix C**.

3.3 Resources/Issues Brought Forward for Analysis

The affected environment of the proposed action and no action alternatives were considered and analyzed by an interdisciplinary team as documented in the Interdisciplinary Team Checklist, **Appendix A**. The checklist indicates which resources of concern are either not present in the project area or would not be impacted to a degree that requires detailed analysis. Resources

which could be impacted to a level requiring further analysis are described in this chapter and impacts to these resources are analyzed in Chapter 4.

3.3.1 Cultural Resources

Cultural resources are the evidence of how humans relate to their environment which can be seen through examples such as cultural uses of the environment, the built environment, and human social institutions. There are three major categories of cultural resources in the Cedar City Field Office: prehistoric and historical resources, architectural resources, and traditional cultural properties (TCPs).

From 1982-2012, 31 cultural resource pedestrian surveys were conducted within the area of potential affect (APE), see Table 1. All of these surveys conducted were for cultural resources clearance for earlier mining-related projects. The 31 sites found include 25 historical sites, 2 multicomponent sites (containing both historical and prehistoric components), and 4 prehistoric sites. Historical sites are mainly mining-related activities such as prospect pits, mining claim markers, refuse scatters and mines, while prehistoric sites are mainly lithic scatters. Diagnostic artifacts found for the prehistoric sites indicate an Archaic to Fremont occupation of this area. Of the 31 sites, 9 are eligible for the National Register of Historic Places (NRHP) and 22 are not eligible for the NRHP.

Table 1. Cultural Surveys

State Project Number	Project Title	Acres Surveyed in APE	% of APE Surveyed
U82UA0076	IPP Intensive	17.3	0.2%
U94BL0462	Rocky Range Well	2.2	0.0%
U95BL0719	Kiewet Mining - Railroad Ballast	3.1	0.0%
U95BL0720	West Hills Gravel Exploration	0.5	0.0%
U95IG0562	Kiewit Mining Group - Range Quarry and Roads	26.3	0.3%
U96IG0343	Ross Centurion Mines Powerline	49.1	0.6%
U97AS0655	Twin Mountain Rock Quarry Expansion Area	55.4	0.7%
U97BL0140	Indian Ridge Prescribed Burn	3.5	0.0%
U98BL0418	Nevada Star Mining Plan	39.7	0.5%
U02BL0367	Western Utah Copper Mine	7.4	0.1%
U03BL1098	PV Notice	8.8	0.1%
U04BL0361	Coyote Spring Pipeline	20.2	0.2%
U04BL1258	Wind Energy Test Tower	2.3	0.0%
U04IG0533	Dotson-Milford Mineral Belt, Drill and Access	5.7	0.1%
U05BL0868	Hidden Treasure Roads	28.3	0.3%
U05IG0046	Dotson-Beaver Lake West Drill Sites Survey	6.4	0.1%
U05IG0649	Dotson-Rocky Range Drill Sites	8.8	0.1%
U06BL1725	Milford Ballast Rock Quarry Permit	1.4	0.0%

	Application Project		
U06IG1419	Dotson - ECB - WCB Drill Sites and Access Road	3.9	0.0%
U06ME0101	Milford Gas Pipeline	55.3	0.7%
U06SQ1530	NSL To Las Vegas 400 Mile Pipeline UNEV	42.8	0.5%
U07IG1440	Dotson-Candy B BLM Lease Survey	39.5	0.5%
U08IG0093	Dotson - Water Well Drill Sites Survey	3.8	0.0%
U08IG1148	WUCC - Copper Range Survey	218.1	2.7%
U08IG1149	WUCC - Concentrator Water System Survey	10.6	0.1%
U09EO0612	Sigurd to Red Butte Transmission Corridor	2.6	0.0%
U09IG0273	WUCC- Sunrise Mine Survey	131.7	1.6%
U10EO0510	Sigurd To Red Butte Transmission Line	19.8	0.2%
U12HO0544	A Cultural Resource Inventory Of The CS Mining Milford Copper Mine Power Line Corridor, Beaver County, Utah	4.5	0.1%
U12HO0692	A Cultural Resource Inventory Of The Bawana & Sunrise Mine Exploration Areas & Waterline Corridor, Beaver County, Utah	418.5	5.2%
U12HO1000	Hidden Treasure West	932.3	11.5%
	TOTAL	2169.9	26.8%

3.3.2 Livestock Grazing

The project area is located in the Frisco Allotment, which has the following use:

PERMITTEE	ALLOT-MENT	NUMBER OF LIVESTOCK	KIND OF LIVESTOCK	SEASON OF USE	PERCENT PUBLIC LAND	AUMS*
R. Larson Sheep Co.	Frisco	2640 1800 50	Sheep Sheep Cattle	10/16-03/31 04/01-05/31 10/16-05/31	92% 100%	2683 664 376

*Animal Unit Months

The vegetative monitoring report completed at the time of the grazing permit renewal in 2008 concluded that the Standards and Guidelines for Healthy Rangelands were being met within the Frisco Allotment with the exception of Standard 3. Rangeland Health Standards and Guidelines Assessments were completed within the allotments in August of 2006. Standard 3 was not being met within the allotment due to the presence of cheatgrass, broom snakeweed, and halogeton. However, it was determined that these areas within the allotment are making progress toward

meeting the standard. The allotment was in a severe drought between 1999 and 2004, which was determined to be a causal factor for the conditions of the allotment. In addition, it was determined that mining, exploration, and historic livestock grazing had introduced the invasive species and these species were spread through those continued activities. Furthermore, it was determined that in isolated areas of disturbance within the Frisco Allotment it would take chemical and mechanical treatment to move the vegetation to a more diverse plant community with an increase in perennial grasses and forbs that would improve the habitat for most wildlife species.

Utilization has been collected following the grazing permit renewal to assess livestock grazing. Utilization collected in 2009 and 2011 were within acceptable utilization objectives.

3.3.3 Mineral Resources

The proposed action would remove ore and waste material from the pits specified in Chapter 2 of this EA. An inventory of indicated or inferred tonnage of ore contained in each ore deposit was performed in 2013. The results of that inventory are specified in **Table 3.3-1** below.

Table 3.3-1 Indicated or Inferred Ore Tonnage for Deposits within the CSM MOA

DEPOSIT	STATUS	ORE TONNAGE	ORE GRADE
BAWANA	Indicated	175,000	0.91%
NIAGARA/ COPPERHILL	Inferred	1,500,000	1.70%
SUNRISE	Inferred	1,021,000	1.12%
HIDDEN TREASURE	Indicated	448,000	1.80%
COPPER RANCH	Indicated	6,288,000	0.65%
CANDY B	Inferred	11,600,000	0.81%
MARIA	Indicated	787,000	1.13%
TOTALS		**21,819,000**	**1.23%**

Due to the nature of mine modeling, actual tons of ore and waste anticipated to be moved during mining activities is still unknown.

3.3.4 Socioeconomics

The project area falls in the center of Beaver County, which is a large, mostly rural county with an overall population of about 6,460 in 2013 (USCB 2014). The population of the county is concentrated in three communities: Beaver, Minersville, and Milford. Milford, with a population of 1,409, is the closest community to the proposed project area, being about four miles to the southeast. Total wages in the county totaled $90 million in 2013 of which $9.2 million (10 percent) was attributable to jobs in mining. There were 193 employed in the mining industry in Beaver County in 2013 (BLS 2014). The principal employers being CS Mining (the current project proponent) and Martin Marietta Minerals, which operates the Milford Quarry, a ballast rock quarrying operation.

3.3.5 Soils

There is no published Natural Resources Conservation System (NRCS) soil survey data available for this area and digital data is "spotty" such that only portions of the project area have received preliminary mapping in which the soil series were defined. Generally speaking, the project is located on shallow to deep gravelly, cobbly or stoney semi-desert loam ecological sites, which occur on dissected alluvial fans and valley plains. The soils are formed in alluvium derived mainly from mixed igneous parent materials. Soils on the valley floor and transition areas can be deep and well drained. Soils on side slopes are shallow to bedrock. Topsoils on these sites are not abundant, ranging in depth from zero to 12 inches to a generally alkaline heavy clay layer. The potential for soil loss from sites in depleted condition is approximately 5 tons per acre per year. Soils on the side slopes are shallow to bedrock and potential losses are proportionately less, as less erodible soils are exposed to the elements and are instead under protective rock armor.

3.3.6 Vegetation, including Invasive Species

The plant community is characterized by an overstory of either Wyoming big sagebrush or black sagebrush. Sometimes the two species hybridize, making plant identification difficult. This particular area likely receives from 6 to 8 inches of precipitation, so regardless of the species, the sagebrush is short, generally less than 2 feet tall and capable of providing protection from the erosive forces of wind and water. This plant community is in a moderately depleted range condition, likely because of its close proximity to Milford, Utah, from which hundreds of thousands of grazing animals were freighted historically. This area would have likely been a "holding area" for livestock awaiting shipment. As a result, it has kept its sagebrush overstory, but desirable understory species (e.g. Indian ricegrass, bottlebrush squirreltail and globemallow) are lacking.

When ecological sites such as those described for this site are subject to disturbances of soils and vegetation, such as grazing or mining, noxious and invasive plants (eg cheatgrass, rabbitbrush, Russian thistle and halogeton) can thrive. Reclamation of this site would prove difficult because of the low moisture it receives, shallow and potentially highly alkaline soils and the potentially high density of invasive species, which would compete for nutrients and limited available moisture. Reclamation seed mixes (both interim and final) should contain plant species which are relatively aggressive and competitive with invasive weeds.

Historic mine dumps in the area, which have not been disturbed in the last 50 years, have partially revegetated without being dominated by halogeten, while areas which were more recently disturbed are covered in halogeten, in spite of multiple reseeding attempts. This is likely due to a decrease in precipitation in the region. Redisturbing these historic dumps could further increase the presence of invasive weeds. It is more likely that successful revegetation would occur by not disturbing revegetating slopes and reclaiming newer disturbances using a terrace system. This process would not disturb the entire dump face during reclamation, but would place terraces on the dump slope which would be used for topsoil placement and reseeding. Concentrating topsoil and water use in these smaller areas could improve vegetative recovery and reduce the encroachment of halogeten.

3.3.7 Wildlife

The project area is generally semi-arid, high-desert country characterized by dissected hills of relatively low relief surrounded by valley flats. The project area is located between 5,200 and 5,800 feet elevation above mean sea level in an area with flats dominated by big sagebrush (*Artemisia tridentata*) and the hills/mountains dominated by black sagebrush (*Artemisia nova*). Sagebrush provides important winter habitat for several wildlife species (e.g., mule deer and pronghorn) and localized habitat for sagebrush-obligate species (e.g., pygmy rabbit and Brewer's sparrow). Sagebrush also provides important breeding, nesting, and brood-rearing habitat for these species and others.

General wildlife observations were made along with surveys for raptors and bats, conducted in the project area on several occasions during 2013 (JBR 2013) and 2014 (JBR 2014). This section describes the results of raptor and bat surveys, and also describes big game and other potential wildlife in the area.

Animals observed within or directly adjacent to the project area are listed in Table 3.3-2 in Appendix D.

Raptors

Special habitat needs for raptors include nest sites, foraging areas, and roosting or resting sites. Buffer zones are usually recommended around raptor nest sites during early spring and summer when raptors are raising their young. The most utilized raptor nesting areas are generally found along riparian areas and cliff faces.

Sixty large stick nests, suitable for use by raptors, were found/checked (JBR 2014) within the general raptor and golden eagle survey areas, which included the Rocky Range Mountains, the southern portion of the Beaver Lake Mountains, and the northern portion of the Star Range. Of the nests found/checked 10 were active, 6 with raptor species and 4 being used by ravens.

Golden eagles *(Aquila chrysaetos)*have been noted both within and near the project area. They are year round residents. Three active golden eagle nests have been discovered within the five-mile buffer of the MOA. There are consistent sightings of both adult and juvenile golden eagles within the MOA that further supports that golden eagles do nest in the vicinity (JBR 2014).

Of three active golden eagle nests identified during the 2014 survey (JBR 2014), two were successful and fledged chicks. Nest UT040002012 at the extreme north end of the survey area fledged two chicks. Nest UT040002020 at the extreme south end of the survey area fledged at least one chick and possibly two. Due to the nest location, extremely high on a rock face, and the depth of the nest, it was very difficult for surveyors to achieve a vantage point to see into the nest. One nest (UNK_012) failed. An eagle pair was observed improving this nest by surveyors during early spring, and a subsequent visit to the nest later in the 2014 nesting season confirmed a golden eagle incubating at the site. A final return visit to the nest for the purpose of verifying nesting success found the nest to be prematurely vacated. Surveyors were able to get higher than the nest and utilizing a spotting scope to see into the nest; there was no evidence of adult eagles or chicks in or near the nest. No deceased chicks were found in or under the nest, rather the nest was confirmed to be completely empty. The failed golden eagle nest was located adjacent to an

active common raven nest and during every previous nest site monitoring period ravens were observed harassing the nesting golden eagles.

Ferruginous hawk *(Buteo regalis)* have also been documented in the general area. Multiple years of raptor nest surveys have not documented any ferruginous hawk nests within 0.5 mile of the Project Area until the 2104 survey when a ferruginous hawk nest was identified in a power line structure next to the Marietta Mine crusher yard. This nest was active and fledged chicks.

The project area is suitable red-tailed hawk *(Buteo jamaicensis)*foraging habitat. One red-tailed hawk nesting territory has been documented within the 1-mile buffer of the MOA. It is a stick nest on a power line structure adjacent to a dirt road. This nest was active in 2012, but gone in 2013. It is unknown if an alternate nest within the territory was used..

Several raptor individuals (unassociated with nests) were seen during the general raptor survey event; two ferruginous hawks were seen courting and copulating near the edge of the 1-mile buffer survey area boundary but no nest was located in or near the survey area. Several American kestrels *(Falco sparverius)*, were also noted flying through the survey area but none were found to be nesting within the survey area. Prairie falcons were observed flying over the project area and two active prairie falcon nests were discovered well outside the 0.5-mile buffer.

Bats

There are four locations noted in or near the project area that have potential to contain bats. These locations include the old Sunrise adit, the Montreal adit, the Old Hickory 100 Level adit, and the Niagara adit. Appendix D contains information regarding species observed in surveys conducted in 2013 and 2014.

Of the bat species detected, only the Townsend's big-eared bat (*Corynorhinus townsendii*) and the fringed myotis (*Myotis thysanodes*) are considered special status species (BLM sensitive). The Townsend's big-eared bat was detected on the recordings at both the Niagara and Old Hickory adits during the fall acoustical monitoring period while the fringed myotis was only detected at the Niagara adit, during the spring acoustical monitoring period (JBR 2014). Fringed Myotis are present based on only two call sequences identified to this species; it is possible these two sequences are a different species, but due to their conservation status they were included.

Migratory Birds

Migratory birds are important components of biological diversity and indicators of environmental conditions at local, regional, and global scales. A variety of migratory birds are found in the project area. The most commonly occupied breeding habitat for migratory birds in the project area is sagebrush shrub steppe. A complete list of birds noted during the survey is located in **Table 3.3-3, located in Appendix D**.

Big Game

The project area is not in crucial winter range for mule deer or range for elk. However, it is within a large area that has been mapped by the Utah Division of Wildlife Resources as crucial yearlong pronghorn habitat (BLM 2013a). The mapped habitat covers the valleys of the western

deserts of Utah from Iron County to southern Box Elder County. Pronghorn are speedy ungulates that occur in open, dry habitats. In Utah, nearly all pronghorn populations occur in shrubsteppe containing large expanses of open, low, rolling, or flat terrain (UDWR 2009). The project area is located within the Southwest Desert Herd Management Area, which contains about 2 million acres of crucial yearlong habitat. The herd unit is below the population objective (BLM 2013b). The site characteristics provide suitable habitat: open country with sagebrush and perennial grasses and forbs. The project area is not known to be important pronghorn fawning nor wintering habitats. Pronghorn use of the project area appears to be limited due to low population numbers in this portion of the unit, limited species distribution in the area, and current levels of human disturbance (BLM 2013a).

Threatened, Endangered, Candidate, or Sensitive Animal Species

Table 3.3-4, in Appendix D, lists all special status animal species occurring in the Cedar City Field Office planning area. Special status species that have a moderate to high probability of being impacted by the project include burrowing owl *(Athene cunicularia)*, , big free-tailed bat (*Nyctinomops macrotis*) , fringed myotis, spotted bat *(Euderma maculatum)*, Townsend's big-eared bat, and Western red bat *(Lasirurs blossevillii)*. Other species would not be found in the survey area due to lack of suitable habitat. Details about their habitat are listed in **Table 3.3-4 in Appendix D**.

4.0 ENVIRONMENTAL IMPACTS

4.1 Direct and Indirect Impacts

Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

4.1.1 Alternative A – Proposed Action

Cultural Resources
The results of the cultural resource records search indicate both prehistoric and historical use of the proposed action area. Based on the previously recorded sites within the proposed action area, expected cultural resources include prehistoric sites with artifacts commonly attributed to the Archaic through the Fremont cultural phases, while historical resources will be primarily mining-related.

During the cultural resource records search, 9 NRHP-Eligible sites were noted within the Proposed Action area. Due to the nature of the Proposed Action, these sites would be adversely affected if disturbed. A historic properties treatment plan would be developed and implemented to resolve adverse effects to these historic properties.

Class III cultural surveys would be completed before any surface disturbing activity was initiated. Most historic properties found would be avoided. Historic properties which could not be avoided would be mitigated in coordination with the Utah State Historic Preservation Office. About 9 sites incorporating approximately 51 acres of historic properties may be affected.

Livestock Grazing
The proposed project would disturb vegetation on 765 acres of BLM administered land which would reduce the AUMs on the allotment by approximately 64. This could reduce the current permitted livestock use on the Frisco Allotment by 9 head of cattle or 63 head of sheep. This would be a reduction of 18% of the allotted number of cattle and about a 1% reduction in the allotted number of sheep. The kind of livestock, season of use, grazing system, and water resources would not be changed or impacted by the project.

4.1.1.1 Mineral Resources
Approximately 22 million tons of copper-bearing minerals would be permanently removed from land within the MOA. Waste rock moved during mining operations would either be placed on new or expanded dumps, or would be used to backfill existing and/or proposed open pits. The local topography would be altered both by the creation and/or expansion of open pits, and by the storage of waste overburden and interburden.

4.1.1.2 Socioeconomics

The proposed action would directly employ roughly 250 people. Most of the economic benefits would accrue to Milford, the nearest community. This represents 9.2 percent of the workforce in Beaver County, and the average wages and benefits of those employed are considerably above the average. Additional economic benefits could be expected to accrue to Milford and Beaver County via the multiplier effect, this being economic benefits and indirect additional jobs created to services and supply the direct mining jobs.

4.1.1.4 Soils

Soils would be disturbed on a total of approximately 1,225 acres (765 public and 460 private and/or State). Due to CSM's commitment to conduct concurrent reclamation, at any given time during the life of the MOA, it is anticipated that only 700 total acres would be disturbed. Expansion of pits and dumps would have a potential soil disturbance of approximately 395 acres of public, 180 acres of private, and 50 acres of State land. Pit and dump expansion would involve scraping and removing plant growth medium (anything appearing as "topsoil"). Soils could be lost through a combination of wind and water erosion. These scraped and removed soils would be stored on topsoil stockpiles, which would be comprised of approximately 30 public and 20 private acres. Additionally, approximately 230 acres of public, 210 acres of private, and 20 acres of State land soils would likely be disturbed as a result of constructing and / or widening the haul roads. Exploration disturbance would temporarily displace approximately 140 acres of public land soils.

During operations and storage, disturbed soils could be lost at a rate of 5 tons per acres per year to wind and water erosion. However, anticipated loss of topsoil would likely be much less due to stipulations the proponent has adopted as a part of the proposed action. These include interim seeding of soil stockpiles and final seeding. Haul roads would be graveled, watered, or have magnesium chloride or other approved tackfiers applied as needed to reduce fugitive dust. Additional mitigation would be required for problematic soil stockpiles, which are prone to continuous fugitive dust problems (see mitigation measures).

4.1.1.5 Vegetation

Vegetation would be affected on the same acreages as described for soils. There would be a long term loss of sagebrush steppe community, which ranges in condition from poor to fair. Primary values lost would be protective cover for soils, wildlife habitat and livestock and wild horse forage.

The sagebrush community would be lost for the life of the mining operation and then for some indeterminate amount of time following, during which sagebrush would re-establish through artificial means such as reseeding with a seed mix which includes sagebrush, or though natural means, of letting sagebrush encroach into the disturbed areas from seed source remaining on the edge of the disturbance. Losses to vegetation are partially mitigated though stipulations the proponent has adopted, such as stockpiling soils and reseeding them, monitoring and treating noxious (and some invasive) plant species, and its long term reclamation plan of respreading topsoil and planting with a final seed mix.

4.1.1.6 Wildlife

A total of 1,225 acres would be disturbed under the Proposed Action; 140 acres for exploration and 1,085 acres for mine expansion and associated facilities.

Human activity and disturbance would be new in the Big Wash and Crossroads exploration areas, as there are no existing mining activities occurring in those areas. However, overall impacts to wildlife from exploration activities would be negligible to minor and short term. Habitat, 140 acres total, would be temporarily impacted from drilling activities under the Proposed Action. The disturbance at the drill locations would be reclaimed and re-seeded after drilling and thus would be a short-term loss. Suitable habitat is abundant and available adjacent to the project area. Minimal indirect effects to some small, less mobile individuals would likely occur as they could be forced to disperse from the area or may be killed or injured during exploration activities. Wildlife in the area would likely be displaced temporarily during active drilling activities into adjacent undisturbed habitat. Impacts to entire populations are not anticipated.

In areas of existing mining activities, wildlife has likely been displaced or habituated to the noise and activity. Although mine activities would be expanded onto adjacent lands, overall impacts to wildlife in these areas would also be negligible to minor, but long term (for the life of the project). Reclamation would occur concurrently with mining; an expended pit would be reclaimed as mining at another pit commenced, therefore not all 1,085 acres of habitat would be impacted at once.

Raptors

Direct impacts to golden eagles are not anticipated as a result of the proposed action.
Golden eagles would be indirectly impacted by the loss of foraging habitat. This impact would vary depending on the quality and quantity of habitat disturbed at any given point in time; but at maximum disturbance acreages it is still expected to be minor. Displacement of eagles to adjacent suitable habitat is anticipated however the impact would be minor. Due to the presence of ongoing operations at both the CSM project and the nearby Rocky Range ballast mine, eagles in this area are likely habituated to mining disturbances such as people, haul trucks, and blasting.

Any raptor could be attracted to the mining and haul road areas to scavenge road kill. If this occurred, they could be hit by haul trucks.

Bats

Bats can be very sensitive to human disturbance and sound, causing them to abandon roosts, including maternity colonies and hibernacula. Disturbances during winter may cause bats to wake up, or come out of torpor, expending additional calories which can cause death. Several of the bat species documented in the project area in 2014 also winter in Utah and a few may be active during warmer periods in the winter.

Existing studies address two obvious possible impacts to roosting or hibernating bats subjected to blasting caused vibrations: 1) severe vibrations causing roof failure and crushing fatalities and, 2) lesser vibrations rousing bats from their hibernation torpor with the attendant negative effect of depleting critical body reserves.

Vibration estimates suggestthat it is very unlikely that any acute adverse effect (death) would occur to any hibernating or roosting bats due to roof fall but that some risk exists that bats could be awakened from torpor.

Bats entering or leaving the adits would probably be disturbed by activity from the nearby pits, dumps, and haul roads. The noise and lights could disrupt flight and foraging patterns. Further, under the proposed action, eventually all the adits in the area would be destroyed. In order to minimize the potential for impacting bats, these adits would be monitored and efforts made to ensure that adits are free of bats prior to destroying.

A worst case scenario would predict displacement and death of a few hundred individuals of several species, including Townsend's big-eared bats and fringed myotis, both sensitive species. A best case scenario would be based on no bats using the adits when mining commences, however unlikely, and that impacts would be the loss of foraging habitat and displacement when bats return to the area in the spring. The actual impact is likely somewhere in between.

Migratory Birds

The potential direct impacts to migratory bird species would include the short-term loss of 140 acres and long-term loss of approximately 1,085 acres of potentially suitable breeding and foraging habitat including sagebrush and black sagebrush, as well as impacts from noise and dust, described below. Not all 1,225 acres would be disturbed at the same time as reclamation at one pit would occur as another is being mined and the same with exploration drilling. Direct impacts to breeding birds (including raptors) would be minimized by avoiding habitat removal between March 15 and July 31. If habitat removal or disturbance were to occur between March 15 and July 31, breeding bird surveys on public and private lands in the project area would be implemented, and appropriate mitigation prescribed in cooperation with the BLM, USFWS, and UDWR.

Vegetation removal in the MOA would reduce potential habitat for migratory bird nesting, cover, and foraging. The vegetation in these areas would be removed for the long term (the life of the project) and be unavailable for migratory birds during that time. An altered type of potentially suitable habitat would be available after reclamation activities. Impacts to migratory birds from habitat losses would be minor and long term. Due to the relatively small scale of operations (1,225 acres of disturbance) and extensive shrubland habitat available in the area, overall populations of migratory birds would not be affected.

Indirect impacts to habitat surrounding the disturbance areas (i.e., not directly disturbed) would occur as a result of project operations, specifically as a result of dust and noise introductions. Dust that falls on surrounding vegetation may make it less palatable for foraging as well as less suitable for bird nesting and breeding. Dust would be controlled in the project area by water trucks, which would lessen dust impacts. Overall, dust would have minor and long-term impacts on the suitability of migratory bird habitats surrounding the project area. Some individuals may utilize areas further away from project disturbances in avoidance of dust and project noise. Populations of migratory birds would not be affected.

Noise from project construction and operations, including the blasting activities, would make surrounding areas less suitable for nesting and breeding. Natural factors such as topography, vegetation, and temperature can reduce noise over distance.

Birds would likely displace to similar habitat away from the noise or become habituated to it, especially in areas where mining activities already occur. Anthropogenic impacts would last for the life of the project. These impacts to nesting migratory bird habitat use would be forthe life of the project, but minor because birds could nest elsewhere if the project area is unsuitable. Therefore, only nests that are initially undetected or established after construction may be adversely affected by noise or human presence.

Big Game

Pronghorn that use or migrate through the disturbance areas may be affected by the loss of habitat as they would have to circumvent the project area. Further, pronghorn would be impacted by increased noise and traffic. They would move to other areas. However, these effects are not expected to extend to population growth rates or reproduction within the larger population (i.e., moderate effects) because of the small size of the project area.

There could be pronghorn-vehicle collisions and subsequent fatalities, although this is not anticipated. No impacts to the population are anticipated due to the limited use that pronghorn make of the project area and the large area of adjacent suitable habitat. No impacts are anticipated to the local pronghorn population or to hunting opportunities. For these reasons the project would be in compliance with Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation.

There would be a direct loss of approximately 1,225 acres of wildlife habitat from this project. The disturbance impacts would extend outward and would impact many more acres, depending upon species. Disturbances from the proposed project could allow for the expansion of cheatgrass and invasion of noxious weeds which would impact long-term habitat quality. Disturbed lands would be restored as soon as practicable and weeds would be controlled at all times. Reclamation seed mixes would contain species adapted to low precipitation, as well as sagebrush and native grasses and forbs.

Big game habitat losses are approximately 1,085 acres of crucial year-long pronghorn habitat which would be lost for the long term (life of the project), until successful reclamation of the project area. In general, big game would be expected to habituate to the disturbances and continue to use the surrounding habitats as they do currently, including r seasonal movements. Thus, habitat fragmentation impacts to big game are expected to be minor and long term.

Threatened, Endangered, Candidate or Sensitive Animal Species

Impacts to the special status birds with moderate to high potential to occur in the project area would be the same as general impacts discussed for Migratory Birds; long term and minor, with the implementation of spatial/seasonal buffers. Most of the general impacts described in this section for wildlife also apply to the remaining special status species, discussed below. Pre-construction surveys would be conducted to determine the presence of these species in the

project area, and if found, the application of spatial and seasonal (timing) buffers would follow BLM guidance (BLM 2006).

Impacts to special status bats would be the same as general impacts discussed for bats, above. However, of these only the fringed myotis and Townsend's big ear bat were identified during bat surveys.

4.1.2 Alternative B – No Action

Since the No Action Alternative would only involve a modification to reduce impacts, and mitigation measures determined necessary are included in the Proposed Action, impacts from the No Action Alternative would be expected to be similar to those resulting from the Proposed Action Alternative.

4.2 Cumulative Impacts Analysis

Cumulative impacts are those impacts resulting from the incremental impact of an action when added to other past, present, or reasonably foreseeable actions regardless of what agency or person undertakes such other actions.

4.2.1 Cumulative Impact Area (CIA)

The cumulative impact area is dependent on the resource of concern. For cultural resources, minerals resources, soils, wildlife, and vegetation, the CIA is limited to portions of the adjacent hydrologic unit code (HUC) 12 boundaries, taken to the Beaver River to the east (**Figure 4.2-1**). For livestock grazing, the CIA is limited to the Frisco Allotment. For socio-economics, the CIA is assumed to be Beaver County, although some workers commute from Iron County.

4.2.2 Past and Present Actions

The southern end of the Rocky Range and the Beaver Lake Mountains have been highly impacted by historic and recent mining activities. Historic mining disturbances, having occurred prior to federal and state mining reclamation acts, were left unreclaimed. Mineral exploration and extractive activities remain the principal source of land disturbance in the present. Past impacts to vegetation, soils, wildlife and its habitat have occurred from mining activities (both historical and modern), transportation projects such as roads and railroads, historical and current grazing, recreation, and development associated with the town of Milford. Off road vehicle use may increase due to the increase in human population and the popularity of these vehicles.

Within the MOA, the proposed operations would add to three currently active surface copper mines (the Hidden Treasure, Bawana, and Sunrise Pits), and would re-open two existing mines (the Maria and OK Pits). The MOA also includes active disturbances on private and State land consisting of milling activities, tailings storage, ore storage stockpiles and haulage roads (See **Appendix C** for complete description of current operations). A rock quarry, with a permit area of 219 acres, is located two miles north of the proposed action and is extracting up to one million tons per year of rock which is sized for use as railroad ballast. Known copper resources stretching from the southern end of the Rocky Range westward to the southern end of the Beaver Lake Mountains are currently being evaluated by the project proponent.

4.2.3 Reasonably Foreseeable Action Scenario (RFAS)

Reasonably Foreseeable Actions include the same uses as those described above. It is expected that more mineral exploration and development will be proposed in the general area into the reasonably foreseeable future. Some of this activity would occur in pre-reclamation law disturbed areas that would be re-disturbed and consequently subject to current reclamation requirements.

4.2.4 Cumulative Impact Analysis

Cultural Resources

As cultural resources are relics of man's use of the natural world, cultural resources are created and destroyed throughout time. Many of today's cultural resources were mining disturbances of the past; mining disturbances of today may produce cultural artifacts in the future. The destruction of cultural artifacts in the MOA would be cumulative to those affected by past mining related operations. The creation of new cultural resources for the future would be cumulative to those existing from previous mining activities.

Livestock Grazing

Livestock grazing in the area has been impacted historically by overutilization and mining. The Frisco Allotment has also been recently impacted by a continuing drought. These factors have reduced the available forage to the lower levels seen today. In the long term, cumulative impacts to livestock grazing should be mitigated to a certain extent as reclamation introduces new forage. However, the majority of the area will still likely contain unvegetated mine pits and scarcely vegetated mine dumps. Reclamation activities may decrease the ratio of invasive species to favorable forage in the long term.

Minerals Resources

Historic production of hardrock minerals (up until 2006) within the project area totaled roughly 2.29 million tons of copper ore, containing by-product gold and silver values. (Wray 2006) Since 2006, the current operator and project proponent together with their processor in interest have produced roughly 1 million tons of copper ore with gold and silver by-products. Historic exploration and mining activities in the project area totaled about 350 acres of disturbance. Current permitted mining and exploration disturbances in the project area total 600 acres, 450 acres of which are associated with the project proponent's activities and the balance with the adjacent ballast rock quarry.

Socio-economics

Beaver County was founded on mining and agriculture. As the number of mining operations has decreased, the economy of Beaver County has suffered. Those engaged in the development of the proposed project are currently employed by CS Mining and active on other company projects so the proposed project would maintain the current overall employment in the mining sector in the County.

Soils and Vegetation

The CIA for soils and vegetation is based on adjacent HUC 12 watershed, truncated at the Beaver River to the east, containing about 86,500 acres. Within this area there exists about

15,500 acres of private land, 9000 acres of land administered by SITLA and about 62,000 acres of public land.

Within the CIA for soil and vegetation, a total of about 1,500 acres have been disturbed through non-grazing usage. This includes about 650 acres of pre-reclamation law exploration, mining and milling disturbances, 600 acres of presently permitted minerals-related disturbances, and about 250 acres of road disturbances. These past and current concentrated impacts to soils and vegetation are cumulative to historic impacts associated with poor grazing practices throughout much of the CIA, both of which have worked to alter vegetative diversity and has increased overall soil erosion.

Wildlife
Exploration and historic mining in the area have resulted in the loss or alteration of some areas of native habitats. As noted under Soils and Vegetation, 1,500 acres have been disturbed and have altered habitat. However, the amount of habitat disturbance is small in comparison to the overall wildlife habitat in the area. Increased human presence in the region could also cause cumulative effects to wildlife through vehicle mortalities, off-highway vehicle use, increased legal or illegal hunting, noise effects, and harassment. Although mineral exploration and mining activity could increase in the area, the remote and rural nature of the area is expected to remain, along with its value for wildlife.

The Proposed Action, in combination with past, present, and future activities in and around the MOA would combine to alter the natural setting and habitat. The level of alteration would be offset to some extent by reclamation activities. The incremental increases to the cumulative effects on wildlife species as a result of the proposed action are anticipated to be minor.

5.0 CONSULTATION AND COORDINATION

5.1 Introduction

The issue identification section of Chapter 1 identifies those issues analyzed in detail in Chapter 4. The ID Team Checklist provides the rationale for issues that were considered but not analyzed further. The issues were identified through the public and agency involvement process described in sections 5.2 and 5.3 below.

5.2 Persons, Groups, and Agencies Consulted

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Utah State Historic Preservation Office (SHPO)	Consultation for undertakings, as required by the National Historic Preservation Act (NHPA) (16 USC 470)	Consultation with SHPO is on-going. Site specific plans would be approved before any historic properties were affected.
Paiute Indian Tribe of Utah	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1531) and NHPA (16 USC 1531)	A meeting was held on January 22, 2015 to describe and discuss the concerns of the Tribe concerning the proposed action. The Tribe stated that they have no concerns with the project

		going forward, but would like to be kept informed of any changes or updates to the project.

5.3 Summary of Public Participation

During preparation of the EA, the public was notified of the proposed action by posting on the Utah Internet Homepage on October 8, 2014. No one has contacted the BLM in response to the notice. A 30 day public comment period was offered beginning on January 26, 2015. No responses were received during the public comment period.

5.4 List of Preparers

5.4.1 BLM

See Appendix A.

5.4.2 Non-BLM Preparers

Name	Title	Responsible for the Following Section(s) of this Document
Leslie Buhler – CS Mining, LLC	Land and Permitting Manager	2.2, 3.2, 3.3.4, Appendix B, Appendix C
Alysen Swenson – CS Mining, LLC	Environmental Specialist	2.2, 3.2, 3.3.4, Appendix B, Appendix C

6.0 REFERENCES, GLOSSARY AND ACRONYMS

6.1 References Cited

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6.2 List of Acronyms

Acronym	Definition
AUM	Animal Unit Months
BLM	Bureau of Land Management
CCFO	Cedar City Field Office
CIA	Cumulative Impact Area
CSM	CS Mining, LLC
CWCS	Utah Comprehensive Wildlife Conservation Strategy
DR	Decision Record
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENBB	Environmental Notification Bulletin Board
FONSI	Finding of No Significant Impact
HUC	Hydrologic unit code
ITDF	Intermediate Tailings Disposal Facility
MOA	Milford Operations Area
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NRCS	Natural Resources Conservation System
ppv	peak particle velocities
RFAS	Reasonably Foreseeable Action Scenario
ROW	Right-of-way
SHPO	Utah State Historic Preservation Office
SITLA	Utah School and Institutional Trust Lands Administration
SLBM	Salt Lake Base Meridian
UDOGM	Utah Division of Oil, Gas and Mining
UDWR	Utah Division of Wildlife Resources
USFWS	United States Fish and Wildlife Service
WUCC	Western Utah Copper Company

APPENDICES

APPENDIX A

INTERDISCIPLINARY TEAM NEPA CHECKLIST

Project Title: CS Mining, Milford Operations Area, Phase 2

NEPA Log Number: DOI-BLM-UT-C010-2014-0061-EA

File/Serial Number: UTU-82071

Project Leader: Ed Ginouves

DETERMINATION OF STAFF: (Choose one of the following abbreviated options for the left column)

NP = not present in the area impacted by the proposed or alternative actions
NI = present, but not affected to a degree that detailed analysis is required
PI = present with potential for significant impact analyzed in detail in the EA; or identified in a DNA as requiring further analysis
NC = (DNAs only) actions and impacts not changed from those disclosed in the existing NEPA documents cited in Section C of the DNA form.

Determi-nation	Resource	Rationale for Determination*	Signature	Date
RESOURCES AND ISSUES CONSIDERED (INCLUDES SUPPLEMENTAL AUTHORITIES APPENDIX 1 H-1790-1)				
NI	Air Quality	Proposed project is within an area that is attainment of National Ambient Air Quality Standards (NAAQS). Mining and milling operations similar to those proposed have been ongoing for several years under permit from the Utah Division of Air Quality (DAQ). Permitting through the DAQ would continue to occur as certain production / time thresholds were met as required by law and regulation. Dust fines (fugitive dust) would be expected to increase over the life of the project because of additional disturbance, haulage, crushing, etc. due to expansion of the mine site. These impacts are offset somewhat from placing topsoil and temporarily reseeding the waste dumps, reclaiming as they go and gravelling, watering and otherwise treating roads with tackifiers to reduce fugitive dust.	C. Egerton	09/18/14
NP	Areas of Critical Environmental Concern	None within the CCFO boundaries.	D. Jacobson	10-29-2014
PI	Cultural Resources	Known prehistoric and historic sites exist within the project area. However, if all eligible archaeological sites (historic properties) are avoided and no indirect effects occur on adjacent historic sites, this undertaking may have a "no adverse effect" and NI determination. If avoidance of historic properties is not possible this project may have an adverse effect (PI determination) and would require a treatment plan and completion of the measures outlined in the treatment plan.	Jamie Palmer	10/6/2014
NI	Greenhouse Gas Emissions	The project proposal involves burning fossil carbon based fuels for clearing, mining, hauling, milling, reclamation, etc., which would produce byproducts such as CO2, water vapor, etc. Ongoing research has identified the potential effects of so-called "greenhouse gas" (ghg) emissions (including CO2, methane, nitrous oxide, water vapor and several trace gasses) on global climate. The release of these gasses	C. Egerton	09/18/14

Determi-nation	Resource	Rationale for Determination*	Signature	Date
		during mining activities is cumulative with other local ghg releases (such as traffic on local surface roads and state roads 21 and 130, the Union Pacific Railroad, etc.), regional and global releases. The lack of scientific tools to predict climate change on local or regional scales limits the ability to quantify potential future impacts as a result of this singular project or cumulatively with other activities within the analysis area with any confidence. It is thought that this project would not contribute significant levels of ghg emissions as this expansion will not substantially increase the amount of fossil fuels burned from current levels, but instead would change the location of emissions as new mining areas were opened.		
NI	Environmental Justice	No minority or economically challenged populations would be disproportionately affected.	E. Ginouves	9/10/14
NP	Farmlands (Prime or Unique)	Potential for prime, unique or important farmlands does not exist due to steep slopes, lack of topsoil and lack of irrigation water.	C. Egerton	09/18/14
PI	Fish and Wildlife Excluding USFW Designated Species	Proposal would impact up to 765 acres of habitat on public land. Habitat would be unavailable until reclamation is complete (could be several decades). No fish species would be impacted. Terrestrial wildlife may be impacted by disturbance and fragmentation of habitat. Reproduction may be impacted if implementation of initial surface disturbing activities occurs during the breeding or nesting seasons. Need to determine level of potential impacts. See attached wildlife information.	M. Crane	12/22/14
NP	Floodplains	A review of floodplain maps for Beaver County reveals the Big Wash is the nearest 100 year floodplain of any concern and it is located far enough away that this project is not expected to influence it.	C. Egerton	09/18/14
NI	Fuels/Fire Management	The proposed action would not have an impact on fire or fuels management.	M. Mendenhall	9/10/14
PI	Geology / Mineral Resources/Energy Production	The proposed action would permanently deplete a portion of the copper, gold and silver resource contained in the various skarn copper deposit proposed for surface mining. The deposits are located on previously patented mining claims (private land) and unpatented mining claims (BLM – managed land). There are no known mineral resources in the project area other than the copper, gold and silver resources proposed for extraction and deposits of stone, sand and gravel in alluvium and underlying barren bedrock.	E. Ginouves	9/10/14
PI	Hydrologic Conditions	Based upon site inspection photos, rangeland health analyses, etc., hydrologic conditions on the project site are relatively good. Little topsoil exists on the slopes, but sloping soils tend to be well armored with surface rock and vegetation in areas where surface disturbance has not occurred. Soils on the lower slopes and terraces are also relatively stable, but would be subject to both wind and water erosion if protective vegetation cover were removed. Impacts to hydrologic conditions are expected, depending on the amount of expected surface disturbance. An attempt at mitigation is made by the proposal to strip, stockpile and protect from wind and water erosion until such time that the	C. Egerton	09/22/14

Determi-nation	Resource	Rationale for Determination*	Signature	Date
		topsoil may be used for reclamation. The success or failure of final reclamation will be important in the restoration of hydrologic conditions. Since hydrologic conditions are so closely related to vegetation and soils, it would serve us well to combine these for the EA.		
PI	Invasive, Non-native Species	There are no known noxious weeds on site, however, disturbances such as those which are proposed create habitat in which noxious weeds and other invasives (halogeton, Russian thistle, cheatgrass) can thrive. Noxious weed issues are mitigated by the company's commitment to monitoring all public land sites for noxious weed growth and rapidly treating, through BLM approved methods, any "discovered" populations of noxious weeds. Invasive weeds are expected to be the larger problem resulting from this large mining operation. Relatively large acreages of surface disturbance are expected to occur on areas that receive low moisture, contain little to no fertile soils, etc. and are thus subject to invasion by annual weeds. The key to protecting the site from dominance by invasive weeds is the proposed approach of reclaiming disturbed areas by seeding desirable, aggressive plant species soon after the disturbance. Past experience in this area is that even when desirable, aggressive species are used for reclamation, success is often limited. New tools, such as mowing of weeds prior to seeding, periodic watering using water trucks, etc., may need to be tried. The degree of success of reclamation efforts will determine whether or not an invasive species issue remains following reclamation.	C. Egerton	09/22/14
NI	Lands/Access	There are no pending lands actions within the project area. Existing right-of-way authorizations and access will not be impacted by the project as proposed.	B. Johnson	9/10/14
PI	Livestock Grazing	The Proposed project would disturb vegetation on 765 acres of BLM administered land which would reduce the AUMs on the allotment by approximately 64. This could reduce the current permitted livestock use on the Frisco Allotment by 9 head of cattle or 63 head of sheep. The kind of livestock, season of use, grazing system, and water resources would not be changed or impacted by the project.	C. Hunter	10/7/14
PI	Migratory Birds	Proposal would impact 765 acres of habitat. Habitat would be unavailable until reclamation is complete (could be several decades). Birds may be impacted by implementation if initial surface disturbing activities occur during the nesting season. Need to determine level of potential impacts. Refer to the wildlife section of EA for more information.	M. Crane	12/22/2014
NI	Native American Religious Concerns	In the previous application and amendments, the Paiute Indian Tribe of Utah has not expressed any concerns with mining at this location, nor felt that this operation would restrict access to any sacred sites or traditional cultural properties. However the Tribe would like to see a copy of the cultural resource report once it is completed.	J. Palmer	1/22/15
NI	Paleontology	The surficial geology of the project area, is Quaternary alluvium and colluvium and falls within Class 1, very low potential for paleontological resources, using the Bureau's	E. Ginouves	9/10/14

Determi-nation	Resource	Rationale for Determination*	Signature	Date
		Potential Fossil Yield Classification System. The probability of the project activity of impacting any fossil resources is negligible. No assessment or mitigation measures specific to paleontological resources are warranted.		
PI	Rangeland Health Standards	The project is within the Frisco allotment. This Allotment is not meeting all of the rangeland standards. The mine activity would increase invasive and non-native species in on the allotment. See Invasive, Non-native Species. Also soils and desired vegetation may be impacted negatively.	C. Hunter	10/7/14
NI	Recreation	Other than a minor amount of dispersed recreation, there are no existing recreation resources which would be affected as a result of this proposal.	D. Jacobson	10-29-2014
PI	Socio-economics	The proposed project work have a substantial impact on local or area socioeconomics, directly employing about 200 people.	E. Ginouves	9/10/14
PI	Soils	The proposal would create new disturbance of soils on approximately 765 public land acres and 390 private land acres via a connected action. In the case of road widening and creation, soils would be impacted by removal of protective vegetation and compaction, making them more susceptible to the erosional forces of wind and water. Various protections would then be put in place to stabilize soils (eg gravelling). Scraping topsoil for segregation and stockpiling would mix soil layers (horizons) and could affect the ultimate productivity of the soils by mixing topsoils with subsoils having less development and fertility and perhaps more salinity / alkalinity. Mitigation of effects on soils would include reseeding stockpiled and otherwise disturbed soils as soon as possible following the disturbance in order to establish protective vegetation cover. Mitigation also includes watering soils or otherwise covering them (erosion blankets, mulching, etc.) as needed to retain soils in place.	C. Egerton	09/22/14
NI	Threatened, Endangered, Candidate or Sensitive Plant Species	There are no threatened or endangered plant species in Beaver County. There are 3 candidate and several BLM sensitive plant species in Beaver County. None of these species are found within the project area, nor is the project area considered to contain suitable or potential habitat.	J. Reese	9/10/14
PI	Threatened, Endangered, Candidate or Sensitive Animal Species	The U.S. Fish and Wildlife Service has identified five threatened, endangered or candidate wildlife species as occurring in Beaver County (USFWS 2013). No habitat is present for the Western yellow-billed cuckoo, least chub, or Utah prairie dog. The California condor may forage on rare occasions in the general area, but the project is about 68 miles from known condor roosting locations. There would be no effect on condors. The project area is about 9 miles from UDWR mapped greater sage-grouse occupied habitat. No sage-grouse or their sign have been noted during numerous wildlife surveys of the project area over the past several years and the habitat is of marginal quality. Greater sage-grouse would not be impacted by the project. BLM sensitive species may occur within the project area. The greatest impact would most likely occur on bat species. Refer to wildlife survey report and attached analysis for more information.	M. Crane	12/22/14

Determi-nation	Resource	Rationale for Determination*	Signature	Date
NP	Wastes (hazardous or solid)	No hazardous or solid wastes as defined by RCRA will be generated or disposed of within the proposed project area.	E. Ginouves	9/10/14
NI	Water Resources/Quality (drinking/surface/ground)	Due to the nature of the topography and the nearest known surface waters, depth to underground water, it is highly unlikely that this project would affect surface or underground water. This proposal would be subject to approved permitting through the Utah Division of Water Quality and would include the development of a Storm Water Management Plan, among other things.	C. Egerton	09/22/14
NP	Wetlands/Riparian Zones	There are no riparian wetland areas within the project area	A. tep hens	9/10/14
NP	Wild and Scenic Rivers	None within the CCFO boundaries.	E. Ginouves	9/10/14
NI	Wilderness/WSA	No designated wilderness or wilderness study areas are within or adjacent to the project area.	D. Jacobson	10-29-2014
NP	Woodland / Forestry	A review of project maps reveals that there are no woodland / forestry resources in the project area.	J. Sathe	09/24/14
PI	Vegetation excluding USFW designated species	Vegetation would be removed and disturbed in this project. Disturbance levels would be the same as for soils, hydrology, etc. Appropriate seed mixes will need to be developed for final reclamation at some point.	C. Egerton	09/22/14
NI	Visual Resources	The project is proposed within visual resource management class IV area, and is consistent with that management. Reclamation proposed will maintain the area in the long term.	D. Jacobson	10-29-2014
NI	Wild Horses and Burros	The project is outside any wild horse Herd Management Area (HMA) or Herd Area (HA).	C. Hunter	10/7/14
NP	Lands with Wilderness Characteristics	The project as proposed is not in an area that was identified as having wilderness characteristics in the 2011 and the updated 2014 inventory. This area did not meet the initial size criteria to even merit conducting a wilderness characteristics inventory.	D. Jacobson	10-29-2014

Reviewer Title	Signature	Date	Comments
NEPA / Environmental Coordinator		2/26/15	
Authorized Officer	Dan Fletcher	3-1-15	

Additional Wildlife Information

Bald and golden eagles are protected by the Eagle Protection Act and are USFWS Birds of Conservation Concern. Bald eagles may winter in the project area between November 1 and March 15 and may occasionally fly over the area while foraging. Golden eagles have been noted both within and near the Sunrise project area. They are year round residents. No active golden eagle nests have been discovered within the CS Mining project area or, with limited survey effort, within about five miles, except for a potential nest located about two miles north in 2013. However, consistent sightings of both adult and juvenile golden eagles within the CS Mining project area suggest that golden eagles do nest in the vicinity. Golden eagles have been recently documented within the CS Mining project area in July 2013, February 2013, June 2012 and July 2011.

Bald eagles are wide ranging in the winter and there are no known roosts or concentration areas within the project area; therefore there would be no impact to bald eagles. Golden eagles would be impacted by a loss of foraging habitat. This impact cannot be quantified because it is unknown how close the mine is to eagle nests or roosts, or how often eagles hunt within the project area. The impact could vary from very minor to displacement of eagles to adjacent suitable habitat. The impact from the loss of foraging habitat would likely be minor as no eagle nests are known to occur within 0.5 mile of the proposed mine. Due to the presence of ongoing operations at both the CS Mining project and the nearby Rocky Range ballast mine, eagles in this area are probably habituated to mining disturbances such as people, haul trucks and blasting.

Burrowing owls have been documented within the general area, although none have been documented within the CS Mining project area. In 2013, one burrowing owl pellet was noted on a mound approximately 0.4 mile from the Sunrise Mine adit. It would be approximately 0.3 miles from the projected boundary of the Sunrise Pit and to the west on the other side of the low range of hills adjacent to the western boundary of the proposed pit. This range of hills rises about 300 feet above the alluvial plain.

While there may be burrowing owls in the vicinity, the only sign documented was about 0.3 mile from proposed disturbance and buffered from the proposed mining by a low range of hills. The recommended spatial buffer for burrowing owl nests is 0.25 mile. There should be no impact to burrowing owls from the Sunrise project.

Ferruginous hawk have also been documented in the general area. Multiple years of raptor nest surveys have not documented any ferruginous hawk nests within 0.5 mile of the Sunrise Project area. The closest known active nesting territory is about 3.6 miles from the Sunrise Project area. Other documented sightings of these hawks occur as close as 1.5 miles and some of these are likely within inactive territories.

The recommended spatial buffer for ferruginous hawk nests is 0.5 mile. There would be no impact to nesting ferruginous hawks since the nearest known occupied territory is about 3.6 miles away.

Although these hawks may occasionally forage within the greater CS Mining project area, there are no impacts anticipated from the proposed Sunrise project.
The project area is suitable red-tailed hawk foraging habitat. One red-tailed hawk nesting territory has been documented at the edge of the 0.5 mile buffer of the proposed waste dump. It is a stick nest on a telephone pole adjacent to a dirt road. This nest was active in 2012, but gone in 2013. It is unknown if an alternate nest within the territory was used, but it would be likely.

Red-tailed hawk foraging habitat is abundant and the loss of habitat would likely not impact red-tailed hawks. These hawks are tolerant of disturbance and nesting activities would not be impacted by the proposed mining. There is no long term data on how frequently these hawks nest within 0.5 mile of the project location.

APPENDIX B

Design Features to Reduce Impacts

The CSM MOA project expansion would comply with all applicable Federal and State laws and local zoning ordinances. The Best Management Practices (BMPs) presented below and BLM's Standard Procedures Applied to Surface Disturbing Activities (BLM 1999: A1.1, A1.3-A1.4) would be utilized to minimize the potential for soil erosion and the introduction of non-native, invasive plant species on public lands. The following project design features and construction protocols are highlighted here as environmental protection measures (EPMs) that would be in effect throughout the MOA.

Air Quality
CSM received an Approval Order (DAQE-AN14219002-12), from the Utah Department of Environmental Quality, Division of Air Quality (DAQ), which is the authority for approving, issuing, and monitoring compliance of air quality permits in Utah. The Approval Order includes operating limits and opacity limits on visible emissions (i.e., fugitive dust) for each class of equipment and operation (i.e., hauling, crushing, conveying). The Approval Order addresses the air quality requirements for the MOA, which CSM will comply with by means of BMPs such as opacity monitoring, dust suppression via water and approved chemical application, and limiting crushing operations to non-windy days if necessary. If any changes were to occur in terms of air quality, CSM will notify all applicable agencies of the changes.

Soils
All haul roads would be designed with ditches and berms running along the edges of the road. This would help to minimize runoff and sediment transport to areas outside the designated disturbance areas. Additional BMPs used to minimize soil degradation include:

- Only clearing and grubbing areas as needed for additional disturbance
- Re-seeding topsoil stockpiles with an interim seed mix, as well as berming the area around the stockpiles to minimize runoff and sediment transport
- Controlling runoff and sediment transport throughout the MOA with features such as berms, ditches, turn-outs, and sumps

Water Quality
Seepage monitoring: water wells would be installed downgradient of any proposed tailings ponds, and would be checked daily for fluids. If fluids are found, then the monitoring plan would be initiated as per UDWQ ground water permit requirements.

Wildlife
CSM would comply with all Federal and State regulations in the mitigation of wildlife resources within the MOA. Mitigation efforts for the MOA would include the following:

- The BLM and Utah Division of Wildlife Resources (UDWR) would be contacted to report injury or fatality of birds, active nests, or young (documented with a photo).

- Both project construction and operational staff would be trained on vegetation and wildlife avoidance and minimization techniques related to the project. Staff would also be provided with instruction on how to identify special status species. Project staff would be required to report direct impacts (e.g., vehicle collisions) to special status species to the BLM.

- Blasting would not occur when big game and other wildlife are within line of sight of the blasting area until the animals have moved through the area.

- Ground disturbing activities which require the removal of vegetation would occur outside of the nesting season; between July 16 - February 28. A variance to this stipulation may be granted in writing by the authorized officer upon the completion of a migratory bird survey using approved methodologies which provide 100% coverage of the area to be disturbed. If any active nests are located in areas of proposed disturbance, those active nests would be protected, with a 75 yard no disturbance buffer, until the young have fledged the nest.

- During the migratory bird breeding season (March1-July 31) surveys would occur prior to any new disturbance to identify active raptor nests (within 0.5 mile radius of the project area).. If any active nests are located in areas of proposed disturbance, those active nests would be protected until the young have fledged the nest.

- Raptor management would be guided by the use of 'Best Management Practices for Raptors and Their Associated Habitats in Utah" (BLM 2006, Appendix C), utilizing seasonal and spatial buffers, as well as mitigation, to maintain and enhance raptor nesting and foraging habitat, while allowing other resource uses.
- The PLS pond, which has a maximum size of 2 acres, will be monitored daily by environmental staff and operational personal for avian mortality. If avian mortality is observed, a mitigation plan will be developed by the CSM in conjunction with the BLM, UDWR, and USFWS to be approved in writing by the authorized officer within 120 days of the event.

Non-native Invasive Species and Noxious Weeds
A weed-free seed mix, approved by the BLM, would be used during reclamation activities.
Periodic (twice yearly during the growing season) inspections for noxious weeds would be conducted during operations, closure, and reclamation, followed with approved control efforts when needed. Routine BLM inspections would monitor invasive species to ensure compliance with these requirements.

Stabilization and Rehabilitation
Topsoil would be scraped and stockpiled and conserved for revegetation efforts following mining operations. Interim seeding with an approved seed mixture would be conducted to discourage weed growth and erosion. All trash, refuse, and fuel/oil spills would be removed from the MOA and disposed of at an approved disposal site, such as the Beaver County Landfill.

Livestock Protection
The integrity of any livestock gates, fence, cattle guards, and water pipes in the MOA would be maintained during mining activities.

Wildfire
All project personnel would have fire-fighting tools and extinguishers available at all times for use if the occasion arises. Project personnel would adhere to any BLM fire prevention requirements. Under BLM's Fire Management Plan, "All facilities, structures, or developments that are susceptible to fire damage will receive intensive suppression. The primary objective with this level of suppression is to prevent loss of life, property, or unacceptable resource damage."

Cultural Resources
All National Register of Historic Places (NRHP)-eligible cultural resources in the project area would be avoided or mitigated prior to disturbance. All mitigation plans would comply with all State and Federal regulations. At the discretion of the BLM archaeologist, an archaeological monitor would be present for any activities in the vicinity of NRHP-eligible sites. Although not anticipated, if previously undocumented cultural or historic objects are discovered during mining activities, the BLM Authorized Officer would be notified and work in the area would halt until documentation and evaluation by either the BLM archaeologist or a BLM-permitted archaeologist could be conducted.

Public Safety
Appropriate warning signs would be posted in locations where potential public access to the mining areas is adjacent and readily available, including at the guarded entrance road and blocked trails/roads. The activities within the MOA would not pose a threat to public health and safety because the active processing area and mine access would be controlled by a guard station, as well as being fenced and gated where applicable, and because the project is designed to manage risk with sound engineering, careful monitoring, and good management practices. The area would be signed (posted) to advise the public as to the existence of the mining operation, periodic blasting, and hazardous chemicals. These signs would be removed upon completion of reclamation when all hazards are removed.

Current pit slopes are designed to be mined in 1-2 lifts of 20 foot benches, with 25 foot catch benches every 60 vertical feet. Final slope angles would be 50-55 degrees. Slopes within the active pits would continue to be constructed at 50-55 degrees, as dictated by historic mining. CSM is in the process of developing a program for ongoing geotechnical evaluation of pit slopes in the Sunrise mine and would continue this program with future pit developments. The program would be carried out by licensed geotechnical engineers at IGES, Inc of Salt Lake City. The program would consist of geotechnical mapping, data analysis and modeling, and design recommendations for pit slopes with appropriate factors of safety for the various open pit segments. Meanwhile, slope stability monitoring would be ongoing for both the active pits.

Before blasting occurs, the blast foreman would sound a warning siren to alert all personnel of an impending blast; at which time all personnel and equipment would be removed from the blast zone. Before blasting, all roads that need to be blocked would be blocked in accordance with

applicable regulations. Ammonium nitrate/fuel oil (ANFO) would be stored in accordance with applicable regulations, and blasting caps would be stored separately in a MSHA approved magazine.

The blasting foreman and aides would insure that all personnel have left the pit area, at which time all access roads that need to be blocked would be blocked. After five minutes time, two siren blasts, each one minute long, would be sounded. After an additional minute the blast foreman turns on his emergency flashing lights, sounds another three siren warnings, each thirty seconds long, and then the blast would be detonated. No one would enter the blast zone until the foreman checks the blast site and sounds the all-clear siren which would be one long siren blast. This protocol would be posted on access roads to the site to inform all visitors as to the blasting practices being utilized at the mine.

Hazardous Materials and Wastes
Dumpsters located on-site would contain all refuse. Refuse would be removed on a regular (weekly to bi-weekly) basis to an approved county landfill, such as the Beaver County Landfill.

CSM would comply with a Spill Prevention Control and Countermeasure (SPCC) Plan pursuant to 43 CFR 3809.401. Further, this SPCC Plan covers more than just the hydrocarbons addressed in the regulation; it also includes other substances of concern, including active solvents. All above ground tanks proposed for placement in the mine operations area would be double walled to prevent spillage or leaks. Any leaks from the primary tank shell would be fully contained within the outer tank shell. As part of normal work practice, any spills from mobile equipment would be promptly reported internally, per the SPCC Plan. Subsequently, CSM personnel would actively clean up any such spills and dispose of them appropriately according to applicable County, State, and Federal regulations.

CSM has on site an Emergency Response Plan to respond to spills of hazardous materials at the mine site, including solvents and diesel (SPCC 2013). The Emergency Response Plan is kept on-site in the mill office and truck shop. This plan describes the required level of containment and safety measures associated with storage, handling, and spill clean-up of materials that may include diesel, solvents, corrosives, and organic chemicals. Operations conducted in accordance with this plan would ensure that impacts from spills would be minimized and the spilled materials contained and removed. CSM has the necessary spill containment and cleanup equipment available on-site, and personnel would be able to respond quickly.

Runoff Features
There are no active streams within the project area. All surface water encountered during mining and operations would be handled in accordance to the best management practices (BMPs) set forth in CSM's storm water management plan (SWMP). Any additional runoff control features that would be constructed by CSM in relation to the MOA project expansion would be designed and maintained according to the SWMP.

Reclamation Techniques

At the conclusion of the operations, all trash, oil, fuel, equipment, debris and structures would be removed from the MOA and the disturbed sites prepared for reclamation. Site preparation and revegetation activities would include:

- *Roads and parking areas*: ripping of hard/compacted surfaces, and grading to blend with adjacent surroundings. Topsoil would then be placed to an appropriate depth over the disturbed area, followed by seeding using an agency-approved seed mix.
- *Ore Stockpiles*: pushing/grading of remaining material to an appropriate configuration. Topsoil would then be placed to an appropriate depth over the disturbed area, followed by seeding using an agency-approved seed mix.
- *Open Pits*: backfilled portions of open pits would be ripped to a depth of 24 inches. Available topsoil would then be placed to an appropriate depth over the disturbed area, followed by seeding using an agency-approved seed mix.
- *Waste Dumps left at angle-of repose with terraces*: ripping to a depth of 24 inches on all terraces and dump tops/access ramps. Topsoil would then be placed to an appropriate depth over the ripped areas, followed by seeding the ripped areas using an agency-approved seed mix.
- *Waste Dumps pushed to an overall 3H:1V slope*: ripping dump slopes along dump contour, as well as dump tops/access ramps to a depth of 24 inches. Topsoil would then be placed to an appropriate depth over the disturbed area, followed by seeding using an agency-approved seed mix.

Termination

If the Project is to be terminated or abandoned, an inspection would be held with the BLM and UDOGM in order to agree upon an acceptable rehabilitation plan for the area.
Successful reclamation would be determined by the BLM and UDOGM.

APPENDIX C

Existing Operations

Exploration

The exploration targets listed below are either currently permitted with UDOGM and the BLM, or are completely on private land.

Copper Ranch Exploration

The Copper Ranch Exploration is an extension of the existing UDOGM exploration permit E/001/0159 to the west of the Copper Ranch Knoll. The area is approximately 86 acres located in Section 17, T. 27 S., R. 11 W., SLB&M. The project area is located entirely on BLM lands. The initial drilling will consist of 8 drill holes on 200 foot centers, average depth at 400 feet. Depending on the drilling results, the project could be expanded up to 300 additional drill holes at the same approximate depth of 400 feet.

Candy B. Exploration

The Candy B. Exploration project is an area over the Candy B patented claim and continuing south onto BLM lands. The claim boundary is 34.09 acres with 23.45 acres located on BLM lands and 10.64 acres located on private patented lands. CSM currently has an approved UDOGM exploration permit E/001/0178 to drill 21 holes, 600-700 feet in depth, and 100 feet on center. The BLM has also approved the project under UTC01 3809: UTU-89128. The total exploration will have 142 drill holes, drill pads and roads. Drill pads will be 30 feet by 60 feet and roads will be 20 feet wide. The entire claim area will be disturbed by the exploration activity.

Hidden Treasure Exploration

The Hidden Treasure Exploration is an area west of the existing Hidden Treasure pit located in Sections 15, 16, 21 and 22, T. 27 S., R 11 W, SLB&M. The exploration area is approximately 29 acres with 4 acres on BLM and 25 acres on SITLA lands. CSM currently has an approved UDOGM exploration permit E/001/0187 to drill 9 drill holes, 400 feet in depth adjacent to the existing pit. BLM approval has also been received under UTC01 3809: UTU-90021. The 9 drill holes are on 50 foot centers. If ore resources are encountered, additional holes will be drilled to delineate the ore deposit on 200 foot centers with additional infield drilling to follow on 100 and 50 foot centers for pit modeling purposes.

Old Hickory Exploration

The Old Hickory Exploration is located near the Old Hickory mine that dates back to the early 1900s. The exploration area is located completely on private land. The area is approximately 11 acres in size. CSM is proposing to drill up to 100 drill holes, 200 to 600 feet in depth, to delineate additional ore resources.

OK East Exploration
The OK East Exploration area is located north and east of the existing OK Mine in Section 7, T. 27 S., R 11 W., SLB&M. The exploration area is approximately 27 acres located completely on private land. CSM is proposing to drill 20 holes to explore for additional ore resources.

Niagara Hill Complex Exploration
The Niagara Hill Complex Exploration is included in the Bawana/Sunrise UDOGM exploration permit E/001/0172. The project area is north of the Bawana pit in Sections 14, 15, 22 and 23, T. 27 S., R. 11 W., SLB&M and is located entirely on private land. To date, 23 drill holes have been completed with an additional 80 drill holes planned to identify the mineral resource. After the exploration holes are completed, it is planned that a new pit will be developed to mine the ore.

Mining Activities

The mines listed below are currently permitted with the BLM and UDOGM for mining, with descriptions of the permitted activity outlined briefly. Currently, CSM conducts open pit mining in three pits: Hidden Treasure, Bawana, and Sunrise. Each pit has its own waste dump and topsoil stockpile. CSM utilizes such mining methods as drilling and blasting, loading material via loader or track hoe, and hauling material to their respective areas (waste dump or process facilities) with 60-ton or 100-ton haul trucks. CSM actively mines the approved pits 24 hours per day, seven days per week, for an average of 340 days per year. Detailed descriptions of the proposed reclamation methods for all currently permitted activities can be found in CSM's NOI (M/001/0067) with UDOGM.

Hidden Treasure Pit and Waste Dump
Under current approved plans, the Hidden Treasure Pit will be deepened to recover additional ore reserves; however, the disturbed area will remain at 25.00 acres (Figure 10a of the UDOGM NOI). An additional 1.8 million tons of waste material will be added to the waste dump which will increase the size of the dump post-reclamation to 72.21 acres (Figure 10b of the UDOGM NOI).

The waste rock will be added in lifts around the perimeter of the existing waste dump within the permitted acreage. Final reclamation will be done with a D-8 and D-10 Caterpillar (CAT), a CAT 385 Track Hoe and CAT 773B or CAT 777G Haul Trucks to slope the dump to the desired 3h:1v slope.

The Hidden Treasure disturbances will be reclaimed in accordance with the BLM and UDOGM's standards (Figure 10b of the UDOGM NOI). Because the waste rock dump will be constructed at the final outslope angle, only minor regarding will be necessary. The dump will be ripped to a depth of two (2) feet and topsoil will be distributed as available for reseeding. If additional topsoil or other materials can be found, the original 12.33 acres from prior operations will be reclaimed in the same manner; otherwise the area will only be ripped and reseeded.

Bawana Pit and Waste Dump
As currently approved, the Bawana Pit will be enlarged to recover additional ore reserves resulting in a total disturbance of 17.85 acres (Figure 11a of the UDOGM NOI). The pit will be

extended to the northwest and approximately 2.3 million tons of overburden will be removed to allow 280,000 tons of ore to be mined. A portion of the overburden will be used to backfill the existing Bawana pit. The remainder of the waste will be placed over the existing dump. Topsoil in the dump expansion area will be stockpiled (Figure 11a of the UDOGM NOI). During final reclamation, the dump will be sloped and reclaimed in accordance with BLM and UDOGM standards (Figure 11b of the UDOGM NOI). The existing Bawana pit will be partially refilled during currently permitted activities, but will eventually be completely refilled with waste rock from the proposed Niagara pit. The expansion of the Bawana dump will result in a total disturbance of 39.47 acres. A 50-foot lift will be added to the existing Bawana dump from prior operations and expanded by adding additional lifts around the perimeter to achieve a 3h:1v slope within the permitted area. The lifts will be managed so the dump material and the topsoil stockpile areas will not be comingled. If sufficient growth media is not available, the waste in the pit would be ripped to a depth of two (2) feet and reseeded.

A 7.53-acre ore stockpile area has been established adjacent to the waste rock dump and across the haul road to the southeast (Figure 11a of the UDOGM NOI). Ore, primarily of lower grade, will be stockpiled here and hauled to the mill for blending with higher grade ore. The stockpile has been in use since prior operators mined the Bawana pit. Topsoil was not salvaged from the site and remains largely in place. After the stockpile is no longer needed and all ore is removed, the in-place soils will be ripped to an appropriate depth (approximately 1.5 times the soil thickness or 1 foot, whichever is greater) and then reseeded.

Sunrise Pit and Waste Dump

The approved Sunrise Pit is located primarily on patented land leased by CSM with its southern part extending onto BLM land. The pit encompasses an area of 12.46 acres (Figure 13a of the UDOGM NOI). Approximately 2.84 million tons of overburden and 577,400 tons of ore are anticipated to be removed from this pit. Ore will be hauled to the mill via a short haul road extending from the north side of the Sunrise Pit northward to the Hidden Treasure haul road near the Bawana pit. The overburden will be placed on the Sunrise waste dump, located east of the Sunrise Pit (Figure 13a of the UDOGM NOI). The Sunrise waste dump is located on a mixture of patented and unpatented land owned and/or controlled by CSM and will have an ultimate footprint of 41.23 acres. The waste dump will be designed and constructed to achieve a 3h:1v outslope.

The Sunrise disturbances will be reclaimed in accordance with the BLM and UDOGM's standards (Figure 13b of the UDOGM NOI). Because the waste rock dump will be constructed at the final outslope angle, only minor regarding will be necessary. Topsoil will be reapplied at a thickness of approximately one foot, ripped, and reseeded to all disturbed areas except the open pit itself.

Overburden to ore stripping ratio varies from pit to pit from approximately 3:1 to 9:1, depending on the individual pit and future economics. Highwall slopes will be constructed to acceptable ranges as delegated by UDOGM and the Mine Safety and Health Administration (MSHA).

CSM Ore Characterization

The material mined from the MOA is primarily copper ore with lesser amounts of gold and silver. The Hidden Treasure, Bawana, and Sunrise copper deposits occur in bodies of garnet-magnetite skarn adjacent to quartz monzonite. These deposits form tabular zones of different orientations.

In 2012, metallurgical and mineralogical tests were performed on samples taken from the Hidden Treasure, Bawana, and Sunrise deposits. The results of these tests reaffirmed historical reports of low to non-existent amounts of pyrite (D. Hartshorn 2013). Copper in all three deposits is dominantly found in the oxide minerals malachite/azurite, cuprite, chrysocolla, and various copper-calcium silicates (ALS 2012a-c). Copper sulfide minerals, chalcopyrite, chalcocite, and bornite, occur in lesser quantities. The geology and mineralization in the Rocky Range is described in more detail in Chapter 3.

Samples representing waste rock (overburden), ore, and the pit bottom from the Bawana deposits have been characterized in terms of acid generation and neutralization potential (AGP and ANP, respectively). The results of that characterization testing are shown in **Table D-1**. The data indicate that all 8 overburden and pit bottom samples had a high neutralization potential and no acid-generating potential. All but 1 of the 8 ore samples had these same characteristics. Based on the proximity of the Bawana pit to the Hidden Treasure pit and the observations and experience by CSM with the geology and mineralization in each pit, the Acid Generating Potential/Acid Neutralizing Potential (AGP/ANP) data for the Bawana pit is reasonably representative of that for Hidden Treasure.

Table D-1 Bawana Mine Acid Base Analysis and Net Carbonate Data

Sample Description	Recvd Wt.	(C_T) C-IR07 C %	(S_T) S-IR08 S %	(C_R) C-IR07 C organic %	(S_R) S-IR08r S %	AGP	ANP	NCV	Result
Bawana OB1	0.22	1.2	0.03	0.08	<0.02	<0.01	4.11	**<4.10**	**Moderately basic**
Bawana OB2	0.20	1.17	0.04	0.23	0.04	0.00	3.45	**3.45**	**Moderately basic**
Bawana OB3	0.28	0.57	0.01	0.05	<0.02	<0.01	1.91	**<1.92**	**Moderately basic**
Bawana OB4	0.28	0.54	0.01	0.03	<0.02	<0.01	1.87	**<1.89**	**Moderately basic**
Bawana OB5	0.18	1.60	0.04	0.37	0.04	0.00	4.51	**4.51**	**Moderately basic**
Bawana OB6	0.18	0.80	0.01	0.08	<0.02	<0.01	2.64	**<2.66**	**Moderately basic**
Bawana OB7	0.14	0.65	0.03	0.04	0.02	-0.01	2.24	**2.23**	**Moderately basic**
Bawana OB8	0.10	3.04	0.57	0.08	0.59	0.03	10.86	**10.89**	**Highly basic**
Bawana Ore1	0.30	3.74	0.05	0.06	0.05	0.00	13.51	**13.51**	**Highly basic**
Bawana Ore2	0.34	0.38	0.03	0.08	<0.02	<-0.01	1.10	**<1.09**	**Moderately basic**
Bawana Ore3	0.30	0.59	0.05	0.15	0.04	-0.01	1.61	**1.60**	**Moderately basic**
Bawana Ore4	0.36	0.75	0.03	0.12	<0.02	<-0.01	2.31	**<2.30**	**Moderately basic**
Bawana Ore5	0.24	0.02	1.11	0.04	0.72	-0.53	-0.07	**-0.61**	**Slightly acidic**
Bawana Ore6	0.10	0.47	0.40	0.14	0.36	-0.05	1.21	**1.16**	**Moderately basic**
Bawana Ore7	0.08	3.12	0.02	0.04	<0.02	<0.00	11.30	**<11.30**	**Highly basic**
Bawana Ore8	0.10	2.44	0.03	0.04	0.02	-0.01	8.81	**8.79**	**Highly basic**
Bawana PB1	0.22	0.43	0.01	0.04	<0.02	<0.01	1.43	**<1.45**	**Moderately basic**
Bawana PB2	0.22	0.58	0.02	0.29	0.02	0.00	1.06	**1.06**	**Moderately basic**

Sample Description	Recvd Wt.	(C_T) C-IR07 C %	(S_T) S-IR08 S %	(C_R) C-IR07 C organic %	(S_R) S-IR08r S %	AGP	ANP	NCV	Result
Bawana PB3	0.22	0.48	0.02	0.15	<0.02	<0.00	1.21	**<1.21**	**Moderately basic**
Bawana PB4	0.30	0.87	0.01	0.03	<0.02	<0.01	3.08	**<3.10**	**Moderately basic**
Bawana PB5	0.14	0.99	0.01	0.13	<0.02	<0.01	3.16	**<3.17**	**Moderately basic**
Bawana PB6	0.20	1.97	0.01	0.05	<0.02	<0.01	7.05	**<7.06**	**Highly basic**
Bawana PB7	0.10	0.96	0.02	0.03	<0.02	<0.00	3.41	**<3.41**	**Moderately basic**
Bawana PB8	0.16	0.22	0.02	0.03	<0.02	<0.00	0.70	**<0.70**	**Slightly basic**

OB = overburden
PB = Pit bottom
NCV = Net Carbonate Value

CSM has obtained AGP/ANP data for representative samples of overburden, wall rock, and pit floor for the Sunrise deposit. The results are summarized in **Table D-2**.

Table D-2 Acid Generating and Neutralization Potential – Sunrise Deposit

	MPA	NP	pH	Ratio (NP:MPA)
Units	tCaCO3/1000t ore	tCaCO3/1000t ore	Unity	Unity
SAMPLE				
OB Composite 1	2.2	479	7.9	219
OB Composite 2	1.9	405	7.7	216
OB Composite 3	5	541	7.6	108.2
OB Composite 4	1.9	405	7.8	216
OB Composite 5	1.6	430	8	275.2
OB Composite 6	1.6	572	8.1	366.1
OB Composite 7	2.2	375	7.7	171.45
PB Composite 1	13.1	671	9.8	51.12
PB Composite 2	4.4	387	9.1	88.46
PB Composite 3	4.1	286	8.7	70.4
PB Composite 4	2.2	148	8.7	67.66
PB Composite 5	2.8	262	8.7	93.16
PB Composite 6	2.2	239	8.4	109.25
PB Composite 7	1.9	183	8.6	97.6
PB Composite 8	2.2	274	8.8	125.25
WR Composite 1	0.9	182	8.8	194.15
WR Composite 2	1.6	200	9.8	128
WR Composite 3	0.6	163	8.9	260.8
WR Composite 4	0.9	182	8.7	194.15
WR Composite 5	1.3	279	9.3	223.2
WR Composite 6	2.5	328	8.6	131.2
WR Composite 7	1.6	172	8.9	110.1
WR Composite 8	1.6	312	8.6	199.7
OZ Composite 3	14.1	679	8.3	48.28
OZ Composite 4	15.3	599	8.4	39.12
OZ Composite 5	7.2	762	8.9	106
OZ Composite 6	30.3	627	8.8	20.68

	MPA	NP	pH	Ratio (NP:MPA)
Units	tCaCO3/1000t ore	tCaCO3/1000t ore	Unity	Unity
OZ Composite 7	1.9	114	8.4	60.8
OZ Composite 8	21.6	401	10	18.6
OZ Composite 9	15.3	577	7.8	37.68
OZ Composite 10	2.5	658	8.9	263.2
WT Composite 1	8.4	718	8.8	85.1
WT Composite 2	11.3	591	9.3	52.53
MPA: Maximum Potential Acidity				
NP: Neutralization Potential				

OB means overburden (cemented alluvium) PB means pit bottom
WR means wallrock
OZ means ore zone
WT means waste rock

The AGP/ANP data for the Sunrise deposit demonstrate that the waste rock, pit floor, and wall rock in the proposed pit will be non-acid-generating and will have excessive neutralizing potential. Acid rock drainage is therefore not anticipated in either the waste rock dump or the pit.

Processing Facilities

CSM currently has processing facilities in place with the capability of crushing, grinding, and flotation of the copper and magnetite ore. These facilities are located completely on private land north of the existing pits, on the southern foothills of the Beaver Lake Mountains. CSM has also received approval from UDOGM to expand current facilities to include an acid leach and solvent extraction/electrowinning (SX/EW) circuit. Currently all approved process facilities are/will be located on 96.3 acres of private land. All access to CSM operations is controlled and restricted by warning signs, security guards, fences, and gates. CSM process facilities operate 24 hours per day, seven days per week. The facilities are closed for approximately one month out of each year for maintenance work, for an average of 340 operational days per calendar year.

Active Crushing, Grinding, and Flotation Process Area

The primary process area consists of a crushing and grinding area with a dirt/gravel floor, and a flotation mill and recovery station with a concrete floor. The entire facility has underlying concrete footings. The facility also includes chemical storage and conditioning tanks, and a lined flotation pond in the southern end of the facilities area.

The concentrating procedures start with primary crushing of the ore with jaw crushers, and secondary crushing with cone crushers. The ore is then sent to a series of ball mills for further grinding followed by a rough magnetic separation which separates the magnetite ore from the copper. The magnetite concentrate is stockpiled in anticipation of its sale to an end user. The copper ore proceeds to the conditioning, reagent, and mixing circuit of flotation and filtration, which results in a copper concentrate and tailings. The copper concentrate is stockpiled for later shipping via truck to offsite facilities for further processing. The tailings are deposited in the flotation tailings pond south of the facilities.

Acid Leach and Solvent Extraction/Electrowinning (SX/EW)
The acid leach circuit and solvent extraction/electrowinning facilities have been approved by UDOGM (UDOGM 2014). After the acid leach circuit and related facilities are built, the tailings from the flotation circuit will be transported via pipeline to the acid-leach/counter-current decantation (CCD) circuit where it will undergo leaching with sulfuric acid solution. The resultant copper-bearing pregnant leach solution (PLS) will be processed in the adjacent SX/EW circuit. All solutions used in the processing of copper ore will be recycled back through the system. Residual solids remaining after each of the extraction steps are recovered and sent to tailings. Most of the solids, termed crud, are recovered by filtration activities at the SX circuit. Design drawings for the acid leach and SX/EW facilities can be found in Appendix F of the UDOGM NOI.

Deleterious or Acid-forming Materials
CSM will be using sulfuric acid in its acid leach circuit and for stripping copper from the solvent prior to electrowinning. Two large sulfuric acid tanks will store acid used in the process. Secondary containment for this facility will have the capacity to contain 110 percent of the total volume of the largest tank. Appropriate spill containment will be provided in all mill facility components that use sulfuric acid.

The solvent extraction circuit will use a kerosene-based organic mixture to separate copper and trace metals from the acid solution that is recovered by the CCD circuit. All chemicals will be handled properly in accordance with guidance provided by the manufacturer. Process solvents will be kept in an isolated location within the fully contained mill, and inadvertent spills will be fully contained within the concrete mill foundation. Any spills will be immediately cleaned up, again in accordance with manufacturers' guidelines. Acid-forming materials are not expected to be encountered during the mining operations.

A detailed chemical spill prevention, control and countermeasures (SPCC) plan is kept onsite at all times. Monitoring of all containments occurs regularly, with any degradation in containment reported immediately. All employees have been trained on the type of materials used in the beneficiation operations, and what actions to take in case of accidental exposure.

CSM stores motor fuel (diesel) on site. Most of the fuel is stored in the tanks at the offsite truck shop. A single 2500 gallon diesel fuel tank is located at the mill. It is contained within an earthen berm lined with a 40-mil HDPE membrane.

Tailings Facilities

Flotation Tailings Pond
The flotation tailings pond is located south and down-gradient of the process facilities. The pond is lined and fenced, and encompasses a footprint of approximately 30 acres of private land. The flotation tailings pond currently receives tails from the flotation milling process outlined above. Upon completion of the acid leach circuit, the flotation tails will be extracted from the existing tailings pond and sent through the leach/SX/EW circuit to recover the remaining copper that was not extracted during flotation processes.

Intermediate Tailings Disposal Facility
The construction and use of an Intermediate Tailings Disposal Facility (ITDF) is included in the approval issued by UDOGM (UDOGM 2014). The ITDF will be located on private land, encompassing 85.1 acres within two small canyons east of the facilities area. The ITDF will have two dams and a capacity of approximately 5 million cubic yards, with an anticipated life of four to eight years. Containment of tailings liquids will be accomplished by one or more of the following: selective distribution of tailings fines to retard infiltration at the bottoms of the impoundment, by collection of infiltrated water using "pump-back" wells installed below the toes of the dams, and/or with geosynthetic clay liner (GCL). At a minimum the upstream faces of both dams will be lined with GCL. The ponds will be designed to contain all un-diverted upland runoff from an appropriate precipitation return event.

Reclamation of the ITDF will be accomplished by first placing a geotextile as needed for foundation stability on top of the partially dried tailings surface and then advancing a one-foot topsoil and geotextile sequentially across the pond surface. Topsoil will be scarified after placement and reseeded by broadcast methods using the Division-approved seed mix. A detailed description of the proposed reclamation activities for the ITDF can be found in CSM's NOI.

Monitoring Wells
CSM has a ground water discharge permit from the Utah Division of Water Quality (UDWQ) under Permit Number UGW010014 (UDWQ 2014). This ground water discharge permit covers the mining and processing activities and tailings ponds described in Section 2.2 of this EA. CSM currently has four monitoring wells associated with the flotation tailings pond, and two down-gradient monitoring wells associated with the ITDF. Additional down-gradient sampling for the ITDF is taken from the WW-6 production well. Upgradient monitoring of the ITDF is done by sampling the WW-3 production well.

Ancillary Facilities

Access and Traffic
The MOA is accessed by driving west from Milford, Utah along Highway 21, then northwest on an unnamed dirt road. There exists a guard station along the unnamed dirt road that controls all traffic entering and exiting the active CSM mining property.

APPENDIX D

Wildlife Report

Affected Environment
The project area is generally semi-arid, high-desert country characterized by dissected hills of relatively low relief surrounded by valley flats. The project area is located between 5,200 and 5,800 feet elevation above mean sea level in an area with flats dominated by big sagebrush (*Artemisia tridentata*) and the hills/mountains dominated by black sagebrush (*Artemisia nova*). Sagebrush provides important winter habitat for several wildlife species (e.g., mule deer and pronghorn) and localized habitat for sagebrush-obligate species (e.g., pygmy rabbit and Brewer's sparrow). Sagebrush also provides important breeding, nesting, and brood-rearing habitat for these species and others.

General wildlife observations were made along with surveys for raptors and bats, conducted in the project area on several occasions during 2013 (JBR 2013) and 2014 (JBR 2014). This section describes the results of raptor and bat surveys, and also describes big game and other potential wildlife in the area.

The following animals (**Table 3.3-2**) were observed within or directly adjacent to the project area:

Table 3.3-2: Animals Observed During Survey

Common Name	Scientific Name
Black-tailed jackrabbit	*Lepus californicus*
Coachwhip	*Masticophis flagellum*
Common side-blotched lizard	*Uta stansburiana*
Desert cottontail	*Sylvilagus auduboni*
Desert horned lizard	*Phrynosoma platyrhinos*
Desert spiny lizard	*Sceloporus magister*
Gopher snake	*Pituophis catenifer*
Great Basin collared lizard	*Crotaphytus bicinctores*
Long-nosed leopard lizard	*Gambelia wislizenii*
Whiptail	*Aspidoscelis tigris*
White-tailed antelope squirrel	*Ammospermophilus leucurus*

Two coyote (*Canis latrans*) dens were noted as active during a 2013 biological survey (JBR 2013), these dens were checked during the 2014 survey and found to be inactive.

Raptors
Special habitat needs for raptors include nest sites, foraging areas, and roosting or resting sites. Buffer zones are usually recommended around raptor nest sites during early spring and summer when raptors are raising their young. The most utilized raptor nesting areas are generally found along riparian areas and cliff faces.

Sixty large stick nests, suitable for use by raptors, were found/checked (JBR 2014) within the general raptor and golden eagle survey areas, which included the Rocky Range Mountains, the southern portion of the Beaver Lake Mountains, and the northern portion of the Star Range. Of the nests found/checked 10 were active, 6 with raptor species and 4 being used by ravens.

Bald and golden eagles are protected by the Bald and Golden Eagle Protection Act and are United States Fish and Wildlife Service (USFWS) Birds of Conservation Concern. Bald eagles may winter in the project area between November 1 and March 15 and may occasionally fly over the area while foraging. Golden eagles have been noted both within and near the project area. They are year round residents. Three active golden eagle nests have been discovered within the five-mile buffer of the MOA. There are consistent sightings of both adult and juvenile golden eagles within the MOA that further supports that golden eagles do nest in the vicinity (JBR 2014).

Of three active golden eagle nests identified during the 2014 survey (JBR 2014), two were successful and fledged chicks. Nest UT040002012 at the extreme north end of the survey area fledged two chicks. Nest UT040002020 at the extreme south end of the survey area fledged at least one chick and possibly two. Due to the nest location, extremely high on a rock face, and the depth of the nest, it was very difficult for surveyors to achieve a vantage point to see into the nest. One nest (UNK_012) failed. An eagle pair was observed improving this nest by surveyors during early spring, and a subsequent visit to the nest later in the 2014 nesting season confirmed a golden eagle incubating at the site. A final return visit to the nest for the purpose of verifying nesting success found the nest to be prematurely vacated. Surveyors were able to get higher than the nest and utilizing a spotting scope to see into the nest; there was no evidence of adult eagles or chicks in or near the nest. No deceased chicks were found in or under the nest, rather the nest was confirmed to be completely empty. The failed golden eagle nest was located very close to a common raven nest and during every previous visit to the nest ravens were observed harassing the nesting golden eagles.

Burrowing owls have been documented within the general area, although none have been documented within the MOA. In 2013, one burrowing owl pellet was noted on a mound approximately 0.4 mile from the Sunrise Mine adit.

Ferruginous hawk have also been documented in the general area. Multiple years of raptor nest surveys have not documented any ferruginous hawk nests within 0.5 mile of the Project Area until the 2104 survey when a ferruginous hawk nest was identified in a power line structure next to the Marietta Mine crusher yard. This nest was active and fledged chicks.

The project area is suitable red-tailed hawk foraging habitat. One red-tailed hawk nesting territory has been documented within the 1-mile buffer of the MOA. It is a stick nest on a power line structure adjacent to a dirt road. This nest was active in 2012, but gone in 2013. It is unknown if an alternate nest within the territory was used, but it would be likely.

Several raptor individuals (unassociated with nests) were seen during the general raptor survey event; two ferruginous hawks were seen courting and copulating near the edge of the 1-mile buffer survey area boundary but no nest was located in or near the survey area. Several

American kestrels were also noted flying through the survey area but none were found to be nesting within the survey area. Prairie falcons were observed flying over the project area and two active prairie falcon nests were discovered well outside the 0.5-mile buffer.

Bats

There are four locations noted in or near the project area that have potential to contain bats. These locations include the old Sunrise adit, the Montreal adit, the Old Hickory 100 Level adit, and the Niagara adit. During field reconnaissance, it was noted that the Montreal adit had been covered, and no sign of activity was present (JBR 2014). For the other three locations, an AnaBat Detector was used to passively survey for bat species in 2013 and 2014 (see JBR 2013 and 2014). In 2014, the more active and recent year, at the Sunrise adit, a total of 952 bat calls over 6 species were recorded during the spring monitoring period and 1,160 calls over 7 species were recorded for the fall period. At the Old Hickory mine, a total of 116 calls were recorded over 7 species during the spring survey while the fall survey produced 451 calls over 10 species. At the Niagara adit, a total of 211 bat calls were recorded over 11 species during the spring survey and 411 calls over 6 species during the fall survey.

Of the bat species detected, only the Townsend's big-eared bat (*Corynorhinus townsendii*) and the fringed myotis (*Myotis thysanodes*) are considered special status species (BLM sensitive). The Townsend's big-eared bat was detected on the recordings at both the Niagara and Old Hickory adits only during the fall acoustical monitoring while the fringed myotis was only detected at the Niagara adit, during the spring acoustical monitoring (JBR 2014). Fringed Myotis are present based on only two call sequences identified to this species; it is possible these two sequences are a different species, but due to their conservation status they were included.

Migratory Birds

Migratory birds are important components of biological diversity and indicators of environmental conditions at local, regional, and global scales. A variety of migratory birds are found in the project area. The most commonly occupied breeding habitat for migratory birds in the project area is sagebrush shrub steppe. A complete list of birds noted during the survey is located in **Table 3.3-3**.

Table 3.3-3: Birds Observed During the Survey

Common Name	Scientific Name
American kestrel	*Falco sparverius*
Bald eagle	*Haliaeetus leucocephalus*
Black-throated sparrow	*Amphispiza bilineata*
Brewer's sparrow	*Spizella breweri*
Brown-headed cowbird	*Molothrus ater*
Chukar	*Alectoris chukar*
Common raven	*Corvus corax*
Ferruginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Horned lark	*Eremophila alpestris*
Lesser nighthawk	*Chordeiles acutipennis*
Loggerhead shrike	*Lanius ludovicianus*
Long-eared owl	*Asio otus*

Common Name	Scientific Name
Northern flicker	*Colaptes auratus*
Pinyon jay	*Gymnorhinus cyanocephalus*
Prairie falcon	*Falco mexicanus*
Rock wren	*Salpinctes obsoletus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Turkey vulture	*Cathartes aura*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*

Big Game

The project area is not in crucial winter range for mule deer or range for elk. However, it is within a large area that has been mapped by the Utah Division of Wildlife Resources as crucial yearlong pronghorn habitat (BLM 2013a). The mapped habitat covers the valleys of the western deserts of Utah from Iron County to southern Box Elder County. Pronghorn are speedy ungulates that occur in open, dry habitats. In Utah, nearly all pronghorn populations occur in shrubsteppe containing large expanses of open, low, rolling, or flat terrain (UDWR 2009). The project area is located within the Southwest Desert Herd Management Area, which contains about 2 million acres of crucial yearlong habitat. The herd unit is below the population objective (BLM 2013b). The site characteristics provide suitable habitat: open country with sagebrush and perennial grasses and forbs. The project area is not known to be important for pronghorn fawning or wintering. Pronghorn use of the project area appears to be limited due to low population numbers in this portion of the unit, limited species distribution in the area, and levels of human disturbance (BLM 2013a).

Threatened, Endangered, Candidate, or Sensitive Animal Species

Table 3.3-4 lists all special status animal species occurring in the Cedar City Field Office planning area. Prior to conducting surveys, 10 special status species were identified that have a moderate to high probability of occurring within or adjacent to the project area: bald eagle, burrowing owl, ferruginous hawk, big free-tailed bat, fringed myotis, kit fox, pygmy rabbit, spotted bat, Townsend's big-eared bat, and Western red bat. Other species would not be found in the survey area due to lack of suitable habitat. Details about their habitat are listed in **Table 3.3-4**.

Table 3.3-4: Special Status Species Known or Potentially Occurring in the MOA

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the project area	Status
FISH				

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the project area	Status
Bonneville cutthroat trout	*Oncorhynchus clarkii utah*	One of three subspecies of cutthroat native to Utah. It occurs in streams and lakes of the Bonneville Basin and a limited portion of the Virgin River Drainage (Bosworth 2003). In general, habitat is variable, ranging from high elevation streams with coniferous and deciduous riparian trees to low elevation streams in sage-steppe grasslands containing herbaceous riparian zones. Regardless of habitat, require a functional stream riparian zone that provides structure, cover, shade, and bank stability.	**None** - No suitable aquatic habitats within the Milford Operations Area.	BLM Sensitive, Conservation Agreement Species, Utah Species of Concern
Desert sucker	*Catostomus clarkii*	In Utah, the species occurs only in the Virgin River system in the southwestern corner of the state.	**None** - No suitable aquatic habitats within the Milford Operations Area.	BLM Sensitive, Utah Species of Concern
Southern leatherside chub	*Lepidomeda aliciae*	Endemic to streams in the southern and eastern Bonneville Basin. Require flowing water and do not persist in lakes or reservoirs. Occupied streams have a high variability of stream flow, annual precipitation, gradient, elevation, conductivity, and pH (Utah Division of Wildlife [UDWR] 2010).	**None** - No suitable aquatic habitats within the MOA.	BLM Sensitive, Utah Species of Concern, Conservation Agreement Species
AMPHIBIANS				
Arizona toad	*Bufo microscaphus*	In Utah, found only in the southwestern portion of the state. This species inhabits streams, washes, irrigated crop lands, reservoirs, and uplands adjacent to water.	**None** - No suitable aquatic habitats within the MOA.	SS
Western (boreal) toad	*Bufo boreas*	Primarily found in or near ponds, lakes, reservoirs, rivers, and streams within grasslands and mountain meadows (Stebbins 1985).	**None** - No suitable aquatic habitats within the MOA.	CA
BIRDS				
American white pelican	*Pelecanus erythrorhynchus*	In Utah, the only known breeding colonies are located in the northern portions of Utah, Utah Lake and Great Salt Lake ecological complex. During spring migration, the breeding season, and fall staging and migration periods, can be observed at many reservoirs throughout the state.	**None** - No suitable aquatic habitats within the MOA.	BLM Sensitive, Utah Species of Concern

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the project area	Status
Bald eagle	*Haliaeetus leucocephalus*	Occur in Utah generally on a migratory or wintering basis, although a small population nests in Utah. Nests in tall trees and commonly near bodies of water where prey are available. Bald eagles will feed on fish, waterfowl, small mammal, and carrion. Will concentrate wherever food is available, roosting in large groups in forested stands that provide protection from weather. They may also winter in upland habitats, feeding on small mammals and deer carrion.	**Moderate** - No lakes or reservoirs occur within or near the MOA. Potential foraging habitat.	BLM Sensitive, Utah Species of Concern
Black swift	*Cypseloides niger*	Use waterfalls for nesting; typically falls that are permanent but may be intermittent if they flow throughout the breeding season (June to early September). Nesting sites are typically coniferous forests, often mixed conifer or spruce-fir forests, but this varies depending on elevation and aspect. Nest sites may include mountain shrub, aspen, or even alpine components.	**None** - There are no waterfalls or bodies of water in or near the MOA.	BLM Sensitive, Utah Species of Concern
Burrowing owl	*Athene cunicularia*	Nests occur in shrub-dominated habitats, including sagebrush steppe and desert scrub, often in sparsely vegetated areas with a short grass herbaceous component (Bosworth 2003). Are obligate burrow nesters and may be largely dependent on prairie dog burrows in much of Utah, but also utilize burrows dug by badgers, ground squirrels, and other burrowing rodents.	**High** - Shrub dominated habitats present. Suitable burrows likely present. Known occurrences in the area.	BLM Sensitive, Utah Species of Concern
California condor	*Gymnogyps californianus*	Mountainous country especially rocky and brushy areas with cliffs; forage over large areas. Species is concentrated in southern Utah, in the region of the Grand Canyon and Zion Canyon.	**Low** - Foraging habitat is present and birds have been documented in region. MOA is about 70 miles from known condor roosting locations.	Federally Listed Endangered west of Interstate 15
Ferruginous hawk	*Buteo regalis*	Occupy grasslands, sagebrush, salt-desert, and other shrublands, and edges of pinyon-juniper woodlands; they may become locally abundant at shrubsteppe and pinyon-juniper ecotones. They may occur as breeding or year around populations in southwest Utah.	**High** - Suitable habitat present throughout most of the MOA. Known occurrences in the area.	BLM Sensitive, Utah Species of Concern
Greater sage-grouse	*Centrocercus urophasianus*	Inhabit sagebrush plains, foothills, and mountain valleys. Sagebrush is the predominant plant of quality habitat. A good understory of grasses and forbs, and associated wet meadow areas, are essential for optimum habitat.	**None** - MOA is located approximately 8.5 miles outside of Utah Division of Wildlife Resources (UDWR) mapped habitat.	Federal Candidate, BLM Sensitive

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the project area	Status
Lewis' woodpecker	*Melanerpes lewis*	Habitats are burned-over Douglas-fir, mixed conifer, pinyon-juniper, riparian, and oak woodlands, but is also the fringes of pine and juniper stands, and deciduous forests, especially riparian cottonwoods (ibid.). Areas with an under-story of grasses and shrubs to support insect prey populations are preferred. Dead trees and stumps are required for nesting.	**Low** - There are no deciduous forests located in or near the MOA. May use MOA during migration.	BLM Sensitive, Utah Species of Concern
Long-billed curlew	*Numenius americana*	Use expansive, open, level to gently sloping or rolling grasslands with short vegetation such as shortgrass or recently grazed mixed-grass prairie. They commonly nest in both wet and dry prairie and in pastures, but rarely nest in hayland, cropland, fallow, or stubble fields (Dechant et al. 2003).	**Low** - No known occurrences in the MOA. The species has been documented as a breeder in region.	BLM Sensitive, Utah Species of Concern
Northern goshawk	*Accipiter gentiles*	Inhabit montane coniferous and deciduous woodland in the west, nesting in stands of intermediate to high canopy-closure with a thin understory, interspersed with small openings, fields, or wetlands. Important microhabitats in Utah include snags, multiple canopies, and down woody debris. In southern Utah, most often associated with mature to old growth stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), followed by aspen (*Populus tremuloides*; Graham et al. 1999).	**Low** - The MOA provides forested habitats, but lacks multiple canopies and intermediate to high canopy-closure. No known occurrences.	BLM Sensitive, Conservation Agreement
Short-eared owl	*Asio flammeus*	Short-eared owls are ground nesters, generally in grasslands and tundra. Nesting habitat has been described in Utah as marshes; wet hummocks; agricultural croplands; arid grassland; sometimes cold desert shrub (including saltbush and greasewood), and sagebrush-rabbitbrush (Bosworth 2003).	**Low** - No known occurrences in the MOA.	BLM Sensitive, Utah Species of Concern
MAMMALS				
Big free-tailed bat	*Nyctinomops macrotis*	Prefers rocky and woodland habitats, where roosting occurs in caves, mines, old buildings, and rock crevices. In Utah the big free-tailed bat has been captured in the following habitats: lowland riparian, desert shrub, and montane forest (Oliver 2000).	**Moderate** - Woodland habitat present and known to occur in region.	BLM Sensitive, Utah Species of Concern
Dark kangaroo mouse	*Microdipodops megacephalus*	In Utah, the species occurs in the West Desert, typically in sagebrush areas with sandy soils.	**None** - Suitable, sandy soils not present in the MOA.	BLM Sensitive, Utah Species of Concern

Common Name	Scientific Name	Habitat Requirements	Probability of Occurrence in the project area	Status
Fringed myotis	*Myotis thysanodes*	Moderately wide range of habitats: lowland riparian, desert shrub, juniper–sagebrush, sagebrush–rabbitbrush, pinyon–juniper–sagebrush, pinyon–juniper, mountain meadow, ponderosa pine forest, and montane forest and woodland. Inhabits caves, mines, and buildings (Oliver 2000).	**Moderate** - Suitable habitat present in the MOA.	BLM Sensitive, Utah Species of Concern
Kit fox	*Vulpes macrotis*	Habitats include desert, grassland/herbaceous, playa/salt flat, savanna, shrubland; primarily in open desert, shrubby or shrub-grass habitat. In the Great Basin it is found in shadscale, greasewood, and sagebrush (NatureServe 2010).	**Moderate** - The MOA contains sagebrush and open desert.	BLM Sensitive, Utah Species of Concern
Pygmy rabbit	*Brachylagus idahoensis*	Habitats are dominated by big sagebrush and on alluvial fans where sagebrush occurs in tall, dense clumps (Green and Flinders 1980). Burrows are usually located at the base of sagebrush plants. Diet consists primarily of big sagebrush species; however, grasses and forbs are utilized in the summer.	**Moderate** - The MOA contains big sagebrush and soils suitable for creating burrows. No known occurrences.	BLM Sensitive, Utah Species of Concern
Spotted bat	*Euderma maculatum*	Inhabit a diversity of habitats: grass, desert, pinyon/juniper, sagebrush, and ponderosa up to high elevation coniferous forests, and also riparian and urban high-rise (cliff analog). Foraging occurs over sagebrush steppe, desert scrub, or montane meadow habitat. It is thought that spotted bats roost singly in steep cliff faces having cracks or crevices, but there is some indication that caves and mines may be used in winter (Altenbach et al. 2002).	**Moderate** - Roosting and foraging habitat present in the MOA.	BLM Sensitive, Utah Species of Concern
Townsend's big-eared bat	*Corynorhinus townsendii*	Dependent on deep caverns or mines for roost, maternity, and hibernation sites. Use variety of grassland/shrub and forested habitats, primarily pinyon-juniper-mahogany, white fir, blackbrush, sagebrush, salt desert scrub, and agricultural and urban habitats (Altenbach et al. 2002).	**High** - Adits and mine shafts present in the MOA. Known occurrences in the MOA.	BLM Sensitive, Utah Species of Concern
Utah prairie dog	*Cynomys parvidens*	Burrowing mammals that require the presence of well-drained soils. Inhabit areas where vegetation can be maintained at a height level, which allows them to identify invading predators. Prefer areas where less than 10% of the vegetation is composed of tall plants greater than 12 inches (Collier 1975).	**None** - The MOA is outside the known range and outside Designated Critical Habitat.	Federal Threatened
Western red bat	*Lasiurus blossevillii*	Found near water, often in wooded areas.	**High** - Suitable habitats and known occurrences in the MOA.	BLM Sensitive, Utah Species of Concern

Environmental Consequences
A total of 1,225 acres would be disturbed under the Proposed Action; 140 acres for exploration and 1,085 acres for mine expansion and associated facilities.

Human activity and disturbance would be new in the Big Wash and Crossroads exploration areas, as there are no existing mining activities occurring in those areas. However, overall impacts to wildlife from exploration activities would be negligible to minor and short term. Habitat, 140 acres total, would be temporarily impacted from drilling activities under the Proposed Action. The disturbance at the drill locations would be reclaimed and re-seeded after drilling and thus would be a short-term loss. Suitable habitat is abundant and available adjacent to the project area. Minimal indirect effects to some small, less mobile individuals would likely occur as they could be forced to disperse from the area or may be killed or injured during exploration activities. Wildlife in the area would likely be displaced temporarily during active drilling activities into adjacent undisturbed habitat. Populations on the whole would not be affected.

In areas of existing mining activities, wildlife has likely been displaced or habituated to the noise and activity. Although mine activities would be expanded onto adjacent lands, overall impacts to wildlife in these areas would also be negligible to minor, but long term (for the life of the project). Reclamation would occur concurrently with mining; an expended pit would be reclaimed as mining at another pit commenced, therefore not all 1,085 acres of habitat would be impacted at once.

Raptors
Bald eagles are wide ranging in the winter and there are no known roosts or concentration areas within the project area; therefore there would be no impact to bald eagles.

Golden eagles would be impacted by a loss of foraging habitat. The impact could vary from very minor to displacement of eagles to adjacent suitable habitat. The impact from the loss of foraging habitat would be minor. Due to the presence of ongoing operations at both the CSM project and the nearby Rocky Range ballast mine, eagles in this area are probably habituated to mining disturbances such as people, haul trucks, and blasting.

Red-tailed hawk foraging habitat is abundant and the loss of habitat would likely not impact red-tailed hawks. These hawks are tolerant of disturbance and nesting activities would not be impacted by the Proposed Action.

Any raptor could be attracted to the mining and haul road areas to scavenge road kill. If this occurred, they could be hit by haul trucks. However, BLM is unaware of road kills within the MOA, except for an occasional snake.

Raptor management would be guided by the use of 'Best Management Practices for Raptors and Their Associated Habitats in Utah" (BLM 2006, Appendix C), utilizing seasonal and spatial buffers, as well as mitigation, to maintain and enhance raptor nesting and foraging habitat, while allowing other resource uses.

The application of spatial and seasonal/timing buffers would follow guidance in BLM (2006), and specifically depend upon the type and duration of activity proposed to take place within the buffer as well as the distance and visibility of the activity from the active nest site. An activity report would be provided to the BLM during this time frame. BLM (2006) states that "land managers should evaluate the type and duration of the proposed activity, the position of topographic and vegetative features, the sensitivity of the affected species, the habituation of breeding pairs to existing activities in the proposed project area, and the local raptor nesting density, when determining site-specific buffers." If longer term activities such as those involving mine operations are proposed within a spatial and seasonal buffer for an active nest, perennial surface occupancy restrictions may be advised."

Bats

Bats can be very sensitive to human disturbance and sound, causing them to abandon roosts, including maternity colonies and hibernacula. Disturbances during winter may cause bats to wake up, or come out of torpor, expending additional calories which can cause death. Several of the bat species documented in the project area in 2014 also winter in Utah and a few may be active during warmer periods in the winter.

Published studies of the impact of blasting vibrations on hibernating bats in underground mines or caves exist (Myers 1975; Pritchard 2012; WVDEP 2006 & 2007) but only broad generalizations can be drawn from these studies due to a variety of site-specific factors. The existing studies address two obvious possible impacts to roosting or hibernating bats subjected to blasting caused vibrations: 1) severe vibrations causing roof failure and crushing fatalities and, 2) lesser vibrations rousing bats from their hibernation torpor with the attendant negative effect of depleting critical body reserves.

Peak vibration levels from blasting are typically expressed as peak particle velocities (ppv, given in in/sec in the US) and are a function of charge weight, distance from the charge to the measuring point, and the site-specific geologic conditions between the charge and measuring point. While actual peak particle velocities can only be known precisely for a given situation by actual physical measurement, they can be reasonably estimated through equations derived from thousands of actual blasting vibration measurements. The studies suggest that peak vibration levels on the order of greater than 1 in/sec are necessary to cause roof failures (Siskind, 2000). The studies also indicate that to awake bats from hibernation torpor would require peak vibration levels greater than 0.2 in/sec. For the proposed action, being evaluated, vibration estimating formulas suggest that a ppv between 0.2 -0.4 in/sec could be expected in the Sunrise Adit, or the other adits, from the nearest projected shot hole (worst case) from the proposed Sunrise Mine pit. This estimate suggests that it is very unlikely that any acute adverse effect (death) would occur to any hibernating or roosting bats due to roof fall but that some risk exists that bats could be awakened from torpor.

Bats entering or leaving the adits would probably be disturbed by activity from the nearby pits, dumps, and haul roads. The noise and lights could disrupt flight and foraging patterns. Further, under the proposed action, eventually all the adits in the area would be destroyed. In order to minimize the potential for impacting bats, these adits will be monitored and efforts made to ensure that adits are free of bats prior to destroying.

A worst case scenario would predict displacement and death of a few hundred individuals of several species, including Townsend's big-eared bats and fringed myotis, both sensitive species. A best case scenario would be based on no bats using the adits when mining commences (unlikely) and that impacts would be the loss of foraging habitat and displacement when bats return to the area in the spring. The actual impact is likely somewhere in between.

Migratory Birds

The potential direct impacts to migratory bird species would include the short-term loss of 140 acres and long-term loss of approximately 1,085 acres of potentially suitable breeding and foraging habitat including sagebrush and black sagebrush, as well as impacts from noise and dust, described below. Not all 1,225 acres would be disturbed at the same time as reclamation at one pit would occur as another is being mined and the same with exploration drilling. Direct impacts to breeding birds (including raptors) would be minimized by avoiding habitat removal between March 15 and July 31. If habitat removal or disturbance were to occur between March 15 and July 31, breeding bird surveys on public and private lands in the project area would be implemented, and appropriate mitigation prescribed in cooperation with the BLM, USFWS, and UDWR.

Vegetation removal in the MOA would reduce potential habitat for migratory bird nesting, cover, and foraging. These areas would be removed for the long term (the life of the project) and be unavailable for migratory birds during that time. An altered type of potentially suitable habitat would be available after reclamation activities. Impacts to migratory birds from habitat losses would be minor and long term. Due to the relatively small scale of operations (1,225 acres of disturbance) and extensive shrubland habitat available in the area, overall populations of migratory birds would not be affected.

Indirect impacts to habitat surrounding the disturbance areas (i.e., not directly disturbed) would occur as a result of project operations, specifically as a result of dust and noise introductions. Dust that falls on surrounding vegetation may make it less palatable for foraging as well as less suitable for bird nesting and breeding. Dust would be controlled in the project area by water trucks, which would lessen dust impacts. Overall, dust would have minor and long-term impacts on the suitability of migratory bird habitats surrounding the project area. Some individuals may utilize areas further away from project disturbances in avoidance of dust and project noise. Populations of migratory birds would not be affected.

Noise from project construction and operations, including the blasting activities, would make surrounding areas less suitable for nesting and breeding. Natural factors such as topography, vegetation, and temperature can reduce noise over distance.

Birds would likely displace to similar habitat away from the noise or become habituated to it, especially in areas where mining activities already occur. Human presence impacts would last for the life of the project. These impacts to nesting migratory bird habitat use would be long term (the life of the project) but minor because birds could nest elsewhere if the project area is unsuitable. Therefore, only nests that are initially undetected or established after construction may be adversely affected by noise or human presence.

Big Game

Pronghorn that use or migrate through the disturbance areas may be affected by the loss of habitat as they would have to circumvent the project area. Further, pronghorn would be impacted by increased noise and traffic. They would move to other areas. However, these effects are not expected to extend to population growth rates or reproduction within the larger population (i.e., moderate effects) because of the small size of the project area.

There could be pronghorn-vehicle collisions and subsequent fatalities, although this is not anticipated. Impact to the population is anticipated to be minimal due to the limited use that pronghorn make of the project area and the large area of adjacent suitable habitat. No impacts are anticipated to the local pronghorn population or to hunting opportunities. For these reasons the project would be in compliance with Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation.

There would be a direct loss of approximately 1,225 acres of wildlife habitat from this project. The disturbance impacts would extend outward and would impact many more acres, depending upon species. Disturbances from the proposed project could allow for the expansion of cheatgrass and invasion of noxious weeds which would impact long-term habitat quality. Disturbed lands would be restored as soon as practicable and weeds would be controlled at all times. Reclamation seed mixes would contain species adapted to low precipitation, as well as sagebrush and native grasses and forbs.

Big game habitat losses are approximately 1,085 acres of crucial year-long pronghorn habitat would be lost for the long term (life of the project), until successful reclamation of the project area. In general, big game would be expected to habituate to the disturbances and continue to use the surrounding habitats as they do currently, including for seasonal movements. Thus, habitat fragmentation impacts to big game are expected to be minor and long term.

Threatened, Endangered, Candidate or Sensitive Animal Species

Species with a low probability of occurring in the project area (**Table 3.3-4**) are unlikely to be affected by the proposed action. These species include California condor (Endangered), Lewis' woodpecker (BLM Sensitive, Utah species of concern), long-billed curlew (BLM Sensitive, Utah species of concern), northern goshawk (BLM Sensitive, conservation agreement), and short-eared owl (BLM Sensitive, Utah species of concern).

In the unlikely event that California condor would forage in the project area, it would be unaffected by exploration activities. If a condor was observed, the Fish and Wildlife Service would be notified and activities would be delayed until the bird had cleared the area. Habitat in the project area is marginal for Lewis' woodpecker, long-billed curlew, northern goshawk, and short-eared owl. These species are very unlikely to occur in the project area and be affected by the Proposed Action.

Impacts to the special status birds with moderate to high potential to occur in the project area (bald eagle, burrowing owl, and ferruginous hawk) would be the same as general impacts discussed for Migratory Birds; long term and minor, with the implementation of spatial/seasonal

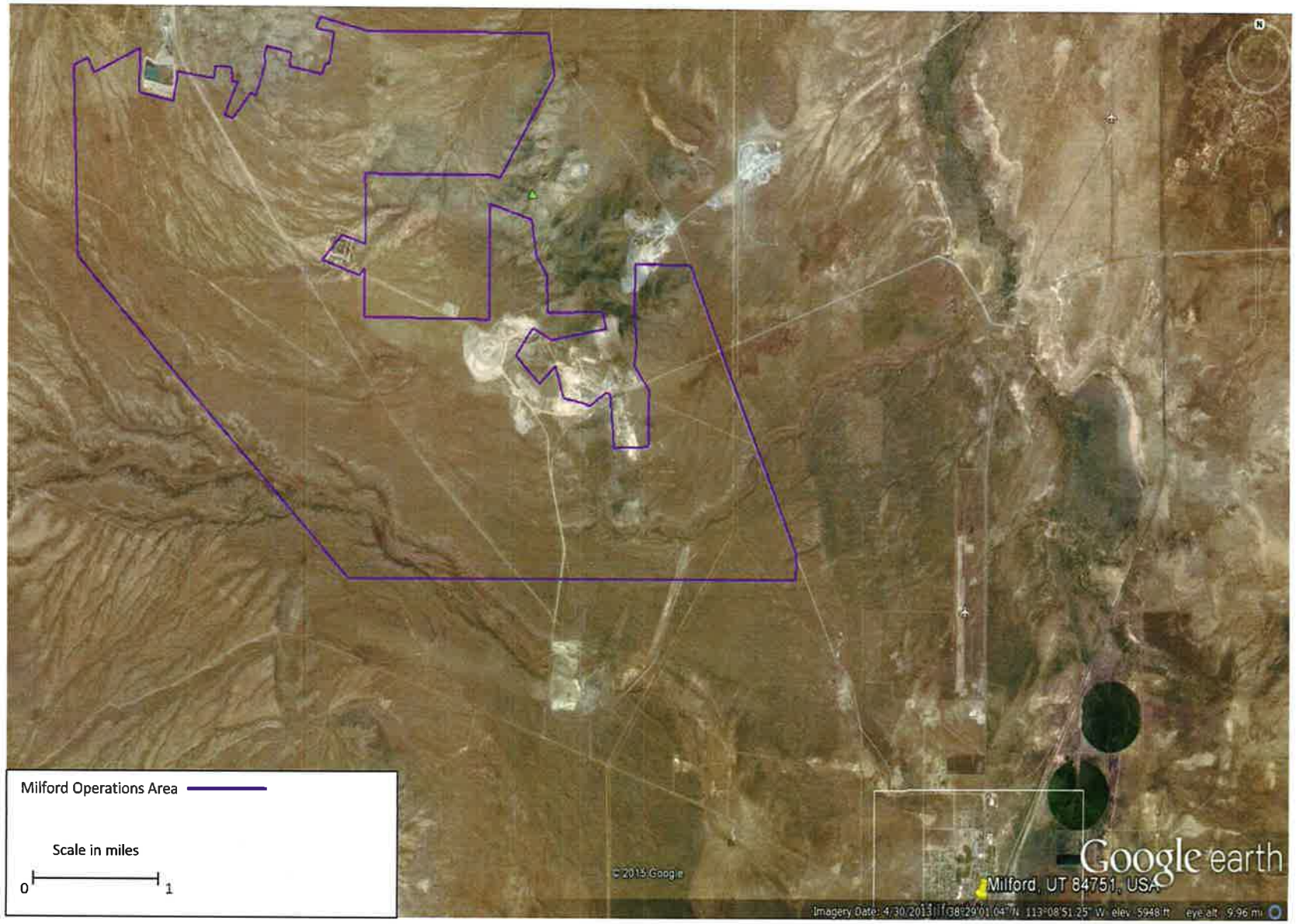
buffers. Most of the general impacts described in this section for wildlife also apply to the remaining special status species, discussed below. Pre-construction surveys would be conducted to determine the presence of these species in the project area, and if found, the application of spatial and seasonal (timing) buffers would follow BLM guidance (BLM 2006).

Impacts to special status bats (**Table 3.3-4**; big free-tailed bat, fringed myotis, spotted bat, Townsend's big ear bat, and western red bat – all BLM Sensitive, Utah species of concern) would be the same as general impacts discussed for Bats, above. However, of these only the fringed myotis and Townsend's big ear bat were identified during bat surveys.

Impacts to pygmy rabbits would be negligible, as no pygmy rabbits were observed, habitat in the project area is marginal, and the habitat loss would not affect the potential for pygmy rabbits to establish in the area.

Impacts to kit fox would be negligible, as no kit fox or dens were observed, habitat in the project area is marginal, and the habitat loss would not affect the potential for kit fox to establish in the area. Kit fox would likely displace to similar habitat away from the noise and mining activity or become habituated to it, especially in areas where mining activities already occur.

Figure 1.2-1 General Location of the CS Mining Milford Operations Area



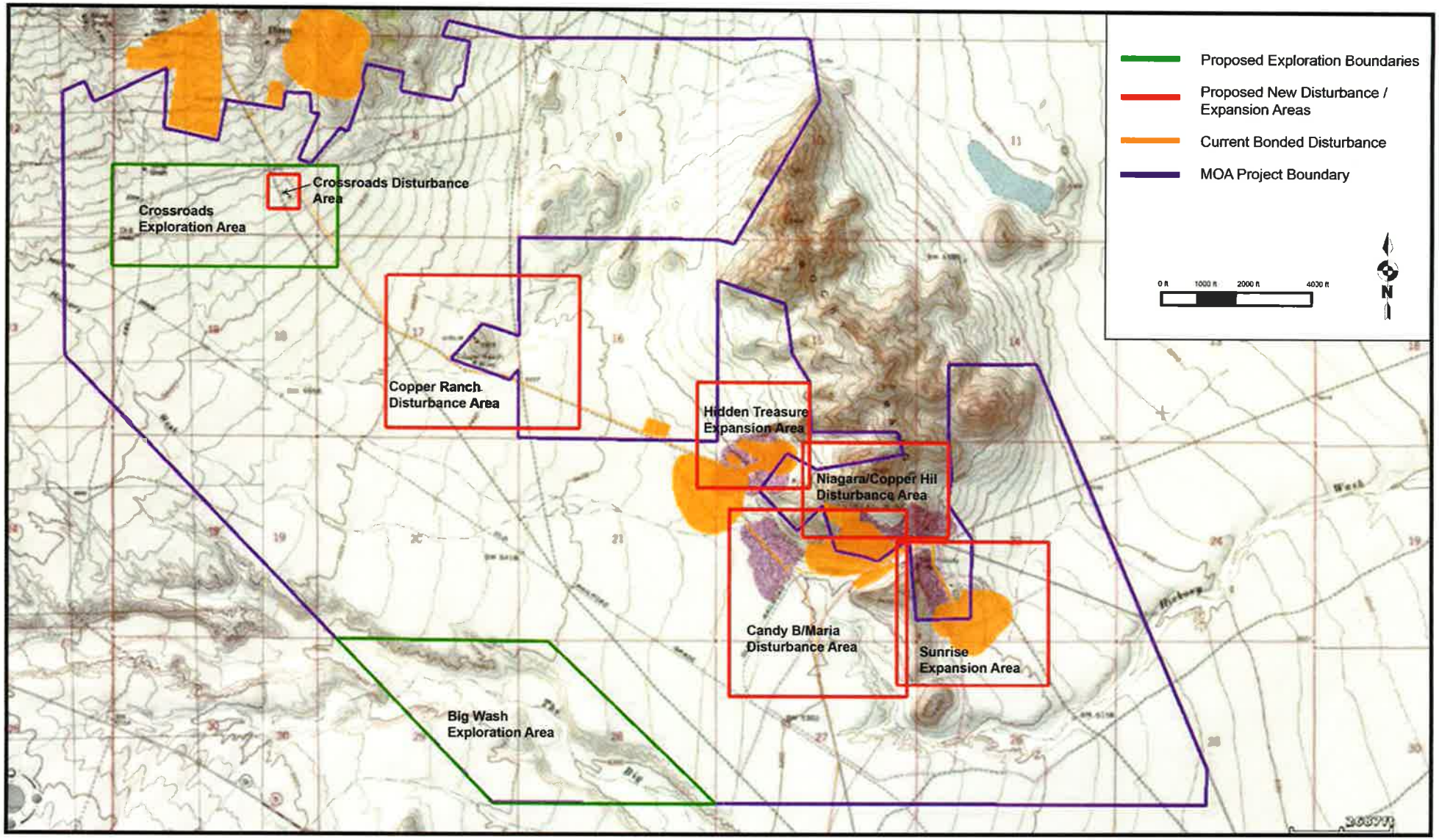


Figure 2.2-1 CS Mining Milford Operations Area General Description

Created January 2, 2015

CS MINING

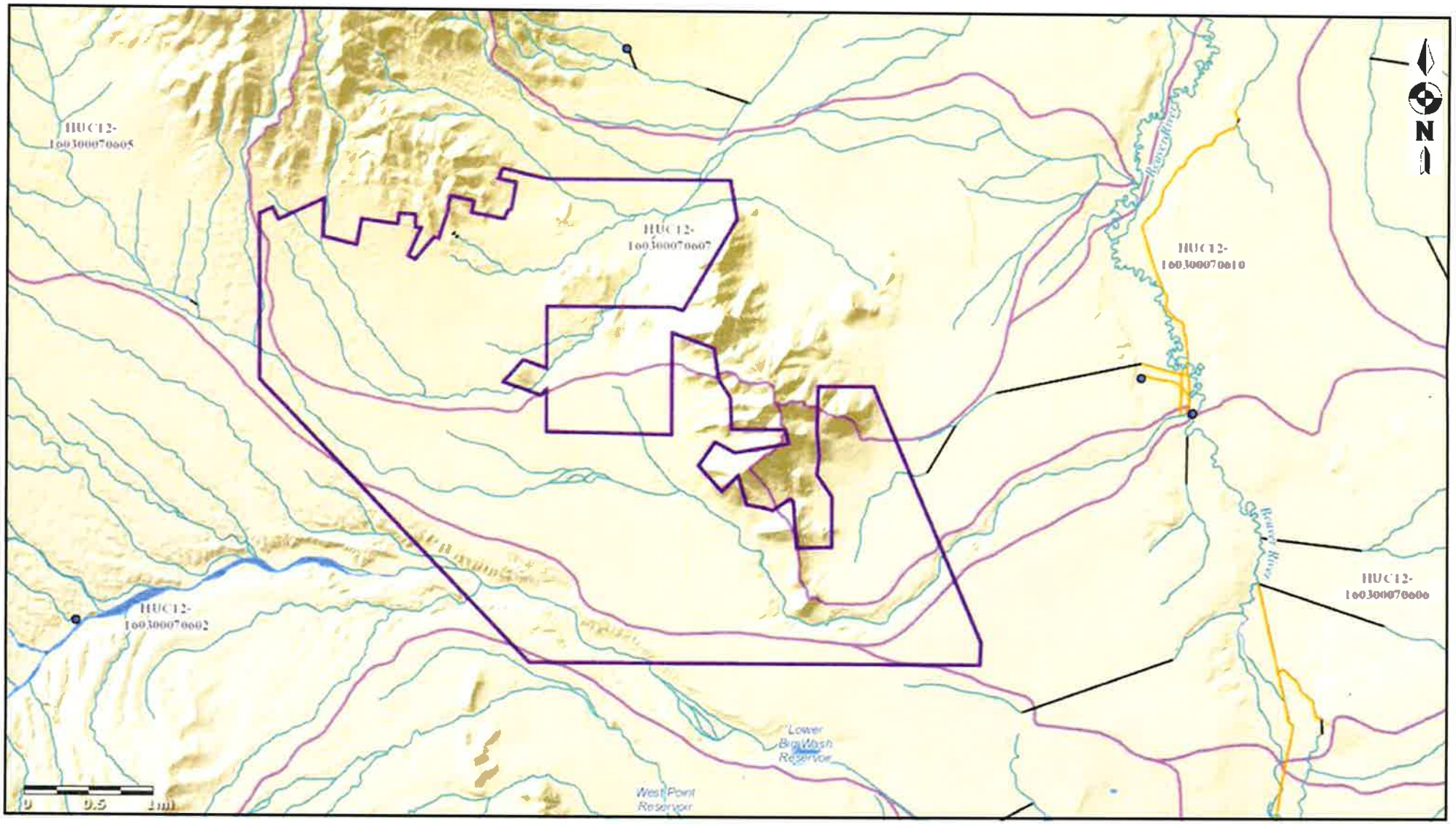


Figure 4.2-1 Cumulative Impact Area for Hydrologic Resources

Created January 20, 2015

Source: USGS Hydrography Mapper http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd#

CS MINING

FINDING OF NO SIGNIFICANT IMPACT
Environmental Assessment
DOI-BLM-UT-C010-2014-0061-EA
CS Mining LLC, Milford Operations Area Project Expansion

Based on the analysis of potential environmental impacts contained in the attached environmental assessment, and considering the significance criteria in 40 CFR 1508.27, I have determined that the CS Mining LLC, Milford Operations Area Project Expansion will not have a significant effect on the human environment. An environmental impact statement is therefore not required.

Dan Fletcher
Authorized Officer

3-2-15
Date

DECISION RECORD
Environmental Assessment
DOI-BLM-UT-C010-2014-0061-EA
CS Mining LLC, Milford Operations Area Project Expansion

Authorities

The proposed action is regulated under the applicable 43 CFR 3809 regulations, consistent with Section 2 of the Mining and Policy Act of 1970 and Section 102(a)(7), (8), and (12) of the Federal Land Policy and Management Act. These state that it is the policy of the Department of the Interior to encourage the development of Federal mineral resources and reclamation of disturbed lands. Under the mining laws, a person has statutory right, consistent with Departmental regulations, to go upon the open Federal lands for the purpose of mineral prospecting, exploration, development, extraction, and uses reasonably incident thereto.

Compliance and Monitoring

Bureau policy for active plans of operations is quarterly compliance inspections. The operations area will be monitored for noxious weeds during those inspections.

Terms / Conditions / Stipulations

All design features contained in Appendix B and the Proposed Action of the attached EA will be followed.

Plan Conformancy and Consistency

The proposed action has been reviewed and found to be in conformance with the following BLM Land Use Plan and the associated decision(s): Pinyon Management Framework Plan, approved June 10, 1983. Although the proposed action is not specifically mentioned in the plan, it is clearly consistent with the objectives, goals, and decisions of the approved plan. It has been determined that the proposed action would not conflict with other decisions throughout the plan.

Public Involvement

The proposal was initially posted on the Bureau's Electronic Notification Bulletin Board (ENBB) on October 8, 2014. No comments were received. The draft environmental assessment was posted on the ENBB on January 26, 2015 for a 30 day public comment period. Again, no comments were received.

Alternatives Considered

The only alternative considered was the no action alternative. The no action alternative could be chosen if the proposed action would result in undue and unnecessary degradation of public lands. The resource review concluded that the proposed action would not result in undue and unnecessary degradation and so this alternative was not chosen.

Decision

It is my decision to approve the proposed action contained in DOI-BLM-UT-C010-2014-0061-EA, subject to the Design Features to Reduce Impacts, Appendix B of the EA.

Rationale for Decision

The proposed action is in conformance with the current land use plan and is consistent with Section 2 of the Mining and Policy Act of 1970 and section 102(a)(7), (8), and (12) of the Federal Land Policy and Management Act. The proposed action would not cause any undue or unnecessary degradation to resource values, as defined above, which means that the claimants have a right to enter and conduct exploration, mining and mining related activities on their claims. The proposal was posted on the Bureau's Electronic Notification Bulletin Board on October 8, 2014 and no public inquiries have been received for the proposal.

Protest/Appeal

A party adversely affected by a decision under this subpart may ask the State Director of the appropriate BLM State Office to review the decision or an adversely affected party may bypass State Director review and directly appeal a BLM decision under this subpart to the Office of Hearings and Appeals (OHA) under 43 CFR Part 4. The original BLM decision remains in effect while State Director review is pending, except that the State Director may stay the decision during the pendency of his or her review. The State Director's decision will be effective immediately and remain in effect, unless a stay is granted by OHA. An adversely affected party may appeal the State Director's decision to OHA under 43 CFR Part 4, except that you may not appeal a denial of your request for State Director review or a denial of your request for a meeting with the State Director. Once the State Director issues a decision under this subpart, it replaces the original BLM decision, which is no longer in effect, and you may appeal only the State Director's decision.

Request for State Director Review

A party adversely affected by this decision may ask the State Director of the Utah State Office, 440 W 200 S, Suite 500, P.O. Box 45155, Salt Lake City, UT 84145-0155 to review the decision. The State Director must receive your request for State Director review no later than 30 calendar days after you receive or are notified of the BLM decision you seek to have reviewed.

Your request for State Director review must be a single package that includes a brief written statement explaining why BLM should change its decision and any documents that support your written statement. Mark your envelope "State Director Review." You must also provide a telephone or fax number for the State Director to contact you. When you submit your request for State Director review, you may also request a meeting with the State Director. The State Director will notify you as soon as possible if he or she can accommodate your meeting request.

The State Director may accept your request and review a decision made under this subpart. The State Director will decide within 21 days of a timely filed request whether to accept your request and review the original BLM decision. If the State Director does not make a decision within 21 days on whether to accept your request for review, you should consider your request for State Director review declined, and you may appeal the original BLM decision to Office of Hearings and Appeals (OHA). The State Director will not begin a review and will end an ongoing review if you or another affected party files an appeal of the original BLM decision with OHA under 43 CFR Part 3809.801 before the State Director issues a decision under this subpart, unless OHA agrees to defer consideration of the appeal pending a State Director decision. If you file an appeal with OHA after requesting State Director review, you must notify the State Director who, after receiving your notice, may request OHA to defer considering the appeal.
If you fail to notify the State Director of your appeal to OHA, any decision issued by the State Director may be voided by a subsequent OHA decision.

The State Director will promptly send you a written decision, which may be based on any of the following:

1. The information you submit;
2. The original BLM decision and any information BLM relied on for that decision;
3. Any additional information, including information obtained from your meeting, if any, with the State Director.

Any decision issued by the State Director under this subpart may affirm the original BLM decision, reverse it completely, or modify it in part. The State Director's decision may incorporate any part of the original BLM decision.

Appeals to the Office of Hearings and Appeals

An adversely affected party may bypass State Director review and directly appeal a BLM decision under this subpart to the Office of Hearings and Appeals under 43 CFR Part 4.

In order for OHA to consider your appeal of a decision, you must file a notice of appeal in writing to the Elizabeth Burghard at BLM Cedar City Filed Office, 176 East DL Sargent Drive, Cedar City, UT 84721, within 30 days of this decision. Public notification of this decision will be considered to have occurred on September 25, 2009. Your written appeal must contain your name and address and the BLM serial number of the notice or plan of operations that is the subject of the appeal. If a statement of reasons for the appeal is not included with the notice, it must be filed with the Interior Board of Land Appeals, Office of Hearings and Appeals, U.S. Department of the Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the Authorized Officer.

If you wish to file a petition for stay pursuant to 43 CFR Part 4.21(b), the petition for stay should accompany your notice of appeal and shall show sufficient justification based on the following standards:

1. The relative harm to the parties if the stay is granted or denied,
2. The likelihood of the appellant's success on the merits,
3. The likelihood of irreparable harm to the appellant or resources if the stay is not granted, and
4. Whether the public interest favors granting the stay.

If a petition for stay is submitted with the notice of appeal, a copy of the notice of appeal and petition for stay must be served on each party named in the decision from which the appeal is taken, and with the IBLA at the same time it is filed with the Authorized Officer.

A copy of the notice of appeal, any statement of reasons and all pertinent documents must be served on each adverse party named in the decision from which the appeal is taken and on the Office of the Regional Solicitor, U.S. Department of the Interior, 6201 Federal Building, 125 South State Street, Salt Lake City, Utah 84138-1180, not later than 15 days after filing the document with the Authorized Officer and/or IBLA.

Dan Fletcher — 3-2-15

Authorized Officer — Date

Attachments: DOI-BLM-UT-C010-2014-0061-EA

APPENDIX O

Mill SDS

Southern Utah University
WATER LAB
"Chemical and Bacteriological Testing"

Report of Analysis

Name: CS Mining
1208 South 200 West
Milford, UT 84757
Sample Date: 2/26/2015 1:55:00 PM
Receipt Date: 2/26/2015 4:00:00 PM
Report Date: 2/27/2015
Sample Site: Magnitite

Sample ID#: K2015 00401
Sample Type: Waste Water
Sampler: TODD MEMMOTT

Parameter	Sample Result	Units	MRL	Method	Analysis Date	Analysis Time	Analyst
Aluminum	3150	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Antimony	5.23	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Arsenic	82.0	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Barium	77.0	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Beryllium	<1	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Cadmium	0.929	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Chromium	36.8	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Cobalt	126	ug/L	0	200.8	2/26/2015	4:01:00 PM	SP
Copper	10500	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Iron	390000	ug/L	50	200.8	2/26/2015	4:01:00 PM	SP
Lead	63.7	ug/L	5	200.8	2/26/2015	4:01:00 PM	SP
Manganese	7120	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Molybdenum	32.0	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Nickel	21.7	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Selenium	<5	ug/L	5	200.8	2/26/2015	4:01:00 PM	SP
Silver	<200	ug/L	200	200.8	2/26/2015	4:01:00 PM	SP
Thallium	<1	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Vanadium	74.3	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP
Zinc	735	ug/L	1	200.8	2/26/2015	4:01:00 PM	SP

Report Approved By: _____
Kim Weaver, Technical Director

Southern Utah University Water Laboratory

Analysis Request Form / Chain of Custody

Company: CS Mining

Address: 1208 South 200 West

City: Milford State: UT Zip: 84751

Phone: 435-387-5053 Ex 8205 Fax:

Contact: Todd Memmott

Project ID: MAG Analysis

☐ Digestion Required

Billing Address: Same

Billing City: State: Zip:

P.O. #:

RUSH

Lab ID#	Sample Location	Sample Date	Sample Time	Number of Containers	Matrix: Drinking Water	Ground Water	Surface Water	Waste Water	Other (Specify):	Analysis Requested: Nitrate & Nitrite	Nitrate / Nitrite Total	Sulfate	BOD / COD / TSS	Lead & Copper	Inorganic & H.M.	~~Heavy Metals~~	Full Metal Spectrum										
K201S00401	1. Magnetite	2/26/15	1355	1				X																			
	2.																										
	3.																										
	4.																										
	5.																										
	6.																										
	7.																										
	8.																										
	9.																										
	10.																										

Sampled by: (print) Todd Memmott	Sampled by: (signature) [signature]	Receiving Temp. (C):	Receiving PH:
Special Instruction			
		Sampled Delivered by Courier:	
Relinquished by: (signature) [signature]	Received by: (signature) SM	Date/Time 2/26/15 1600	Comments
Relinquished by: (signature)	Received by: (signature)	Date/Time	Comments
Relinquished by: (signature)	Received by: (signature)	Date/Time	Comments

Southern Utah University Water Lab
351 West Center Street
Room 206, Science Bldg.
Cedar City, UT 84720

Phone (435) 586-7914
(435) 865-8395
Fax (435) 865-8051

White: Original Yellow: File Pink: Customer

AERO® 3739 PROMOTER

Revision Date 03/12/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

- Trade name AERO® 3739 PROMOTER

1.2 Relevant identified uses of the substance or mixture and uses advised against

Uses of the Substance / Mixture

- Use in mining industry

1.3 Details of the supplier of the safety data sheet

Company

CYTEC INDUSTRIES INC.
504 CARNEGIE CENTER
PRINCETON, NJ 08540 USA

Local contact

+800-438-5615; +888-298-3272

1.4 Emergency telephone

FOR EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT, CONTACT CHEMTREC (24-Hour Number): +1-800-424-9300 within the United States and Canada, or +1-703-527-3887 for international collect calls.

Disclaimer

The ® indicates a Registered Trademark in the United States and the ™ indicates a trademark in the United States. The mark may also be registered, subject of an application for registration, or a trademark in other countries.

SECTION 2: Hazards identification

Although OSHA has not adopted the environmental portion of the GHS regulations, this document may include information on environmental effects.

2.1 Classification of the substance or mixture

HCS 2012 (29 CFR 1910.1200)

Corrosive to Metals, Category 1	H290: May be corrosive to metals.
Acute toxicity, Category 4	H302: Harmful if swallowed.
Skin corrosion, Category 1	H314: Causes severe skin burns and eye damage.
Serious eye damage, Category 1	H318: Causes serious eye damage.
Skin sensitization, Category 1	H317: May cause an allergic skin reaction.

2.2 Label elements

HCS 2012 (29 CFR 1910.1200)

Pictogram



Signal Word

- Danger

Hazard Statements

- H290	May be corrosive to metals.
- H302	Harmful if swallowed.
- H314	Causes severe skin burns and eye damage.
- H317	May cause an allergic skin reaction.

Precautionary Statements

Prevention

- P234	Keep only in original container.
- P261	Avoid breathing mist or vapors.
- P264	Wash skin thoroughly after handling.
- P270	Do not eat, drink or smoke when using this product.
- P272	Contaminated work clothing must not be allowed out of the workplace.
- P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

- P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
- P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
- P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
- P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
- P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
- P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
- P363	Wash contaminated clothing before reuse.
- P390	Absorb spillage to prevent material damage.

Storage

- P405	Store locked up.
- P406	Store in corrosive resistant container with a resistant inner liner.

Disposal

- P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards which do not result in classification

- H400: Very toxic to aquatic life.
- H410: Very toxic to aquatic life with long lasting effects.

SECTION 3: Composition/information on ingredients

3.1 Substance

- Not applicable, this product is a mixture.

3.2 Mixture

- Chemical nature Mineral processing reagent

Hazardous Ingredients and Impurities

Chemical name	Identification number CAS-No.	Concentration [%]
Benzothiazole compound	*****	15 - 40
Sodium hydrogensulfide (hydrate)	207683-19-0	<= 7
Dithiocarbamate	*****	<= 7
Sodium sulfide (Na(SH))	16721-80-5	<= 5
Dialkyl dithiocarbamate	*****	<= 5
Sodium hydroxide (Na(OH))	1310-73-2	<= 1

The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

SECTION 4: First aid measures

4.1 Description of first-aid measures

In case of inhalation

- Quickly move the person away from the contaminated area. Make the affected person rest.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Be prepared to provide first aid or medical support if necessary.

In case of skin contact

- Wash off immediately with plenty of water for at least 15 minutes.
- Use appropriate protective equipment when treating a contaminated person.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Be prepared to provide first aid or medical support if necessary.

In case of eye contact

- Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
- Keep eye wide open while rinsing.
- Show this sheet to the doctor.
- Always obtain medical advice, even if there are no symptoms.
- Be prepared to provide first aid or medical support if necessary.

In case of ingestion

- Do NOT induce vomiting.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Do not give anything to drink.
- Be prepared to provide first aid or medical support if necessary.

4.2 Most important symptoms and effects, both acute and delayed

Effects

- Effects on health may appear after exposure.
- The effects will depend on target organs.
- Chronic exposure may cause allergic dermatitis.
- Exposure may cause allergic rhinitis, conjunctivitis, asthma or shock.
- If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the esophagus and the stomach.

- In case of inhalation, irritation/corrosion of the respiratory tract.
- Risk of respiratory disorder
- May cause irreversible skin damage.
- Chronic exposure may cause dermatitis.
- May cause irreversible eye damage.
- Loss of the eye

Symptoms

- Symptoms will depend on the target organs.
- Inhalation may provoke the following symptoms:
- Cough
- Breathing difficulties
- Irritation
- Redness
- Swelling of tissue
- Ingestion may provoke the following symptoms:
- Nausea
- Diarrhea
- Abdominal pain
- May cause respiratory tract irritation.
- allergic rhinitis
- Severe allergic skin reactions, bronchiospasm and anaphylactic shock
- Itching
- Dermatitis
- Causes skin burns.
- Lachrymation
- Conjunctivitis
- Causes eye burns.
- The gas deadens the sense of smell. Do not depend on odor to detect presence of gas.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician

- Be aware to maintain life support if necessary.
- Take victim immediately to hospital.
- Immediate medical attention is required.
- Consult with an ophthalmologist immediately in all cases.
- Burns must be treated by a physician.
- Treat symptomatically.
- Contact a poison control center.
- Keep under medical supervision for at least 48 hours.

SECTION 5: Firefighting measures

Flash point	Seta closed cup No flash up to boiling point
Autoignition temperature	No data available
Flammability / Explosive limit	No data available

5.1 Extinguishing media

Suitable extinguishing media

- Use water, carbon dioxide or dry chemical to extinguish fires.

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting

- Under fire conditions:
- Will burn
- On combustion, toxic gases are released.
- In the presence of water, forms corrosive solutions.

Hazardous combustion products:

- Carbon disulfide may be formed under fire conditions.

5.3 Advice for firefighters

Special protective equipment for fire-fighters

- Wear self-contained, positive pressure breathing apparatus and full firefighting protective clothing for fire situations only.
- For further information refer to section 8 "Exposure controls / personal protection."

Specific fire fighting methods

- Cool containers/tanks with water spray.
- Do not use a solid water stream as it may scatter and spread fire.

Further information

- Do not flush to sewer which may contain acid.
- This could result in generation of toxic and flammable carbon disulfide and carbonyl sulfide.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- Where exposure level is not known, wear approved, positive pressure, self-contained respirator.
- Where exposure level is known, wear approved respirator suitable for level of exposure.
- Avoid contact with the skin and the eyes.
- In addition to the protective clothing/equipment in Section 8, wear a two piece PVC suit with hood or PVC overalls with hood.

6.2 Environmental precautions

- Stop the leak. Turn leaking containers leak-side up to prevent the escape of liquid.
- Contain the spilled material by diking.
- Do not let product enter drains.
- Do not allow uncontrolled discharge of product into the environment.

- Spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies

6.3 Methods and materials for containment and cleaning up

- Stop leak if safe to do so.
- Keep in properly labeled containers.
- Keep in suitable, closed containers for disposal.
- Wash nonrecoverable remainder with large amounts of water.
- Soak up with inert absorbent material and dispose of as hazardous waste.
- Decontaminate tools, equipment and personal protective equipment in a segregated area.
- Dispose of in accordance with local regulations.
- Never return spills in original containers for re-use.

6.4 Reference to other sections

- 7. HANDLING AND STORAGE
- 8. EXPOSURE CONTROLS/PERSONAL PROTECTION
- 13. DISPOSAL CONSIDERATIONS

SECTION 7: Handling and storage

7.1 Precautions for safe handling

- To avoid product degradation and equipment corrosion, do not use iron, copper or aluminum containers or equipment.
- This material corrodes aluminum at a rate greater than 6.25 mm (0.25 inch) a year at a test temperature of 55 °C (130 °F). It is thus considered to be a Class 8 Corrosive for transportation purposes.
- Do not release to water.
- Large quantities of undiluted product should not be mixed with acids, since evolution of toxic and flammable carbon disulfide and carbonyl sulfide could result. In particular, precautions must be taken to avoid the accidental discharge of large volumes of the product in acid storage tanks or any tank or containment containing acidic materials. This precaution does not, of course, apply to addition of this reagent to flotation pulps in amounts customarily used in flotation, where the reagent amounts are small and instantly diluted to concentrations well below the solubility limits.

- Avoid inhalation, ingestion and contact with skin and eyes.
- Avoid high temperatures.
- Avoid splashes.
- Wear personal protective equipment.
- For personal protection, see section 8.

Hygiene measures

- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.
- When using do not eat, drink or smoke.
- Eye wash bottles or eye wash stations in compliance with applicable standards.
- Ensure that eyewash stations and safety showers are close to the workstation location.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions

- Do not freeze.

- Take all necessary measures to avoid accidental discharge of products into drains and waterways due to the rupture of containers or transfer systems.
- Keep away from incompatible materials to be indicated by the manufacturer.
- Keep container tightly closed in a dry and well-ventilated place.
- Keep away from heat and sources of ignition.

Requirements for storage rooms and vessels

Recommended storage temperature: 32 - 95 °F (0 - 35 °C)

- Keep containers tightly closed in a cool, well-ventilated place.
- Keep away from sources of ignition - No smoking.
- Mixture may charge electrostatically: always use grounding leads when transferring from one container to another.
- To guarantee the quality and properties of the product keep according to Storage temperature and conditions.

7.3 Specific end use(s)

- Contact your supplier for additional information

SECTION 8: Exposure controls/personal protection

Introductory Remarks: These recommendations provide general guidance for handling this product. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Assistance with selection, use and maintenance of worker protection equipment is generally available from equipment manufacturers.

8.1 Control parameters

Components with workplace occupational exposure limits

Components	Value type	Value	Basis
Sodium sulfide (Na(SH))	TWA	0.77 mg/m3	Corporate Acceptable Exposure Limit
Sodium sulfide (Na(SH))	STEL	1.5 mg/m3	Corporate Acceptable Exposure Limit
Sodium hydroxide (Na(OH))	C	2 mg/m3	National Institute for Occupational Safety and Health
Sodium hydroxide (Na(OH))	C	2 mg/m3	American Conference of Governmental Industrial Hygienists
Sodium hydroxide (Na(OH))	TWA	2 mg/m3	Occupational Safety and Health Administration - Table Z-1 Limits for Air Contaminants

NIOSH IDLH (Immediately Dangerous to Life or Health Concentrations)

Components	CAS-No.	Concentration
Sodium hydroxide (Na(OH))	1310-73-2	10 mg/m³

8.2 Exposure controls

Control measures

Engineering measures
- Ensure adequate ventilation.
- Apply technical measures to comply with the occupational exposure limits.

Individual protection measures

Respiratory protection
- Self-contained breathing apparatus in confined spaces/insufficient oxygen/in case of large uncontrolled emissions/in all circumstances when the mask and cartridge do not give adequate protection.
- Use only respiratory protection that conforms to international/ national standards.
- Respirator with a vapor filter (EN 141)
- Respirator with a full face mask.
- Use the indicated respiratory protection if the occupational exposure limit is exceeded.

Hand protection
- Take note of the information given by the producer concerning permeability and break through times, and of special workplace conditions (mechanical strain, duration of contact).
- Impervious gloves

Suitable material
- Nitrile or fluorinated rubber gloves.

Eye protection
- Chemical resistant goggles must be worn.
- Tightly fitting safety goggles.

Skin and body protection
- Impervious clothing
- Full protective suit
- Change working clothes after each work-shift.
- Contaminated work clothing should not be allowed out of the workplace.

Hygiene measures
- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.
- When using do not eat, drink or smoke.
- Eye wash bottles or eye wash stations in compliance with applicable standards.
- Ensure that eyewash stations and safety showers are close to the workstation location.

SECTION 9: Physical and chemical properties

Physical and Chemical properties here represent typical properties of this product. Contact the business area using the Product information phone number in Section 1 for its exact specifications.

9.1 Information on basic physical and chemical properties

Physical state	liquid
Form	Liquid with possibility of black precipitate.
Color	light yellow to green to amber
Odor	slightly sulfurous
Odor Threshold	No data available
Melting point/freezing point	Crystallization temperature: < 5 °F (< -15 °C)
Initial boiling point and boiling range	Boiling point/boiling range: > 158 °F (> 70 °C)
Flammability (solid, gas)	No data available
Flammability (liquids)	No data available
Flammability / Explosive limit	No data available
Flash point	Seta closed cup No flash up to boiling point
Autoignition temperature	No data available
Decomposition temperature	No data available
pH	>= 12.0 (undiluted)
Viscosity	No data available
Solubility	Water solubility:

	completely soluble
Partition coefficient: n-octanol/water	No data available
Vapor pressure	No data available
Density	1.180 - 1.250 g/cm3 (77 °F (25 °C))
Relative density	No data available
Relative vapor density	No data available
Particle characteristics	No data available
Evaporation rate (Butylacetate = 1)	No data available

9.2 Other information

Oxidizing properties	Not considered as oxidizing.
Peroxides	The substance or mixture is not classified as organic peroxide.
Corrosion of Metals	Corrosive to metals
Molecular weight	Mixture
Reactions with water / air	Contact with acids liberates toxic gas.

SECTION 10: Stability and reactivity

10.1 Reactivity

- Stable

10.2 Chemical stability

- Stable under normal conditions.

10.3 Possibility of hazardous reactions

- No dangerous reaction known under conditions of normal use.

10.4 Conditions to avoid

- Keep away from heat and sources of ignition.
- Avoid excessive heat for prolonged periods of time.

10.5 Incompatible materials

- Acids
- Strong oxidizing agents
- Aluminum
- Copper
- Brass
- bronze

10.6 Hazardous decomposition products

Hazardous decomposition products

- Carbon dioxide (CO_2)

Thermal decomposition

- Carbon monoxide
- Sulfur oxides
- Metal oxides
- Nitrogen oxides (NOx)

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute oral toxicity	This product is classified as acute toxicity category 4 According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Acute inhalation toxicity	Corrosive to the respiratory tract.
Acute dermal toxicity	Not classified as hazardous for acute dermal toxicity according to GHS. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Acute toxicity (other routes of administration)	Not applicable
Skin corrosion/irritation	Corrosive to skin According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Serious eye damage/eye irritation	Risk of serious damage to eyes. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

Respiratory or skin sensitization

Benzothiazole compound	By analogy Maximization Test - Guinea pig Classified as a skin sensitizer category 1 according to GHS criteria Method: OECD Test Guideline 406 Unpublished reports
Sodium hydrogensulfide (hydrate)	study scientifically unjustified
Dithiocarbamate	By analogy Maximization Test - Guinea pig Responding animals in GPMT < 30% Method: OECD Test Guideline 406 Unpublished reports
Dialkyl dithiocarbamate	By analogy

	Maximization Test - Guinea pig Responding animals in GPMT < 30% Method: OECD Test Guideline 406 Unpublished reports
Sodium hydroxide (Na(OH))	Humans Does not cause skin sensitization. Published data

Mutagenicity

Genotoxicity in vitro	Product is not considered to be genotoxic. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Genotoxicity in vivo	Product is not considered to be genotoxic. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Carcinogenicity	The product is not considered to be carcinogenic. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

This product does not contain any ingredient designated as probable or suspected human carcinogens by:

NTP
IARC
OSHA

Toxicity for reproduction and development

Toxicity to reproduction / fertility	The product is not considered to affect fertility.,According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Developmental Toxicity/Teratogenicity	The product is not considered to be toxic for development.,According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

STOT

STOT-single exposure	The substance or mixture is not classified as specific target organ toxicant, single exposure according to GHS criteria. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
STOT-repeated exposure	The substance or mixture is not classified as specific target organ toxicant, repeated exposure according to GHS criteria. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data. The product itself has not been tested.

Experience with human exposure

Experience with human exposure : Inhalation

In contact with acid

Symptoms: Released substances:
carbon disulphide.
Carbonyl sulfide
Inhalation may provoke the following symptoms:
Irritating to the respiratory system and mucous membranes.
Coma
cardiorespiratory failure
Neurological disorders
Gastrointestinal disturbance

Experience with human exposure : Skin contact

No data is available on the product itself.

Experience with human exposure : Eye contact

No data is available on the product itself.

Experience with human exposure : Ingestion

No data is available on the product itself.

CMR effects

Carcinogenicity

Benzothiazole compound	Not classified as a carcinogen according to GHS criteria

Mutagenicity

Benzothiazole compound	Not classified as mutagen according to GHS criteria.

Teratogenicity

Benzothiazole compound	Not classified as toxic for the reproduction (development) according to GHS criteria

Reproductive toxicity

Benzothiazole compound	Not classified as toxic for the reproduction (fertility and/or development) according to GHS criteria

Aspiration toxicity — No aspiration toxicity classification, According to the available data on the components, According to the classification criteria for mixtures.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic Compartment

Acute toxicity to fish	The product itself has not been tested.
Acute toxicity to daphnia and other aquatic invertebrates	The product itself has not been tested.
Toxicity to aquatic plants	The product itself has not been tested.
Toxicity to microorganisms	The product itself has not been tested.

Chronic toxicity to fish	The product itself has not been tested.
Chronic toxicity to daphnia and other aquatic invertebrates	The product itself has not been tested.

Sediment compartment

Toxicity to benthic organisms	The product itself has not been tested.

Terrestrial Compartment

Toxicity to soil dwelling organisms	The product itself has not been tested.
Toxicity to terrestrial plants	The product itself has not been tested.
Toxicity to above ground organisms	The product itself has not been tested.

M-Factor

Benzothiazole compound	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1 (according to the Globally Harmonized System (GHS))
Sodium hydrogensulfide (hydrate)	Acute aquatic toxicity = 100 (according to the Globally Harmonized System (GHS))
Dithiocarbamate	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1 (according to the Globally Harmonized System (GHS))
Sodium sulfide (Na(SH))	Acute aquatic toxicity = 100 (according to the Globally Harmonized System (GHS))
Dialkyl dithiocarbamate	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1 (according to the Globally Harmonized System (GHS))

12.2 Persistence and degradability

Abiotic degradation

Stability in water	Conclusion is not possible for a mixture as a whole.
Photodegradation	Conclusion is not possible for a mixture as a whole.
Other Physicochemical reactions	Conclusion is not possible for a mixture as a whole.

Physical- and photo-chemical elimination

Physico-chemical removability	Conclusion is not possible for a mixture as a whole.

Biodegradation

Biodegradability	As (bio)degradability is not relevant for mixtures, all the components of the mixture were assessed individually (rapid degradability assessment available below).
Ratio BOD / COD	Conclusion is not possible for a mixture as a whole.
Ratio BOD / ThOD	Conclusion is not possible for a mixture as a whole.

Biochemical Oxygen Demand (BOD)	Conclusion is not possible for a mixture as a whole.
Dissolved organic carbon (DOC)	Conclusion is not possible for a mixture as a whole.
Chemical Oxygen Demand (COD)	Conclusion is not possible for a mixture as a whole.
Adsorbed organic bound halogens (AOX)	Conclusion is not possible for a mixture as a whole.
Degradability assessment	Conclusion is not possible due to incomplete or heterogeneous data on the components. Unpublished reports Published data

12.3 Bioaccumulative potential

Partition coefficient: n-octanol/water	Conclusion is not possible for a mixture as a whole.
Bioconcentration factor (BCF)	As bioaccumulation is not relevant for mixtures, all the components of the mixture were assessed individually. Conclusion is not possible due to incomplete or heterogeneous data on the components. Unpublished reports Published data

12.4 Mobility in soil

Adsorption potential (Koc)	Water internal evaluation
Known distribution to environmental compartments	Conclusion is not possible due to incomplete or heterogeneous data on the components.

12.5 Results of PBT and vPvB assessment

According to the available data on the components
Product does not contain substances which are persistent, bioaccumulative, and toxic (PBT) at levels of 0.1% or higher.
Product does not contain substances which are very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.
Remark(s): According to the available data on the components

12.6 Other adverse effects

Ecotoxicity assessment

Short-term (acute) aquatic hazard	Very toxic to aquatic life. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Long-term (chronic) aquatic hazard	Very toxic to aquatic life with long lasting effects. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product Disposal

- The Company encourages the recycle, recovery and reuse of materials, where permitted. If disposal is necessary, The Company recommends that organic materials, especially when classified as hazardous waste, be disposed of by thermal treatment or incineration at approved facilities. All local and national regulations should be followed.

SECTION 14: Transport information

Transportation status: IMPORTANT! Statements below provide additional data on listed transport classification.
The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or other regulatory descriptors.

49 CFR

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUIDS, N.O.S. (Benzothiazole compound, Inorganic sulfides)
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	154
14.5 Environmental hazards	YES
Marine pollutant	

TDG

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Benzothiazole compound, Inorganic sulfides)
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	154
14.5 Environmental hazards	YES
Marine pollutant	

NOM

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Benzothiazole compound, Inorganic sulfides)
14.3 Transport hazard class	8
Label(s)	8

14.4 Packing group	
Packing group	II
ERG No	154
14.5 Environmental hazards	YES
Marine pollutant	

IMDG

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Benzothiazole compound, Inorganic sulfides)
IMDG Code segregation group	Alkalis (SGG18)
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
14.5 Environmental hazards	YES
Marine pollutant	

14.6 Special precautions for user

EmS F-A , S-B

For personal protection, see section 8.

14.7 Transport in bulk vessels according to IMO instruments

No data available

IATA

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Benzothiazole compound, Inorganic sulfides)
14.3 Transport hazard class	8
Label(s):	8
14.4 Packing group	
Packing group	II
Packing instruction (cargo aircraft)	855
Max net qty / pkg	30.00 L
Packing instruction (passenger aircraft)	851
Max net qty / pkg	1.00 L
14.5 Environmental hazards	YES

14.6 Special precautions for user

For personal protection, see section 8.

Note: The above regulatory prescriptions are those valid on the date of publication of this sheet. Given the possible evolution of

transportation regulations for hazardous materials, it would be advisable to check their validity with your sales office.

SECTION 15: Regulatory information

15.1 Notification status

Inventory Information	Status
United States TSCA Inventory	- All substances listed as active on the TSCA inventory
Canadian Domestic Substances List (DSL)	- Listed on Inventory
Australian Inventory of Industrial Chemicals (AIIC)	- Listed on Inventory
Japan. CSCL - Inventory of Existing and New Chemical Substances	- Listed on Inventory
Korea. Korean Existing Chemicals Inventory (KECI)	- Listed on Inventory
China. Inventory of Existing Chemical Substances in China (IECSC)	- Listed on Inventory
Philippines Inventory of Chemicals and Chemical Substances (PICCS)	- Listed on Inventory
Taiwan Chemical Substance Inventory (TCSI)	- Listed on Inventory
New Zealand. Inventory of Chemical Substances	- All components are listed on the NZIoC inventory. Additional HSNO obligations may apply. Please refer to Section 15 of SDS for New Zealand.
EU. European Registration, Evaluation, Authorization and Restriction of Chemical (REACH)	- When purchased from a Syensqo legal entity based in the EEA ("European Economic Area"), this product is compliant with the registration provisions of the REACH Regulation (EC) No. 1907/2006 as all its components are either excluded, exempt, and/or registered. When purchased from a legal entity outside of the EEA, please contact your local representative for additional information.
Korea. Act on Registration and Evaluation of Chemicals	- When purchased from a Syensqo legal entity based in Korea, this product is compliant with "Act on Registration and Evaluation of Chemicals" (AREC or K-REACH, Article 10) as all its components are either excluded, exempt, and/or (pre)registered. When purchased from a legal entity outside of Korea, please contact your local representative for additional information.

15.2 Federal Regulations

US. EPA EPCRA SARA Title III

SARA Hazard Designation Sections 311/312 (40 CFR 370)

Corrosive to Metals	Yes
Acute toxicity (any route of exposure)	Yes
Skin corrosion or irritation	Yes
Serious eye damage or eye irritation	Yes
Respiratory or skin sensitization	Yes

The categories not mentioned are not relevant for the product.

Section 313 Toxic Chemicals (40 CFR 372.65)
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Section 302 Emergency Planning Extremely Hazardous Substance Threshold Planning Quantity (40 CFR 355)
This material does not contain any components with a section 302 EHS TPQ.

Section 302 Emergency Planning Extremely Hazardous Substance Reportable Quantity (40 CFR 355)

Components	CAS-No.	Reportable quantity
Carbon disulfide	75-15-0	100 lb
Benzenamine	62-53-3	5000 lb

Section 304 Emergency Release Notification Reportable Quantity (40 CFR 355)

Components	CAS-No.	Reportable quantity
Carbon disulfide	75-15-0	100 lb
Benzenamine	62-53-3	5000 lb

US. EPA CERCLA Hazardous Substances and Reportable Quantities (40 CFR 302.4)

Components	CAS-No.	Reportable quantity
Sodium hydrogensulfide (hydrate)	207683-19-0	5000 lb
Carbon disulfide	75-15-0	100 lb
Sodium sulfide (Na(SH))	16721-80-5	5000 lb
Sodium hydroxide (Na(OH))	1310-73-2	1000 lb
Carbon disulfide	75-15-0	100 lb
Benzenamine	62-53-3	5000 lb

15.3 State Regulations

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

Please contact your local sales representative if you have questions and need more information concerning this product under California's Proposition 65 statute (www.p65warnings.ca.gov).

SECTION 16: Other information

Further information

- Distribute new edition to clients

Date Prepared: 03/12/2024

Key or legend to abbreviations and acronyms used in the safety data sheet

- C: Ceiling limit
- STEL: Short term exposure limit
- TWA: 8-hour time weighted average
- : Corporate Acceptable Exposure Limit
- ACGIH: American Conference of Governmental Industrial Hygienists
- OSHA: Occupational Safety and Health Administration
- NTP: National Toxicology Program
- IARC: International Agency for Research on Cancer
- NIOSH: National Institute for Occupational Safety and Health
- ADR: European Agreement on International Carriage of Dangerous Goods by Road.
- ADN: European Agreement on the International Carriage of Dangerous Goods by Inland Waterways.
- RID: European Agreement concerning the International Carriage of Dangerous Goods by Rail.
- IATA: International Air Transport Association.
- ICAO-TI: Technical Specification for Safe Transport of Dangerous Goods by Air.
- IMDG: International Maritime Dangerous Goods.
- TWA: Time weighted average
- ATE: Estimated value of acute toxicity
- EC: European Community number
- CAS: Chemical Abstracts Service.
- LD50: Substance that causes 50% (half) death in the test animals group (Median Fatal Dose).
- LC50: Substance concentration causing 50% (half) death in the test animals group.
- EC50: Effective Concentration of the substance causing the maximum of 50%.
- PBT: Persistent, Bioaccumulative and Toxic substance.
- vPvB: Very Persistent and Very Bioaccumulative.
- SEA: Classification, labeling, packaging regulation
- DNEL: Derived No Effect Level
- PNEC: Predicted No Effect Concentration
- STOT: Specific Target Organ Toxicity

Not all acronyms listed above are referenced in this SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information, and belief at the date of its publication. Such information is only given as a guidance to help the user handle, use, process, store, transport, dispose, and release the product in satisfactory safety conditions and is not to be considered as a warranty or quality specification. It should be used in conjunction with technical sheets but do not replace them. Thus, the information only relates to the designated specific product and may not be applicable if such product is used in combination with other materials or in any other manufacturing process, unless otherwise specifically indicated. It does not release the user from ensuring he is in conformity with all regulations linked to its activity.

AERO® MX-2418 PROMOTER

Revision Date 04/04/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

- Trade name AERO® MX-2418 PROMOTER

1.2 Relevant identified uses of the substance or mixture and uses advised against

Uses of the Substance / Mixture

- Use in mining industry

1.3 Details of the supplier of the safety data sheet

Company

CYTEC INDUSTRIES INC.
504 CARNEGIE CENTER
PRINCETON, NJ 08540 USA

Local contact

+800-438-5615; +888-298-3272

1.4 Emergency telephone

FOR EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT, CONTACT CHEMTREC (24-Hour Number): +1-800-424-9300 within the United States and Canada, or +1-703-527-3887 for international collect calls.

Disclaimer

The ® indicates a Registered Trademark in the United States and the ™ indicates a trademark in the United States. The mark may also be registered, subject of an application for registration, or a trademark in other countries.

SECTION 2: Hazards identification

Although OSHA has not adopted the environmental portion of the GHS regulations, this document may include information on environmental effects.

2.1 Classification of the substance or mixture

HCS 2012 (29 CFR 1910.1200)

Flammable liquids, Category 3	H226: Flammable liquid and vapor.
Acute toxicity, Category 4	H302: Harmful if swallowed.
Skin irritation, Category 2	H315: Causes skin irritation.
Serious eye damage, Category 1	H318: Causes serious eye damage.
Skin sensitization, Category 1	H317: May cause an allergic skin reaction.
Germ cell mutagenicity, Category 2	H341: Suspected of causing genetic defects.
Carcinogenicity, Category 2	H351: Suspected of causing cancer.
Specific target organ toxicity - single exposure, Category 3	H335: May cause respiratory irritation. (Respiratory system)
Specific target organ toxicity - repeated exposure, Category 1	H372: Causes damage to organs through prolonged or repeated exposure. (Liver)
Specific target organ toxicity - repeated exposure, Category 2	H373: May cause damage to organs through prolonged or repeated exposure. (Blood, thymus)
Aspiration hazard, Category 1	H304: May be fatal if swallowed and enters airways.

2.2 Label elements

HCS 2012 (29 CFR 1910.1200)

Pictogram



Signal Word

- Danger

Hazard Statements

- H226	Flammable liquid and vapor.
- H302	Harmful if swallowed.
- H304	May be fatal if swallowed and enters airways.
- H315	Causes skin irritation.
- H317	May cause an allergic skin reaction.
- H318	Causes serious eye damage.
- H335	May cause respiratory irritation.
- H341	Suspected of causing genetic defects.
- H351	Suspected of causing cancer.
- H372	Causes damage to organs (Liver) through prolonged or repeated exposure.
- H373	May cause damage to organs (Blood, thymus) through prolonged or repeated exposure.

Precautionary Statements

Prevention

- P201	Obtain special instructions before use.
- P202	Do not handle until all safety precautions have been read and understood.
- P210	Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
- P233	Keep container tightly closed.
- P240	Ground/bond container and receiving equipment.
- P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
- P242	Use only non-sparking tools.
- P243	Take precautionary measures against static discharge.
- P260	Do not breathe mist or vapors.
- P264	Wash skin thoroughly after handling.
- P270	Do not eat, drink or smoke when using this product.
- P271	Use only outdoors or in a well-ventilated area.
- P272	Contaminated work clothing must not be allowed out of the workplace.
- P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

- P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/ doctor.
- P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
- P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
- P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
- P308 + P313	IF exposed or concerned: Get medical advice/ attention.
- P331	Do NOT induce vomiting.
- P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
- P362	Take off contaminated clothing and wash before reuse.
- P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.

Storage

- P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
- P403 + P235	Store in a well-ventilated place. Keep cool.

- P405 Store locked up.

Disposal

- P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards which do not result in classification

- H400: Very toxic to aquatic life.
- H410: Very toxic to aquatic life with long lasting effects.

SECTION 3: Composition/information on ingredients

3.1 Substance

- Not applicable, this product is a mixture.

3.2 Mixture

- Chemical nature Mineral processing reagent

Hazardous Ingredients and Impurities

Chemical name	Identification number CAS-No.	Concentration [%]
Polyether	*****	15 - 40
2-Pentanol, 4-methyl-	108-11-2	<= 20
Thio carbonate	*****	<= 20
Fuels, diesel, no. 2	68476-34-6	10 - 30
Thio ester	*****	5 - 10
1-Pentanol	71-41-0	<= 5
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester	1001320-38-2	<= 3
Primary alkyl alcohol	*****	<= 2
Thioimidodicarbonic acid ((HO)C(O)NHC(S)(OH)), O1,O3-dibutyl ester	39142-36-4	0.1 - 1
2-Pentanone, 4-methyl-	108-10-1	<= 0.5
Carbamic acid ester	*****	<= 0.2

The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

SECTION 4: First aid measures

4.1 Description of first-aid measures

In case of inhalation

- Quickly move the person away from the contaminated area. Make the affected person rest.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Be prepared to provide first aid or medical support if necessary.

In case of skin contact

- Wash off immediately with plenty of water for at least 15 minutes.
- Use appropriate protective equipment when treating a contaminated person.
- Always obtain medical attention.
- Show this sheet to the doctor.
- Be prepared to provide first aid or medical support if necessary.

In case of eye contact

- Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
- Keep eye wide open while rinsing.
- Show this sheet to the doctor.
- Always obtain medical advice, even if there are no symptoms.
- Be prepared to provide first aid or medical support if necessary.

In case of ingestion

- Do NOT induce vomiting.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Do not give anything to drink.
- Be prepared to provide first aid or medical support if necessary.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms

- Symptoms will depend on the target organs.
- Inhalation may provoke the following symptoms:
- Cough
- Breathing difficulties
- Irritation
- Redness
- Swelling of tissue
- Ingestion may provoke the following symptoms:
- Nausea
- Diarrhea
- Abdominal pain
- Asphyxia
- Unconsciousness
- Bloody vomiting
- May cause respiratory tract irritation.
- allergic rhinitis
- Severe allergic skin reactions, bronchiospasm and anaphylactic shock
- Itching
- Dermatitis
- Causes skin burns.
- Lachrymation
- Conjunctivitis
- Causes eye burns.
- Suffocation
- The gas deadens the sense of smell. Do not depend on odor to detect presence of gas.

Effects

- Effects on health may appear after exposure.
- Serious effects on health may appear after prolonged or repeated exposure.
- The effects will depend on target organs.
- May be fatal if swallowed and enters airways.
- Chronic exposure is suspected of causing genetic effects on basis of animal data. Effects on human have not been proven.
- Chronic exposure is suspected of causing cancer on basis of animal data. Effects on human have not been proven.
- Chronic exposure may cause allergic dermatitis.
- Exposure may cause allergic rhinitis, conjunctivitis, asthma or shock.
- If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the esophagus and the stomach.
- In case of inhalation, irritation/corrosion of the respiratory tract.
- Risk of respiratory disorder

- bronchitis
- Nose bleeding
- Chemical pneumonitis
- pulmonary edema
- May cause irreversible skin damage.
- Chronic exposure may cause dermatitis.
- May cause irreversible eye damage.
- Loss of the eye

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician

- Be aware to maintain life support if necessary.
- Take victim immediately to hospital.
- Immediate medical attention is required.
- Consult with an ophthalmologist immediately in all cases.
- Burns must be treated by a physician.
- Treat symptomatically.
- Contact a poison control center.
- Keep under medical supervision for at least 48 hours.
- Contact the occupational physician in case of exposure.

SECTION 5: Firefighting measures

Flash point	124 °F (51 °C) Method: closed cup
Autoignition temperature	No data available
Flammability / Explosive limit	No data available

5.1 Extinguishing media

Suitable extinguishing media

- Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media

- High volume water jet

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting

- Under fire conditions:
- Will burn
- On combustion, toxic gases are released.

Hazardous combustion products:

- Sulfur dioxide, hydrogen sulfide or carbon disulfide may be formed under fire conditions.

5.3 Advice for firefighters

Special protective equipment for fire-fighters

- In the event of fire, wear self-contained breathing apparatus.

- Personal protective equipment comprising: suitable protective gloves, safety goggles and protective clothing.
- Wear a positive-pressure supplied-air respirator with full facepiece.
- For further information refer to section 8 "Exposure controls / personal protection."

Specific fire fighting methods

- Cool containers/tanks with water spray.
- Do not use a solid water stream as it may scatter and spread fire.

Further information

- Do not flush to sewer which may contain acid.
- This could result in generation of toxic and flammable carbon disulfide, carbonyl sulfide and hydrogen sulfide.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- Where exposure level is not known, wear approved, positive pressure, self-contained respirator.
- Where exposure level is known, wear approved respirator suitable for level of exposure.
- In addition to the protective clothing/equipment in Section 8, wear a two piece PVC suit with hood or PVC overalls with hood.

6.2 Environmental precautions

- Stop the leak. Turn leaking containers leak-side up to prevent the escape of liquid.
- Contain the spilled material by diking.
- Do not let product enter drains.
- Do not allow uncontrolled discharge of product into the environment.

- Spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies

6.3 Methods and materials for containment and cleaning up

- Remove all sources of ignition.
- Stop leak if safe to do so.
- Keep in properly labeled containers.
- Keep in suitable, closed containers for disposal.
- Wash nonrecoverable remainder with large amounts of water.
- Soak up with inert absorbent material and dispose of as hazardous waste.
- Decontaminate tools, equipment and personal protective equipment in a segregated area.
- Dispose of in accordance with local regulations.
- Never return spills in original containers for re-use.

6.4 Reference to other sections

- 7. HANDLING AND STORAGE
- 8. EXPOSURE CONTROLS/PERSONAL PROTECTION
- 13. DISPOSAL CONSIDERATIONS

SECTION 7: Handling and storage

7.1 Precautions for safe handling

- Containers must be bonded and grounded when pouring or transferring material.
- This material contains a flammable or combustible liquid and vapor.
- Do not release to water.
- Large quantities of undiluted product should not be mixed with acids, since evolution of toxic and flammable

hydrogen sulfide, carbon disulfide and carbonyl sulfide could result. In particular, precautions must be taken to avoid the accidental discharge of large volumes of the product in acid storage tanks or any tank or containment containing acidic materials. This precaution does not, of course, apply to addition of this reagent to flotation pulps in amounts customarily used in flotation, where the reagent amounts are small and instantly diluted to concentrations well below the solubility limits.

- Avoid inhalation, ingestion and contact with skin and eyes.
- Avoid splashes.
- Avoid high temperatures.
- Wear personal protective equipment.
- For personal protection, see section 8.

Hygiene measures

- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.
- When using do not eat, drink or smoke.
- Eye wash bottles or eye wash stations in compliance with applicable standards.
- Ensure that eyewash stations and safety showers are close to the workstation location.
- Keep away from food and drink.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions

- Ensure all equipment is electrically grounded before beginning transfer operations.
- Take all necessary measures to avoid accidental discharge of products into drains and waterways due to the rupture of containers or transfer systems.
- Keep containers tightly closed in a dry, cool and well-ventilated place.
- Keep away from open flames, hot surfaces and sources of ignition.
- Keep away from incompatible materials to be indicated by the manufacturer.

- Observe the general rules of industrial fire protection.
- Areas containing this material should have fire safe practices and electrical equipment in accordance with applicable regulations and/or guidelines. Standards are primarily based on the material`s flashpoint, but may also take into account properties such as miscibility with water or toxicity. All local and national regulations should be followed. |par In the Americas, National Fire Protection Association (NFPA) 30: Flammable and Combustible Liquids Code, is a widely used standard. NFPA 30 establishes storage conditions for the following classes of materials: Class I Flammable Liquids, Flashpoint <37.8 °C. Class II Combustible Liquids, 37.8 °C < Flashpoint <60 °C. Class IIIa Combustible Liquids, 60 °C < Flashpoint < 93 °C. Class IIIb Combustible Liquids, Flashpoint > 93 °C.
- Keep away from sources of ignition - No smoking.

Requirements for storage rooms and vessels

Recommended storage temperature: 32 - 95 °F (0 - 35 °C)

- To guarantee the quality and properties of the product keep according to Storage temperature and conditions.

7.3 Specific end use(s)

- Contact your supplier for additional information

SECTION 8: Exposure controls/personal protection

Introductory Remarks: These recommendations provide general guidance for handling this product. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Assistance with selection, use and maintenance of worker protection equipment is generally available from equipment manufacturers.

8.1 Control parameters

Components with workplace occupational exposure limits

Components	Value type	Value	Basis
2-Pentanol, 4-methyl-	TWA	25 ppm 100 mg/m3	National Institute for Occupational Safety and Health
	Potential for dermal absorption		
2-Pentanol, 4-methyl-	ST	40 ppm 165 mg/m3	National Institute for Occupational Safety and Health
	Potential for dermal absorption		
2-Pentanol, 4-methyl-	TWA	20 ppm	American Conference of Governmental Industrial Hygienists
2-Pentanol, 4-methyl-	STEL	40 ppm	American Conference of Governmental Industrial Hygienists
2-Pentanol, 4-methyl-	TWA	25 ppm 100 mg/m3	Occupational Safety and Health Administration - Table Z-1 Limits for Air Contaminants
	Skin designation		
Fuels, diesel, no. 2	TWA	100 mg/m3	American Conference of Governmental Industrial Hygienists
	Form of exposure : Inhalable fraction and vapor Danger of cutaneous absorption Expressed as :total hydrocarbons		
1-Pentanol	WEEL	100 ppm	American Industrial Hygiene Association
2-Pentanone, 4-methyl-	TWA	50 ppm 205 mg/m3	National Institute for Occupational Safety and Health
2-Pentanone, 4-methyl-	ST	75 ppm 300 mg/m3	National Institute for Occupational Safety and Health
2-Pentanone, 4-methyl-	TWA	20 ppm	American Conference of Governmental Industrial Hygienists
2-Pentanone, 4-methyl-	STEL	75 ppm	American Conference of Governmental Industrial Hygienists
2-Pentanone, 4-methyl-	TWA	100 ppm 410 mg/m3	Occupational Safety and Health Administration - Table Z-1 Limits for Air Contaminants

NIOSH IDLH (Immediately Dangerous to Life or Health Concentrations)

Components	CAS-No.	Concentration
2-Pentanol, 4-methyl-	108-11-2	400 parts per million
2-Pentanone, 4-methyl-	108-10-1	500 parts per million

Biological Exposure Indices

Components	Value type	Value	Basis
2-Pentanone, 4-methyl-	BEI	1 mg/l methyl isobutyl ketone Urine End of shift (As soon as possible after exposure ceases)	American Conference of Governmental Industrial Hygienists

8.2 Exposure controls

Control measures

Engineering measures
- Ensure adequate ventilation.
- Apply technical measures to comply with the occupational exposure limits.

Individual protection measures

Respiratory protection
- Self-contained breathing apparatus in confined spaces/insufficient oxygen/in case of large uncontrolled emissions/in all circumstances when the mask and cartridge do not give adequate protection.
- Use only respiratory protection that conforms to international/ national standards.
- Respirator with a vapor filter (EN 141)
- Respirator with a full face mask.
- Use the indicated respiratory protection if the occupational exposure limit is exceeded.

Hand protection
- Take note of the information given by the producer concerning permeability and break through times, and of special workplace conditions (mechanical strain, duration of contact).
- Impervious gloves

Suitable material
- Nitrile or fluorinated rubber gloves.

Eye protection
- Chemical resistant goggles must be worn.
- Tightly fitting safety goggles.

Skin and body protection
- Impervious clothing
- Full protective suit
- Change working clothes after each work-shift.
- Contaminated work clothing should not be allowed out of the workplace.

Hygiene measures
- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.
- When using do not eat, drink or smoke.

- Eye wash bottles or eye wash stations in compliance with applicable standards.
- Ensure that eyewash stations and safety showers are close to the workstation location.
- Keep away from food and drink.

SECTION 9: Physical and chemical properties

Physical and Chemical properties here represent typical properties of this product. Contact the business area using the Product information phone number in Section 1 for its exact specifications.

9.1 Information on basic physical and chemical properties

Physical state	liquid
Color	yellow to dark brown
Odor	alcohol-like
Odor Threshold	No data available
Melting point/freezing point	No data available
Initial boiling point and boiling range	No data available
Flammability (solid, gas)	No data available
Flammability (liquids)	No data available
Flammability / Explosive limit	No data available
Flash point	124 °F (51 °C) Method: closed cup
Autoignition temperature	No data available
Decomposition temperature	No data available
pH	>= 7.0 (77 °F (25 °C))
Viscosity	Viscosity, dynamic : 5 - 8 mPa.s (77 °F (25 °C))
Solubility	Water solubility: negligible
Partition coefficient: n-octanol/water	No data available
Vapor pressure	No data available
Density	0.90 - 0.94 g/cm3 (77 °F (25 °C))
Relative density	No data available
Relative vapor density	No data available
Particle characteristics	No data available

Evaporation rate (Butylacetate = 1) No data available

9.2 Other information

Reactions with water / air Contact with acids liberates very toxic gas.

SECTION 10: Stability and reactivity

10.1 Reactivity

- No data available

10.2 Chemical stability

- Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

- Hazardous polymerization does not occur.

10.4 Conditions to avoid

- Keep away from open flames, hot surfaces and sources of ignition.
- Avoid excessive heat for prolonged periods of time.

10.5 Incompatible materials

- Acids
- Strong bases
- Strong oxidizing agents
- Alkaline compounds.

10.6 Hazardous decomposition products

Hazardous decomposition products

- Carbon dioxide (CO2)
- carbon disulphide.
- Carbonyl sulfide

Thermal decomposition

- On combustion or on thermal decomposition (pyrolysis), releases:
- Carbon monoxide
- Hydrogen cyanide (hydrocyanic acid)
- Hydrogen sulfide
- Sulphur dioxide
- Alkyl sulfides
- Alkyl mercaptans

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute oral toxicity This product is classified as acute toxicity category 4
According to the available data on the components.
According to the classification criteria for mixtures.
Unpublished reports and/or published data.

Acute inhalation toxicity	The product has a low acute toxicity According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Acute dermal toxicity	Not classified as hazardous for acute dermal toxicity according to GHS. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Acute toxicity (other routes of administration)	Not applicable
Skin corrosion/irritation	Irritating to skin. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Serious eye damage/eye irritation	Risk of serious damage to eyes. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

Respiratory or skin sensitization

Polyether	Mouse Not classified as sensitising by skin contact according to GHS criteria Method: OECD Test Guideline 429
2-Pentanol, 4-methyl-	Maximization Test - Guinea pig Does not cause skin sensitization. Method: OECD Test Guideline 406 Unpublished reports
Thio carbonate	Local lymph node assay (LLNA) Stimulation Index ≥ 3 Method: OECD Test Guideline 429 Unpublished internal reports
Fuels, diesel, no. 2	Buehler Test - Guinea pig negative Not classified as sensitising by skin contact according to GHS criteria Method: OECD Test Guideline 406 Unpublished reports
Thio ester	Local lymph node assay (LLNA) Stimulation Index ≥ 3 Method: OECD Test Guideline 429 Unpublished internal reports
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester	Local lymph node assay (LLNA) - Mouse EC 3 value ≤ 2 % Method: OECD Test Guideline 429 Unpublished internal reports
Primary alkyl alcohol	By analogy

	Local lymph node assay - Mouse The substance or mixture is not considered to be sensitizing by skin contact. Method: OECD Test Guideline 429 Unpublished internal reports
Thioimidodicarbonic acid ((HO)C(O)NHC(S)(OH)), O1,O3-dibutyl ester	Maximization Test - Guinea pig Classified as a skin sensitizer category 1 according to GHS criteria Method: OECD Test Guideline 406 Unpublished internal reports
2-Pentanone, 4-methyl-	Maximization Test - Guinea pig Does not cause skin sensitization. Method: OECD Test Guideline 406 Unpublished reports
Carbamic acid ester	Maximization Test - Guinea pig Responding animals in GPMT ≥ 30% Published data

Mutagenicity

Genotoxicity in vitro

Polyether	Ames test negative Method: OECD Test Guideline 471
2-Pentanol, 4-methyl-	Ames test with and without metabolic activation negative Method: OECD Test Guideline 471 Unpublished reports Chromosome aberration test in vitro Strain: rat hepatocytes without metabolic activation negative Method: OECD Test Guideline 473 Unpublished reports Gene mutation assays in mammalian cells. Strain: mouse lymphoma cells with and without metabolic activation negative Method: OECD Test Guideline 476 Unpublished reports
Thio carbonate	By analogy Ames test negative Method: OECD Test Guideline 471 Unpublished internal reports

Fuels, diesel, no. 2	Ames test Strain: TA98 with and without metabolic activation positive Method: OECD Test Guideline 471 Information given is based on data obtained from similar products Unpublished reports
Thio ester	By analogy Ames test negative Method: OECD Test Guideline 471 Unpublished internal reports
1-Pentanol	category approach Mutagenicity (Salmonella typhimurium - reverse mutation assay) with and without metabolic activation negative Method: according to a standardized method Unpublished reports category approach In vitro micronucleus test Strain: Chinese hamster fibroblasts with and without metabolic activation negative Published data category approach Gene mutation assays in mammalian cells. Strain: Chinese hamster cells with and without metabolic activation negative Published data Unpublished reports
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester	Ames test with and without metabolic activation negative Method: OECD Test Guideline 471 Unpublished internal reports
Primary alkyl alcohol	By analogy

	Mutagenicity (Salmonella typhimurium - reverse mutation assay) with and without metabolic activation In vitro tests did not show mutagenic effects Unpublished internal reports In vitro micronucleus test Strain: Chinese hamster fibroblasts with and without metabolic activation negative Published data Gene mutation assays in mammalian cells. Strain: Chinese hamster fibroblasts with and without metabolic activation negative Published data
Thioimidodicarbonic acid ((HO)C(O)NHC(S)(OH)), O1,O3-dibutyl ester	Ames test Strain: Salmonella typhimurium and Escherichia coli with and without metabolic activation negative Method: OECD Test Guideline 471 Unpublished internal reports In vitro micronucleus test Strain: Human lymphocytes with and without metabolic activation negative Unpublished internal reports
2-Pentanone, 4-methyl-	Ames test with and without metabolic activation negative Method: OECD Test Guideline 471 Published data

	Gene mutation assays in mammalian cells. Strain: mouse lymphoma cells Method: OECD Test Guideline 476 with metabolic activation negative without metabolic activation ambiguous Published data Chromosome aberration test in vitro without metabolic activation negative Method: OECD Test Guideline 473 Published data
Carbamic acid ester	Ames test negative Published data Mutagenicity (Salmonella typhimurium - reverse mutation assay)
Genotoxicity in vivo	
Thio carbonate	By analogy - mice Oral Method: OECD Test Guideline 474 negative Unpublished internal reports
Fuels, diesel, no. 2	In vivo micronucleus test - Mouse male and female Oral negative Published data
Thio ester	By analogy - mice Oral Method: OECD Test Guideline 474 negative Unpublished internal reports
1-Pentanol	category approach

	In vivo micronucleus test - Mouse Bone marrow Oral Method: OECD Test Guideline 474 negative Unpublished reports
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester	By analogy comet assay - Rat male Oral Method: OECD Test Guideline 489 positive Gavage Unpublished reports
Primary alkyl alcohol	By analogy In vivo micronucleus test - Mouse male and female Oral Method: OECD Test Guideline 474 Gavage In vivo tests did not show mutagenic effects Unpublished reports
Thioimidodicarbonic acid ((HO)C(O)NHC(S)(OH)), O1,O3-dibutyl ester	Chromosome aberration test in vivo - Rat male Oral Method: OECD Test Guideline 475 negative Unpublished internal reports In vivo micronucleus test - Mouse male Oral Method: OECD Test Guideline 474 ambiguous Unpublished internal reports In vivo mammalian alkaline comet assay - Rat Liver cells male Oral Method: OECD Test Guideline 489 negative Unpublished internal reports

	In vivo mammalian alkaline comet assay - Rat Stomach male Oral Method: OECD Test Guideline 489 positive Unpublished internal reports In vivo mammalian alkaline comet assay - Rat Stomach positive
2-Pentanone, 4-methyl-	In vivo micronucleus test - Mouse male and female Intraperitoneal route Method: OECD Test Guideline 474 negative Published data
Carbamic acid ester	- mice Intraperitoneal route negative Published data

Carcinogenicity

Fuels, diesel, no. 2	By analogy Mouse , male and female Dermal Target Organs: Skin Weak local carcinogen Published data
Primary alkyl alcohol	By analogy Mouse , female Intraperitoneal route Published data
2-Pentanone, 4-methyl-	Rat , male and female inhalation (vapor) Exposure time: two-year NOAEC: 1,840mg/m³ Target Organs: Kidney Method: OECD Test Guideline 451 Expert judgment and weight of evidence determination. Not relevant for Humans Published data

Components	CAS-No.	Rating	Basis
2-Pentanone, 4-methyl-	108-10-1	Group 2B: Possibly carcinogenic to humans	IARC

This product does not contain any ingredient designated as probable or suspected human carcinogens by:
NTP
OSHA

Toxicity for reproduction and development

Toxicity to reproduction / fertility	The product is not considered to affect fertility.,According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Developmental Toxicity/Teratogenicity	The product is not considered to be toxic for development.,According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

STOT

STOT-single exposure	The substance or mixture is classified as specific target organ toxicant, single exposure, category 3 with respiratory tract irritation according to GHS criteria. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
STOT-repeated exposure	Target Organs: Liver The substance or mixture is classified as specific target organ toxicant, repeated exposure, category 1 according to GHS criteria. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data. Target Organs: Blood, thymus The substance or mixture is classified as specific target organ toxicant, repeated exposure, category 2 according to GHS criteria. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data. The product itself has not been tested.

Neurological effects

2-Pentanone, 4-methyl-	Rat, No neurotoxic effects observed., Published data

Experience with human exposure

Experience with human exposure : Inhalation

In contact with acid

Symptoms: Released substances:
Hydrogen sulphide
carbon disulphide.
Carbonyl sulfide
Inhalation may provoke the following symptoms:
Irritating to the respiratory system and mucous membranes.
Coma
cardiorespiratory failure
Neurological disorders
Gastrointestinal disturbance

CMR effects

Carcinogenicity

Fuels, diesel, no. 2	Limited evidence of carcinogenicity in animal studies
2-Pentanone, 4-methyl-	Classified as carcinogen category 2 according to GHS criteria

Mutagenicity

Fuels, diesel, no. 2	In vitro tests showed mutagenic effects which were not observed with in vivo test.
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester	Classified as mutagen category 2 according to GHS criteria.
Thioimidodicarbonic acid ((HO)C(O)NHC(S)(OH)), O1,O3-dibutyl ester	Positive result(s) from in vivo mammalian somatic cell mutagenicity tests.

Aspiration toxicity — May be fatal if swallowed and enters airways., According to the available data on the components, According to the classification criteria for mixtures.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic Compartment

Acute toxicity to fish	The product itself has not been tested.
Acute toxicity to daphnia and other aquatic invertebrates	The product itself has not been tested.
Toxicity to aquatic plants	The product itself has not been tested.
Toxicity to microorganisms	The product itself has not been tested.
Chronic toxicity to fish	The product itself has not been tested.
Chronic toxicity to daphnia and other aquatic invertebrates	The product itself has not been tested.

Sediment compartment

Toxicity to benthic organisms The product itself has not been tested.

Terrestrial Compartment

Toxicity to soil dwelling organisms The product itself has not been tested.

Toxicity to terrestrial plants The product itself has not been tested.

Toxicity to above ground organisms The product itself has not been tested.

M-Factor

Thio carbonate	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1 (according to the Globally Harmonized System (GHS))
Thio ester	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1 (according to the Globally Harmonized System (GHS))
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1

12.2 Persistence and degradability

Abiotic degradation

Stability in water Conclusion is not possible for a mixture as a whole.

Photodegradation Conclusion is not possible for a mixture as a whole.

Other Physicochemical reactions Conclusion is not possible for a mixture as a whole.

Physical- and photo-chemical elimination

Physico-chemical removability Conclusion is not possible for a mixture as a whole.

Biodegradation

Biodegradability As (bio)degradability is not relevant for mixtures, all the components of the mixture were assessed individually (rapid degradability assessment available below).

Degradability assessment Conclusion is not possible due to incomplete or heterogeneous data on the components.
Unpublished reports
Published data

12.3 Bioaccumulative potential

Partition coefficient: n-octanol/water Conclusion is not possible for a mixture as a whole.

Bioconcentration factor (BCF) As bioaccumulation is not relevant for mixtures, all the components of the mixture were assessed individually.
At least one of the components is considered to be potentially bioaccumulable.
Unpublished reports
Published data

12.4 Mobility in soil

Adsorption potential (Koc)	Conclusion is not possible for a mixture as a whole.
Known distribution to environmental compartments	Conclusion is not possible due to incomplete or heterogeneous data on the components.
12.5 Results of PBT and vPvB assessment	According to the available data on the components Product does not contain substances which are persistent, bioaccumulative, and toxic (PBT) at levels of 0.1% or higher. Product does not contain substances which are very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects

Ecotoxicity assessment

Short-term (acute) aquatic hazard	Very toxic to aquatic life. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Long-term (chronic) aquatic hazard	Very toxic to aquatic life with long lasting effects. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product Disposal

- The Company encourages the recycle, recovery and reuse of materials, where permitted. If disposal is necessary, The Company recommends that organic materials, especially when classified as hazardous waste, be disposed of by thermal treatment or incineration at approved facilities. All local and national regulations should be followed.

SECTION 14: Transport information

Transportation status: IMPORTANT! Statements below provide additional data on listed transport classification.
The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or other regulatory descriptors.

49 CFR

14.1 UN number	UN 1993
14.2 Proper shipping name	FLAMMABLE LIQUIDS, N.O.S. (2-Pentanol, 4-methyl-, Xanthate ester)
14.3 Transport hazard class Label(s)	3 3
14.4 Packing group Packing group ERG No	 III 128
14.5 Environmental hazards **Marine pollutant**	YES Marine Pollutant (Fuels, diesel, no. 2, Xanthate ester)

TDG

14.1 UN number	UN 1993
14.2 Proper shipping name	FLAMMABLE LIQUID, N.O.S. (2-Pentanol, 4-methyl-, Xanthate ester)
14.3 Transport hazard class Label(s)	3 3
14.4 Packing group Packing group ERG No	 III 128
14.5 Environmental hazards **Marine pollutant**	YES Marine Pollutant (Fuels, diesel, no. 2, Xanthate ester)

NOM

14.1 UN number	UN 1993
14.2 Proper shipping name	FLAMMABLE LIQUID, N.O.S. (2-Pentanol, 4-methyl-, Xanthate ester, Fuels, diesel, no. 2)
14.3 Transport hazard class Label(s)	3 3
14.4 Packing group Packing group ERG No	 III 128
14.5 Environmental hazards **Marine pollutant**	YES

IMDG

14.1 UN number	UN 1993
14.2 Proper shipping name	FLAMMABLE LIQUID, N.O.S. (4-methylpentan-2-ol, Xanthate ester, Fuels, diesel, no. 2)
IMDG Code segregation group	Not Relevant
14.3 Transport hazard class Label(s)	3 3
14.4 Packing group Packing group	 III
14.5 Environmental hazards **Marine pollutant**	YES

14.6 Special precautions for user

EmS	F-E , S-E

For personal protection, see section 8.

14.7 Transport in bulk vessels according to IMO instruments

No data available

IATA

14.1 UN number	UN 1993
14.2 Proper shipping name	FLAMMABLE LIQUID, N.O.S. (4-methylpentan-2-ol, Xanthate ester, Fuels, diesel, no. 2)
14.3 Transport hazard class	3
Label(s):	3
14.4 Packing group	
Packing group	III
Packing instruction (cargo aircraft)	366
Max net qty / pkg	220.00 L
Packing instruction (passenger aircraft)	355
Max net qty / pkg	60.00 L
14.5 Environmental hazards	YES

14.6 Special precautions for user

For personal protection, see section 8.

Note: The above regulatory prescriptions are those valid on the date of publication of this sheet. Given the possible evolution of transportation regulations for hazardous materials, it would be advisable to check their validity with your sales office.

SECTION 15: Regulatory information

15.1 Notification status

Inventory Information	Status
United States TSCA Inventory	- All substances listed as active on the TSCA inventory
Canadian Domestic Substances List (DSL)	- Listed on Inventory
Australian Inventory of Industrial Chemicals (AIIC)	- All components are listed on the inventory, regulatory obligations/restrictions apply
Japan. CSCL - Inventory of Existing and New Chemical Substances	- One or more components not listed on inventory
Korea. Korean Existing Chemicals Inventory (KECI)	- One or more components not listed on inventory

China. Inventory of Existing Chemical Substances in China (IECSC)	- One or more components not listed on inventory
Philippines Inventory of Chemicals and Chemical Substances (PICCS)	- One or more components not listed on inventory
Taiwan Chemical Substance Inventory (TCSI)	- One or more components not listed on inventory
New Zealand. Inventory of Chemical Substances	- One or more components is not listed on the NZIoC inventory. Additional HSNO obligations may apply. Please refer to Section 15 of SDS for New Zealand.
EU. European Registration, Evaluation, Authorization and Restriction of Chemical (REACH)	- When purchased from a Syensqo legal entity based in the EEA ("European Economic Area"), this product is compliant with the registration provisions of the REACH Regulation (EC) No. 1907/2006 as all its components are either excluded, exempt, and/or registered. When purchased from a legal entity outside of the EEA, please contact your local representative for additional information.
Korea. Act on Registration and Evaluation of Chemicals	- When purchased from a Syensqo legal entity based in Korea, this product is compliant with "Act on Registration and Evaluation of Chemicals" (AREC or K-REACH, Article 10) as all its components are either excluded, exempt, and/or (pre)registered. When purchased from a legal entity outside of Korea, please contact your local representative for additional information.

15.2 Federal Regulations

US. EPA EPCRA SARA Title III

SARA HAZARD DESIGNATION SECTIONS 311/312 (40 CFR 370)

Flammable (gases, aerosols, liquids, or solids)	Yes
Acute toxicity (any route of exposure)	Yes
Skin corrosion or irritation	Yes
Serious eye damage or eye irritation	Yes
Respiratory or skin sensitization	Yes
Germ cell mutagenicity	Yes
Carcinogenicity	Yes
Specific target organ toxicity (single or repeated exposure)	Yes
Aspiration hazard	Yes

The categories not mentioned are not relevant for the product.

Section 313 Toxic Chemicals (40 CFR 372.65)
The following components are subject to reporting levels established by SARA Title III, Section 313. This information must be included in all SDSs that are copied and distributed for this material.

Components	CAS-No.	Concentration
2-Pentanone, 4-methyl-	108-10-1	<= 0.5%

Section 302 Emergency Planning Extremely Hazardous Substance Threshold Planning Quantity (40 CFR 355)
This material does not contain any components with a section 302 EHS TPQ.

Section 302 Emergency Planning Extremely Hazardous Substance Reportable Quantity (40 CFR 355)

Components	CAS-No.	Reportable quantity
2-Propen-1-ol	107-18-6	100 lb

Section 304 Emergency Release Notification Reportable Quantity (40 CFR 355)

Components	CAS-No.	Reportable quantity
2-Propen-1-ol	107-18-6	100 lb

US. EPA CERCLA Hazardous Substances and Reportable Quantities (40 CFR 302.4)

Components	CAS-No.	Reportable quantity
2-Propen-1-ol	107-18-6	100 lb
1-Butanol	71-36-3	5000 lb
2-Pentanone, 4-methyl-	108-10-1	5000 lb
1-Propene, 3-chloro-	107-05-1	1000 lb

TSCA Lists

US. TSCA Section 12(b) Export Notification (40 CFR 707)

Components	CAS-No.
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester	1001320-38-2

TSCA - 5(a) Significant New Use Rule List of Chemicals

Components	CAS-No.
Carbamic acid, N-[(butylthio)thioxomethyl]-, butyl ester See 40 CFR § 721.10144	1001320-38-2
Thioimidodicarbonic acid ((HO)C(O)NHC(S)(OH)), O1,O3-dibutyl ester See 40 CFR § 721.10084	39142-36-4

15.3 State Regulations

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

Please contact your local sales representative if you have questions and need more information concerning this product under California's Proposition 65 statute (www.p65warnings.ca.gov).

SECTION 16: Other information

Further information

- Distribute new edition to clients
- Update
- See section 3

Date Prepared: 04/04/2024

Key or legend to abbreviations and acronyms used in the safety data sheet

- PEL: Permissible exposure limit
- ST: STEL - 15-minute TWA exposure that should not be exceeded at any time during a workday
- STEL: Short term exposure limit
- TWA: 8-hr TWA
- ACGIH: American Conference of Governmental Industrial Hygienists
- OSHA: Occupational Safety and Health Administration
- NTP: National Toxicology Program
- IARC: International Agency for Research on Cancer
- NIOSH: National Institute for Occupational Safety and Health
- ADR: European Agreement on International Carriage of Dangerous Goods by Road.
- ADN: European Agreement on the International Carriage of Dangerous Goods by Inland Waterways.
- RID: European Agreement concerning the International Carriage of Dangerous Goods by Rail.
- IATA: International Air Transport Association.
- ICAO-TI: Technical Specification for Safe Transport of Dangerous Goods by Air.
- IMDG: International Maritime Dangerous Goods.
- TWA: Time weighted average
- ATE: Estimated value of acute toxicity
- EC: European Community number
- CAS: Chemical Abstracts Service.
- LD50: Substance that causes 50% (half) death in the test animals group (Median Fatal Dose).
- LC50: Substance concentration causing 50% (half) death in the test animals group.
- EC50: Effective Concentration of the substance causing the maximum of 50%.
- PBT: Persistent, Bioaccumulative and Toxic substance.
- vPvB: Very Persistent and Very Bioaccumulative.
- SEA: Classification, labeling, packaging regulation
- DNEL: Derived No Effect Level
- PNEC: Predicted No Effect Concentration
- STOT: Specific Target Organ Toxicity

Not all acronyms listed above are referenced in this SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information, and belief at the date of its publication. Such information is only given as a guidance to help the user handle, use, process, store, transport, dispose, and release the product in satisfactory safety conditions and is not to be considered as a warranty or quality specification. It should be used in conjunction with technical sheets but do not replace them. Thus, the information only relates to the designated specific product and may not be applicable if such product is used in combination with other materials or in any other manufacturing process, unless otherwise specifically indicated. It does not release the user from ensuring he is in conformity with all regulations linked to its activity.

AERO® MX-5160 PROMOTER

Revision Date 03/12/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

- Trade name AERO® MX-5160 PROMOTER

1.2 Relevant identified uses of the substance or mixture and uses advised against

Uses of the Substance / Mixture

- Use in mining industry

1.3 Details of the supplier of the safety data sheet

Company

CYTEC INDUSTRIES INC.
504 CARNEGIE CENTER
PRINCETON, NJ 08540 USA

Local contact

+800-438-5615; +888-298-3272

1.4 Emergency telephone

FOR EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT, CONTACT CHEMTREC (24-Hour Number): +1-800-424-9300 within the United States and Canada, or +1-703-527-3887 for international collect calls.

Disclaimer

The ® indicates a Registered Trademark in the United States and the ™ indicates a trademark in the United States. The mark may also be registered, subject of an application for registration, or a trademark in other countries.

SECTION 2: Hazards identification

Although OSHA has not adopted the environmental portion of the GHS regulations, this document may include information on environmental effects.

2.1 Classification of the substance or mixture

HCS 2012 (29 CFR 1910.1200)

Acute toxicity, Category 4	H302: Harmful if swallowed.
Skin corrosion, Category 1	H314: Causes severe skin burns and eye damage.
Serious eye damage, Category 1	H318: Causes serious eye damage.
Skin sensitization, Category 1	H317: May cause an allergic skin reaction.
Reproductive toxicity, Category 2	H361: Suspected of damaging fertility or the unborn child.
Specific target organ toxicity - repeated exposure, Category 2	H373: May cause damage to organs through prolonged or repeated exposure if swallowed. (Liver), Oral

2.2 Label elements

HCS 2012 (29 CFR 1910.1200)

Pictogram



Signal Word

- Danger

Hazard Statements

- H302	Harmful if swallowed.
- H314	Causes severe skin burns and eye damage.
- H317	May cause an allergic skin reaction.
- H361	Suspected of damaging fertility or the unborn child.
- H373	May cause damage to organs (Liver) through prolonged or repeated exposure if swallowed.

Precautionary Statements

Prevention

- P201	Obtain special instructions before use.
- P202	Do not handle until all safety precautions have been read and understood.
- P260	Do not breathe mist or vapors.
- P264	Wash skin thoroughly after handling.
- P270	Do not eat, drink or smoke when using this product.
- P272	Contaminated work clothing must not be allowed out of the workplace.
- P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

- P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
- P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
- P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
- P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
- P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
- P308 + P313	IF exposed or concerned: Get medical advice/ attention.
- P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
- P363	Wash contaminated clothing before reuse.

Storage

- P405	Store locked up.

Disposal

- P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards which do not result in classification

- H400: Very toxic to aquatic life.
- H410: Very toxic to aquatic life with long lasting effects.

SECTION 3: Composition/information on ingredients

3.1 Substance

- Not applicable, this product is a mixture.

3.2 Mixture

- Chemical nature Sulfide mineral collector

Hazardous Ingredients and Impurities

Chemical name	Identification number CAS-No.	Concentration [%]
Thiophosphate	*****	>= 10 - <= 30
Monothiophosphate	*****	3 - 7
Modified thionocarbamate	*****	< 10
Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	86329-09-1	< 10
Sodium hydrogensulfide (hydrate)	207683-19-0	<= 5
Dithiocarbamate	*****	<= 5
Sodium sulfide (Na(SH))	16721-80-5	<= 5
Dialkyl dithiocarbamate	*****	<= 5
1-Propanol, 2-methyl-	78-83-1	<= 2
Sodium hydroxide (Na(OH))	1310-73-2	<= 1

The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

SECTION 4: First aid measures

4.1 Description of first-aid measures

In case of inhalation

- Quickly move the person away from the contaminated area. Make the affected person rest.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Be prepared to provide first aid or medical support if necessary.

In case of skin contact

- Wash off immediately with plenty of water for at least 15 minutes.
- Use appropriate protective equipment when treating a contaminated person.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Be prepared to provide first aid or medical support if necessary.

In case of eye contact

- Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
- Keep eye wide open while rinsing.
- Show this sheet to the doctor.
- Always obtain medical advice, even if there are no symptoms.
- Be prepared to provide first aid or medical support if necessary.

In case of ingestion

- Do NOT induce vomiting.
- Immediate medical attention is required.
- Show this sheet to the doctor.
- Do not give anything to drink.

- Be prepared to provide first aid or medical support if necessary.

4.2 Most important symptoms and effects, both acute and delayed

Effects

- Effects on health may appear after exposure.
- Effects on health may appear after prolonged or repeated exposure.
- The effects will depend on target organs.
- Chronic exposure is suspected of causing effects on fertility or on the unborn child on basis of animal data. Effects on human have not been proven.
- Chronic exposure may cause allergic dermatitis.
- Exposure may cause allergic rhinitis, conjunctivitis, asthma or shock.
- If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the esophagus and the stomach.
- In case of inhalation, irritation/corrosion of the respiratory tract.
- Risk of respiratory disorder
- May cause irreversible skin damage.
- Chronic exposure may cause dermatitis.
- May cause irreversible eye damage.
- Loss of the eye

Symptoms

- Symptoms will depend on the target organs.
- Inhalation may provoke the following symptoms:
- Cough
- Breathing difficulties
- Irritation
- Redness
- Swelling of tissue
- Ingestion may provoke the following symptoms:
- Nausea
- Diarrhea
- Abdominal pain
- May cause respiratory tract irritation.
- allergic rhinitis
- Severe allergic skin reactions, bronchiospasm and anaphylactic shock
- Itching
- Dermatitis
- Causes skin burns.
- Lachrymation
- Conjunctivitis
- Causes eye burns.
- The gas deadens the sense of smell. Do not depend on odor to detect presence of gas.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician

- Be aware to maintain life support if necessary.
- Take victim immediately to hospital.
- Immediate medical attention is required.
- Consult with an ophthalmologist immediately in all cases.
- Burns must be treated by a physician.
- Treat symptomatically.
- Contact a poison control center.
- Keep under medical supervision for at least 48 hours.
- Contact the occupational physician in case of exposure.

SECTION 5: Firefighting measures

Flash point	216 °F (102 °C) Pensky-Martens closed cup Solvent
Autoignition temperature	No data available
Flammability / Explosive limit	No data available

5.1 Extinguishing media

Suitable extinguishing media

- Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media

- High volume water jet

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting

- Under fire conditions:
- Will burn
- On combustion, toxic gases are released.

Hazardous combustion products:

- Sulfur dioxide, hydrogen sulfide or carbon disulfide may be formed under fire conditions.

5.3 Advice for firefighters

Special protective equipment for fire-fighters

- In the event of fire, wear self-contained breathing apparatus.
- Personal protective equipment comprising: suitable protective gloves, safety goggles and protective clothing.
- Wear a positive-pressure supplied-air respirator with full facepiece.
- For further information refer to section 8 "Exposure controls / personal protection."

Specific fire fighting methods

- Cool containers/tanks with water spray.
- Do not use a solid water stream as it may scatter and spread fire.

Further information

- Do not flush to sewer which may contain acid.
- This could result in generation of toxic and flammable carbon disulfide, carbonyl sulfide and hydrogen sulfide.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- Where exposure level is not known, wear approved, positive pressure, self-contained respirator.
- Where exposure level is known, wear approved respirator suitable for level of exposure.
- Avoid contact with the skin and the eyes.
- In addition to the protective clothing/equipment in Section 8, wear a two piece PVC suit with hood or PVC overalls with hood.

6.2 Environmental precautions

- Stop the leak. Turn leaking containers leak-side up to prevent the escape of liquid.
- Contain the spilled material by diking.
- Do not let product enter drains.
- Do not allow uncontrolled discharge of product into the environment.

- Spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies

6.3 Methods and materials for containment and cleaning up

- Stop leak if safe to do so.
- Keep in properly labeled containers.
- Keep in suitable, closed containers for disposal.
- Wash nonrecoverable remainder with large amounts of water.
- Soak up with inert absorbent material and dispose of as hazardous waste.
- Decontaminate tools, equipment and personal protective equipment in a segregated area.
- Dispose of in accordance with local regulations.
- Never return spills in original containers for re-use.

6.4 Reference to other sections

- 7. HANDLING AND STORAGE
- 8. EXPOSURE CONTROLS/PERSONAL PROTECTION
- 13. DISPOSAL CONSIDERATIONS

SECTION 7: Handling and storage

7.1 Precautions for safe handling

- Do not release to water.
- Large quantities of undiluted product should not be mixed with acids, since evolution of toxic and flammable hydrogen sulfide, carbon disulfide and carbonyl sulfide could result. In particular, precautions must be taken to avoid the accidental discharge of large volumes of the product in acid storage tanks or any tank or containment containing acidic materials. This precaution does not, of course, apply to addition of this reagent to flotation pulps in amounts customarily used in flotation, where the reagent amounts are small and instantly diluted to concentrations well below the solubility limits.

- Avoid inhalation, ingestion and contact with skin and eyes.
- Avoid splashes.
- Avoid high temperatures.
- Do NOT handle without gloves.
- Wear personal protective equipment.
- For personal protection, see section 8.

Hygiene measures

- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.
- When using do not eat, drink or smoke.
- Eye wash bottles or eye wash stations in compliance with applicable standards.
- Ensure that eyewash stations and safety showers are close to the workstation location.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions

- Do not freeze.

- Take all necessary measures to avoid accidental discharge of products into drains and waterways due to the rupture of containers or transfer systems.
- Keep away from incompatible materials to be indicated by the manufacturer.
- Keep containers tightly closed in a dry, cool and well-ventilated place.
- Keep away from heat and sources of ignition.

Requirements for storage rooms and vessels

Storage period: 24 Months

Recommended storage temperature: 32 - 104 °F (0 - 40 °C)

- Avoid prolonged (4 months or longer) exposure to moisture. Wear proper PPE (respirator) if material has been exposed to moisture for more than 4 months.

- Do not freeze.
- To guarantee the quality and properties of the product keep according to Storage temperature and conditions.

7.3 Specific end use(s)

- Contact your supplier for additional information

SECTION 8: Exposure controls/personal protection

Introductory Remarks: These recommendations provide general guidance for handling this product. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Assistance with selection, use and maintenance of worker protection equipment is generally available from equipment manufacturers.

8.1 Control parameters

Components with workplace occupational exposure limits

Components	Value type	Value	Basis
Sodium sulfide (Na(SH))	TWA	0.77 mg/m3	Corporate Acceptable Exposure Limit
Sodium sulfide (Na(SH))	STEL	1.5 mg/m3	Corporate Acceptable Exposure Limit
1-Propanol, 2-methyl-	TWA	50 ppm 150 mg/m3	National Institute for Occupational Safety and Health
1-Propanol, 2-methyl-	TWA	50 ppm	American Conference of Governmental Industrial Hygienists
1-Propanol, 2-methyl-	TWA	100 ppm 300 mg/m3	Occupational Safety and Health Administration - Table Z-1 Limits for Air Contaminants
Sodium hydroxide (Na(OH))	C	2 mg/m3	National Institute for Occupational Safety and Health
Sodium hydroxide (Na(OH))	C	2 mg/m3	American Conference of Governmental Industrial Hygienists
Sodium hydroxide (Na(OH))	TWA	2 mg/m3	Occupational Safety and Health Administration - Table Z-1 Limits for Air Contaminants

NIOSH IDLH (Immediately Dangerous to Life or Health Concentrations)

Components	CAS-No.	Concentration
1-Propanol, 2-methyl-	78-83-1	1600 parts per million
Sodium hydroxide (Na(OH))	1310-73-2	10 mg/m³

8.2 Exposure controls

Control measures

Engineering measures
- Ensure adequate ventilation.
- Apply technical measures to comply with the occupational exposure limits.

Individual protection measures

Respiratory protection
- Keep in a well-ventilated place.

Hand protection
- Take note of the information given by the producer concerning permeability and break through times, and of special workplace conditions (mechanical strain, duration of contact).
- Impervious gloves

Suitable material
- Nitrile or fluorinated rubber gloves.

Eye protection
- Chemical resistant goggles must be worn.
- Tightly fitting safety goggles.

Skin and body protection
- Impervious clothing
- Full protective suit
- Change working clothes after each work-shift.
- Contaminated work clothing should not be allowed out of the workplace.

Hygiene measures
- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.
- When using do not eat, drink or smoke.
- Eye wash bottles or eye wash stations in compliance with applicable standards.
- Ensure that eyewash stations and safety showers are close to the workstation location.

SECTION 9: Physical and chemical properties

Physical and Chemical properties here represent typical properties of this product. Contact the business area using the Product information phone number in Section 1 for its exact specifications.

9.1 Information on basic physical and chemical properties

Physical state	liquid
Form	clear

Color	light yellow to brown
Odor	Alcohol, sulfur
Odor Threshold	No data available
Melting point/freezing point	Freezing point: < 23 °F (< -5 °C)
Initial boiling point and boiling range	No data available
Flammability (solid, gas)	No data available
Flammability (liquids)	No data available
Flammability / Explosive limit	No data available
Flash point	216 °F (102 °C) Pensky-Martens closed cup Solvent
Autoignition temperature	No data available
Decomposition temperature	No data available
pH	> 12.0 (undiluted)
Viscosity	No data available
Solubility	Water solubility: soluble
Partition coefficient: n-octanol/water	No data available
Vapor pressure	No data available
Density	1.1 - 1.2 g/cm3
Relative density	No data available
Relative vapor density	No data available
Particle characteristics	No data available
Evaporation rate (Butylacetate = 1)	similar to water, The product itself has not been tested.

9.2 Other information

Oxidizing properties	Not considered as oxidizing.
Peroxides	The substance or mixture is not classified as organic peroxide.
Corrosion of Metals	Not corrosive to metals.
Molecular weight	Mixture
Reactions with water / air	Contact with acids liberates very toxic gas.

SECTION 10: Stability and reactivity

10.1 Reactivity

- Stable

10.2 Chemical stability

- Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

- No dangerous reaction known under conditions of normal use.

10.4 Conditions to avoid

- Contact with strong acids or bases may liberate toxic gases.
- Keep away from open flames, hot surfaces and sources of ignition.
- Avoid excessive heat for prolonged periods of time.

10.5 Incompatible materials

- Strong acids
- Bases
- Oxidizing agents
- Copper
- Brass
- Copper alloys
- Noble metals

10.6 Hazardous decomposition products

Hazardous decomposition products

- Alkyl sulfides
- carbon disulphide.
- Carbon dioxide (CO2)
- Carbonyl sulfide

Thermal decomposition

- Carbon monoxide
- Sulfur oxides
- Alkyl mercaptans

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute oral toxicity	This product is classified as acute toxicity category 4 According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Acute inhalation toxicity	Not classified as hazardous for acute inhalation toxicity according to GHS. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

Acute dermal toxicity	Not classified as hazardous for acute dermal toxicity according to GHS. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Acute toxicity (other routes of administration)	Not applicable
Skin corrosion/irritation	Corrosive to skin According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Serious eye damage/eye irritation	Risk of serious damage to eyes. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

Respiratory or skin sensitization

Monothiophosphate	Maximization Test - Guinea pig Responding animals in GPMT < 30% Method: OECD Test Guideline 406 Unpublished internal reports
Modified thionocarbamate	Local lymph node assay - Mouse Maximum Stimulation Index < 3 Method: OECD Test Guideline 429 Unpublished reports
Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	Maximization Test - Guinea pig ≥ 30 % responding at > 1 % intradermal induction dose Method: OECD Test Guideline 406 Unpublished internal reports
Sodium hydrogensulfide (hydrate)	study scientifically unjustified
Dithiocarbamate	By analogy Maximization Test - Guinea pig Responding animals in GPMT < 30% Method: OECD Test Guideline 406 Unpublished reports
Dialkyl dithiocarbamate	By analogy Maximization Test - Guinea pig Responding animals in GPMT < 30% Method: OECD Test Guideline 406 Unpublished reports
1-Propanol, 2-methyl-	Does not cause skin sensitization. By analogy
Sodium hydroxide (Na(OH))	Humans Does not cause skin sensitization. Published data

Mutagenicity

Genotoxicity in vitro	Product is not considered to be genotoxic. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Genotoxicity in vivo	Product is not considered to be genotoxic. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Carcinogenicity	The product is not considered to be carcinogenic. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

This product does not contain any ingredient designated as probable or suspected human carcinogens by:

NTP
IARC
OSHA

Toxicity for reproduction and development

Toxicity to reproduction / fertility

Thiophosphate	Reproduction / developmental toxicity screening test - Rat, male and female, Oral General Toxicity Parent NOAEL: 200 mg/kg bw/day General Toxicity F1 NOAEL: 200 mg/kg bw/day Fertility NOAEL: 200 mg/kg bw/day OECD Test Guideline 422 Unpublished reports
Modified thionocarbamate	Reproduction / developmental toxicity screening test - Rat, male and female, Oral General Toxicity Parent NOAEL: 31 mg/kg bw/day Fertility NOAEL Parent: < 31 mg/kg bw/day Developmental Toxicity NOAEL F1: 31 mg/kg bw/day OECD Test Guideline 422 Gavage, Effects on fertility, Unpublished reports
Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	Rat, male and female, Oral Fertility NOAEL Parent: 15 mg/kg bw/day OECD Test Guideline 422 Effects on fertility, Unpublished internal reports
Sodium hydrogensulfide (hydrate)	By analogy Reproduction / developmental toxicity screening test - Rat, male and female, Inhalation Fertility NOAEL Parent: 80 ppm OECD Test Guideline 421 Test substance, Hydrogen sulfide
Sodium sulfide (Na(SH))	By analogy

	Rat, male and female, inhalation (vapor) OECD Test Guideline 421 no impairment of fertility has been observed, Published data
1-Propanol, 2-methyl-	Two-generation reproductive toxicity - Rat, male and female, inhalation (vapor) General Toxicity Parent NOAEL: >= 7.5 mg/l General Toxicity F1 NOAEL: >= 7.5 mg/l according to a standardized method no impairment of fertility has been observed, Unpublished reports
Sodium hydroxide (Na(OH))	No data available

Developmental Toxicity/Teratogenicity

Thiophosphate	Developmental Toxicity - Rat, male and female, Oral General Toxicity Maternal NOAEL: 800 mg/kg bw/day Developmental Toxicity NOAEL: 800 mg/kg bw/day Method: OECD Test Guideline 414 No effect observed on development, Unpublished reports
Modified thionocarbamate	Pre-natal - Rat, female, Oral General Toxicity Maternal NOAEL: 30 mg/kg bw/day Embryo-fetal toxicity. NOAEL F1: 10 mg/kg bw/day Method: OECD Test Guideline 414 Gavage, Teratogenic effects have been observed, Unpublished reports
Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	Rat, male and female, Oral Method: OECD Test Guideline 422 General Toxicity Maternal NOAEL: 75 mg/kg bw/day Embryo-fetal toxicity. NOAEL F1: 15 mg/kg bw/day Effects on development were observed, Effect on implantation., Unpublished internal reports
Sodium hydrogensulfide (hydrate)	By analogy Rat, female, Inhalation Teratogenicity NOAEL:80ppm Method: OECD Test Guideline 421 Test substance, Hydrogen sulfide
Sodium sulfide (Na(SH))	By analogy Rat, male and female, inhalation (vapor) Method: OECD Test Guideline 421 no teratogenic effects have been observed, Published data
1-Propanol, 2-methyl-	Rat, male and female, inhalation (vapor) General Toxicity Maternal NOAEL: 10 mg/l Teratogenicity NOAEL:10mg/l Method: OECD Test Guideline 414 no teratogenic effects have been observed, Unpublished reports
Sodium hydroxide (Na(OH))	No data available

STOT

STOT-single exposure	The substance or mixture is not classified as specific target organ toxicant, single exposure according to GHS criteria. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
STOT-repeated exposure	Routes of exposure: Ingestion Target Organs: Liver The substance or mixture is classified as specific target organ toxicant, repeated exposure, category 2 according to GHS criteria. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data. The product itself has not been tested.

Experience with human exposure

Experience with human exposure : Inhalation

In contact with acid

Symptoms: Released substances:
Hydrogen sulphide
carbon disulphide.
Carbonyl sulfide
Inhalation may provoke the following symptoms:
Irritating to the respiratory system and mucous membranes.
Coma
cardiorespiratory failure
Neurological disorders
Gastrointestinal disturbance

Experience with human exposure : Skin contact

No data is available on the product itself.

Experience with human exposure : Eye contact

No data is available on the product itself.

Experience with human exposure : Ingestion

No data is available on the product itself.

CMR effects

Mutagenicity	
Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	Not classified as mutagen according to GHS criteria.
Teratogenicity	
Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	Classified as toxic for the reproduction in Category 2 (development) according to GHS criteria
Reproductive toxicity	
Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	Some evidence of adverse effects on sexual function and fertility, and/or on development, based on animal experiments.
Aspiration toxicity	No aspiration toxicity classification, According to the available data on the components, According to the classification criteria for mixtures.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic Compartment

Acute toxicity to fish	The product itself has not been tested.
Acute toxicity to daphnia and other aquatic invertebrates	The product itself has not been tested.
Toxicity to aquatic plants	The product itself has not been tested.
Toxicity to microorganisms	The product itself has not been tested.
Chronic toxicity to fish	The product itself has not been tested.
Chronic toxicity to daphnia and other aquatic invertebrates	The product itself has not been tested.

Sediment compartment

Toxicity to benthic organisms	The product itself has not been tested.

Terrestrial Compartment

Toxicity to soil dwelling organisms	The product itself has not been tested.
Toxicity to terrestrial plants	The product itself has not been tested.
Toxicity to above ground organisms	The product itself has not been tested.

M-Factor

Carbamothioic acid, N-2-propen-1-yl-, O-(2-methylpropyl) ester	Acute aquatic toxicity = 100 Chronic aquatic toxicity = 100 (according to the Globally Harmonized System (GHS))
Sodium hydrogensulfide (hydrate)	Acute aquatic toxicity = 100 (according to the Globally Harmonized System (GHS))
Dithiocarbamate	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1 (according to the Globally Harmonized System (GHS))
Sodium sulfide (Na(SH))	Acute aquatic toxicity = 100 (according to the Globally Harmonized System (GHS))
Dialkyl dithiocarbamate	Acute aquatic toxicity = 1 Chronic aquatic toxicity = 1 (according to the Globally Harmonized System (GHS))

12.2 Persistence and degradability

Abiotic degradation

Stability in water	Conclusion is not possible for a mixture as a whole.
Photodegradation	Conclusion is not possible for a mixture as a whole.

Other Physicochemical reactions	Conclusion is not possible for a mixture as a whole.

Physical- and photo-chemical elimination

Physico-chemical removability	Conclusion is not possible for a mixture as a whole.

Biodegradation

Biodegradability	As (bio)degradability is not relevant for mixtures, all the components of the mixture were assessed individually (rapid degradability assessment available below).
Ratio BOD / COD	Conclusion is not possible for a mixture as a whole.
Ratio BOD / ThOD	Conclusion is not possible for a mixture as a whole.
Biochemical Oxygen Demand (BOD)	Conclusion is not possible for a mixture as a whole.
Dissolved organic carbon (DOC)	Conclusion is not possible for a mixture as a whole.
Chemical Oxygen Demand (COD)	Conclusion is not possible for a mixture as a whole.
Adsorbed organic bound halogens (AOX)	Conclusion is not possible for a mixture as a whole.
Degradability assessment	Conclusion is not possible due to incomplete or heterogeneous data on the components.

12.3 Bioaccumulative potential

Partition coefficient: n-octanol/water	Conclusion is not possible for a mixture as a whole.
Bioconcentration factor (BCF)	As bioaccumulation is not relevant for mixtures, all the components of the mixture were assessed individually. Conclusion is not possible due to incomplete or heterogeneous data on the components. Unpublished reports Published data

12.4 Mobility in soil

Adsorption potential (Koc)	Conclusion is not possible for a mixture as a whole.
Known distribution to environmental compartments	Conclusion is not possible due to incomplete or heterogeneous data on the components.

12.5 Results of PBT and vPvB assessment

According to the available data on the components
Product does not contain substances which are persistent, bioaccumulative, and toxic (PBT) at levels of 0.1% or higher.
Product does not contain substances which are very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects

Ecotoxicity assessment

Short-term (acute) aquatic hazard	Very toxic to aquatic life. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.
Long-term (chronic) aquatic hazard	Very toxic to aquatic life with long lasting effects. According to the available data on the components. According to the classification criteria for mixtures. Unpublished reports and/or published data.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product Disposal

- The Company encourages the recycle, recovery and reuse of materials, where permitted. If disposal is necessary, The Company recommends that organic materials, especially when classified as hazardous waste, be disposed of by thermal treatment or incineration at approved facilities. All local and national regulations should be followed.

SECTION 14: Transport information

Transportation status: IMPORTANT! Statements below provide additional data on listed transport classification.
The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or other regulatory descriptors.

49 CFR

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUIDS, N.O.S. (Dithiophosphate salt)
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	154
14.5 Environmental hazards	YES
Marine pollutant	Marine Pollutant (Modified thionocarbamate)

TDG

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Dithiophosphate salt)
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	154

14.5 Environmental hazards	YES
Marine pollutant	Marine Pollutant (Modified thionocarbamate)

NOM

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Dithiophosphate salt, Modified thionocarbamate)
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	154
14.5 Environmental hazards	YES
Marine pollutant	

IMDG

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Dithiophosphate salt, Modified thionocarbamate)
IMDG Code segregation group	Alkalis (SGG18)
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
14.5 Environmental hazards	YES
Marine pollutant	
14.6 Special precautions for user	
EmS	F-A , S-B

For personal protection, see section 8.

14.7 Transport in bulk vessels according to IMO instruments

No data available

IATA

14.1 UN number	UN 1760
14.2 Proper shipping name	CORROSIVE LIQUID, N.O.S. (Dithiophosphate salt, Modified thionocarbamate)
14.3 Transport hazard class Label(s):	8 8
14.4 Packing group Packing group	II
Packing instruction (cargo aircraft) Max net qty / pkg Packing instruction (passenger aircraft) Max net qty / pkg	855 30.00 L 851 1.00 L
14.5 Environmental hazards	YES

14.6 Special precautions for user
For personal protection, see section 8.

Note: The above regulatory prescriptions are those valid on the date of publication of this sheet. Given the possible evolution of transportation regulations for hazardous materials, it would be advisable to check their validity with your sales office.

SECTION 15: Regulatory information

15.1 Notification status

Inventory Information	Status
United States TSCA Inventory	- All substances listed as active on the TSCA inventory
Canadian Domestic Substances List (DSL)	- Listed on Inventory
Australian Inventory of Industrial Chemicals (AIIC)	- All components are listed on the inventory, regulatory obligations/restrictions apply
Japan. CSCL - Inventory of Existing and New Chemical Substances	- One or more components not listed on inventory
Korea. Korean Existing Chemicals Inventory (KECI)	- One or more components not listed on inventory
China. Inventory of Existing Chemical Substances in China (IECSC)	- One or more components not listed on inventory
Philippines Inventory of Chemicals and Chemical Substances (PICCS)	- Listed on Inventory
Taiwan Chemical Substance Inventory (TCSI)	- One or more components not listed on inventory
New Zealand. Inventory of Chemical Substances	- All components are listed on the NZIoC inventory. Additional HSNO obligations

	may apply. Please refer to Section 15 of SDS for New Zealand.
EU. European Registration, Evaluation, Authorization and Restriction of Chemical (REACH)	- When purchased from a Syensqo legal entity based in the EEA ("European Economic Area"), this product is compliant with the registration provisions of the REACH Regulation (EC) No. 1907/2006 as all its components are either excluded, exempt, and/or registered. When purchased from a legal entity outside of the EEA, please contact your local representative for additional information.
Korea. Act on Registration and Evaluation of Chemicals	- When purchased from a Syensqo legal entity based in Korea, this product is compliant with "Act on Registration and Evaluation of Chemicals" (AREC or K-REACH, Article 10) as all its components are either excluded, exempt, and/or (pre)registered. When purchased from a legal entity outside of Korea, please contact your local representative for additional information.

15.2 Federal Regulations

US. EPA EPCRA SARA Title III

SARA HAZARD DESIGNATION SECTIONS 311/312 (40 CFR 370)

Acute toxicity (any route of exposure)	Yes
Skin corrosion or irritation	Yes
Serious eye damage or eye irritation	Yes
Respiratory or skin sensitization	Yes
Reproductive toxicity	Yes
Specific target organ toxicity (single or repeated exposure)	Yes

The categories not mentioned are not relevant for the product.

Section 313 Toxic Chemicals (40 CFR 372.65)
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Section 302 Emergency Planning Extremely Hazardous Substance Threshold Planning Quantity (40 CFR 355)
This material does not contain any components with a section 302 EHS TPQ.

Section 302 Emergency Planning Extremely Hazardous Substance Reportable Quantity (40 CFR 355)
This material does not contain any components with a SARA 302 RQ.

Section 304 Emergency Release Notification Reportable Quantity (40 CFR 355)
This material does not contain any components with a section 304 EHS RQ.

US. EPA CERCLA Hazardous Substances and Reportable Quantities (40 CFR 302.4)

Components	CAS-No.	Reportable quantity
Sodium hydroxide (Na(OH))	1310-73-2	1000 lb
Sodium hydrogensulfide (hydrate)	207683-19-0	5000 lb
Sodium sulfide (Na(SH))	16721-80-5	5000 lb
1-Propanol, 2-methyl-	78-83-1	5000 lb
1-Butanol	71-36-3	5000 lb

15.3 State Regulations

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

Please contact your local sales representative if you have questions and need more information concerning this product under California's Proposition 65 statute (www.p65warnings.ca.gov).

SECTION 16: Other information

Further information

- Distribute new edition to clients

Date Prepared: 03/12/2024

Key or legend to abbreviations and acronyms used in the safety data sheet

- C: Ceiling limit
- PEL: Permissible exposure limit
- STEL: Short term exposure limit
- TWA: 8-hour, time-weighted average
- : Corporate Acceptable Exposure Limit
- ACGIH: American Conference of Governmental Industrial Hygienists
- OSHA: Occupational Safety and Health Administration
- NTP: National Toxicology Program
- IARC: International Agency for Research on Cancer
- NIOSH: National Institute for Occupational Safety and Health
- ADR: European Agreement on International Carriage of Dangerous Goods by Road.
- ADN: European Agreement on the International Carriage of Dangerous Goods by Inland Waterways.
- RID: European Agreement concerning the International Carriage of Dangerous Goods by Rail.
- IATA: International Air Transport Association.
- ICAO-TI: Technical Specification for Safe Transport of Dangerous Goods by Air.
- IMDG: International Maritime Dangerous Goods.
- TWA: Time weighted average
- ATE: Estimated value of acute toxicity
- EC: European Community number
- CAS: Chemical Abstracts Service.
- LD50: Substance that causes 50% (half) death in the test animals group (Median Fatal Dose).
- LC50: Substance concentration causing 50% (half) death in the test animals group.
- EC50: Effective Concentration of the substance causing the maximum of 50%.
- PBT: Persistent, Bioaccumulative and Toxic substance.
- vPvB: Very Persistent and Very Bioaccumulative.
- SEA: Classification, labeling, packaging regulation
- DNEL: Derived No Effect Level
- PNEC: Predicted No Effect Concentration
- STOT: Specific Target Organ Toxicity

Not all acronyms listed above are referenced in this SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information, and belief at the date of its publication. Such information is only given as a guidance to help the user handle, use, process, store, transport, dispose, and release the product in satisfactory safety conditions and is not to be considered as a warranty or quality specification. It should be used in conjunction with technical sheets but do not replace them. Thus, the information only relates to the designated specific product and may not be applicable if such product is used in combination with other materials or in any other manufacturing process, unless otherwise specifically indicated. It does not release the user from ensuring he is in conformity with all regulations linked to its activity.

SECTION 1. IDENTIFICATION

Product identifier

Trade name : Amerfloc™ 485 polymer
™ Trademark, Solenis or its subsidiaries or affiliates, registered in various countries

Recommended use of the chemical and restrictions on use

Details of the supplier of the safety data sheet	**Emergency telephone number**
Solenis LLC 500 Hercules Road Wilmington, Delaware 19808 United States of America (USA) RegulatoryRequestsNA@solenis.com	1-844-SOLENIS (844-765-3647) **Product Information** Contact your local Solenis representative

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200

This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012).

GHS label elements

This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012).

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

No hazardous ingredients

SECTION 4. FIRST AID MEASURES

General advice : No hazards which require special first aid measures.

If inhaled : If breathed in, move person into fresh air.
If unconscious, place in recovery position and seek medical

advice.
If symptoms persist, call a physician.

In case of skin contact	:	First aid is not normally required. However, it is recommended that exposed areas be cleaned by washing with soap and water.
In case of eye contact	:	Flush eyes with water as a precaution. Remove contact lenses. Protect unharmed eye. If eye irritation persists, consult a specialist.
If swallowed	:	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person. If symptoms persist, call a physician.
Most important symptoms and effects, both acute and delayed	:	No symptoms known or expected.
Notes to physician	:	No hazards which require special first aid measures.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Water spray Foam Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	:	High volume water jet
Specific hazards during firefighting	:	Do not allow run-off from fire fighting to enter drains or water courses.
Hazardous combustion products	:	Carbon monoxide Carbon dioxide (CO2) nitrogen oxides (NOx)
Specific extinguishing methods	:	Product is compatible with standard fire-fighting agents.
Further information	:	Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special protective equipment for firefighters	:	In the event of fire, wear self-contained breathing apparatus.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Comply with all applicable federal, state, and local regulations.
Environmental precautions	:	Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Keep in suitable, closed containers for disposal.

SECTION 7. HANDLING AND STORAGE

Advice on protection against fire and explosion	:	Normal measures for preventive fire protection.
Advice on safe handling	:	Smoking, eating and drinking should be prohibited in the application area. For personal protection see section 8. Dispose of rinse water in accordance with local and national regulations.
Conditions for safe storage	:	Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Electrical installations / working materials must comply with the technological safety standards.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures	:	Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below exposure guidelines (if applicable) or below levels that cause known, suspected or apparent adverse effects.

Personal protective equipment

Hand protection

Material	:	nitrile rubber
Remarks	:	The suitability for a specific workplace should be discussed with the producers of the protective gloves.

Eye protection	:	Not required under normal conditions of use. Wear splash-proof safety goggles if material could be misted or splashed into eyes.
Skin and body protection	:	Wear as appropriate: Impervious clothing Safety shoes Choose body protection according to the amount and concentration of the dangerous substance at the work place. Discard gloves that show tears, pinholes, or signs of wear. Wear resistant gloves (consult your safety equipment supplier).
Hygiene measures	:	Wash hands before breaks and at the end of workday.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	clear, light yellow
Odour	:	none
Odour Threshold	:	No data available
pH	:	4 - 7
Melting point/freezing point	:	< 0 °C
Initial boiling point and boiling range	:	> 100 °C
Flash point	:	does not flash
Evaporation rate	:	No data available
Flammability (solid, gas)	:	No data available
Self-ignition	:	does not ignite
Upper explosion limit	:	Not applicable
Lower explosion limit	:	Not applicable
Vapour pressure	:	2.3 kPa (20 °C)
Relative vapour density	:	0.804 (20 °C)
Relative density	:	1.1 - 1.2
Density	:	No data available

Solubility(ies)		
Water solubility	:	completely miscible
Solubility in other solvents	:	No data available
Partition coefficient: n-octanol/water	:	log Pow: < 0
Decomposition temperature	:	> 150 °C
Viscosity		
Viscosity, dynamic	:	650 - 1,000 cps (25 °C) 30 RPM
Viscosity, kinematic	:	No data available
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	No decomposition if stored and applied as directed.
Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	Product will not undergo hazardous polymerization.
Conditions to avoid	:	Freezing temperatures.
Incompatible materials	:	aluminum Copper Iron strong mineral acids Strong oxidizing agents
Hazardous decomposition products	:	Carbon monoxide Carbon dioxide (CO2) Nitrogen oxides (NOx)

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Not classified based on available information.

Product:

Acute oral toxicity	:	LD 50 (Rat): > 2,000 mg/kg
Acute dermal toxicity	:	LD 50 (Rat): > 2,000 mg/kg

Skin corrosion/irritation

Not classified based on available information.

Product:

Result: Mildly irritating to skin

Serious eye damage/eye irritation

Not classified based on available information.

Product:

Result: Mildly irritating to eyes

Remarks: Unlikely to cause eye irritation or injury.

Respiratory or skin sensitisation

Skin sensitisation

Not classified based on available information.

Respiratory sensitisation

Not classified based on available information.

Product:

Germ cell mutagenicity

Not classified based on available information.

Carcinogenicity

Not classified based on available information.

IARC	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.
NTP	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Not classified based on available information.

STOT - single exposure

Not classified based on available information.

STOT - repeated exposure

Not classified based on available information.

Aspiration toxicity

Not classified based on available information.

Further information

Product:

Remarks: No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	LC 50 (Zebra danio (Danio rerio)): > 10 mg/l Exposure time: 96 h Method: OECD Test Guideline 203
Toxicity to daphnia and other aquatic invertebrates	:	EC 50 (Daphnia magna (Water flea)): > 10 mg/l Exposure time: 48 h Method: OECD Test Guideline 202

Ecotoxicology Assessment

Acute aquatic toxicity	:	Acute aquatic toxicity Category 3; Harmful to aquatic life.
Chronic aquatic toxicity	:	Chronic aquatic toxicity Category 3; Harmful to aquatic life with long lasting effects.

Persistence and degradability

Product:

Biodegradability	:	Result: Not readily biodegradable.

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

Product:

Additional ecological information	:	An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Do not contaminate ponds, waterways or ditches with chemical or used container. Send to a licensed waste management company.

Dispose of in accordance with all applicable local, state and federal regulations.

Contaminated packaging : Empty remaining contents.
Dispose of as unused product.
Empty containers should be taken to an approved waste handling site for recycling or disposal.
Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International transport regulations

REGULATION

ID NUMBER	PROPER SHIPPING NAME	*HAZARD CLASS	SUBSIDIARY HAZARDS	PACKING GROUP	MARINE POLLUTANT / LTD. QTY.

IATA-DGR

Not dangerous goods

IMDG-Code

Not dangerous goods

CFR

Not dangerous goods

***ORM = ORM-D, CBL = COMBUSTIBLE LIQUID**

Marine pollutant		no

Dangerous goods descriptions (if indicated above) may not reflect quantity, end-use or region-specific exceptions that can be applied. Consult shipping documents for descriptions that are specific to the shipment.

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : No SARA Hazards

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop. 65

Proposition 65 warnings are not required for this product based on the results of a risk assessment.

The components of this product are reported in the following inventories:

DSL	:	All components of this product are on the Canadian DSL
ENCS	:	On the inventory, or in compliance with the inventory
AICS	:	On the inventory, or in compliance with the inventory
KECI	:	On the inventory, or in compliance with the inventory
PICCS	:	On the inventory, or in compliance with the inventory
IECSC	:	On the inventory, or in compliance with the inventory
TCSI	:	On the inventory, or in compliance with the inventory
TSCA	:	On TSCA Inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16. OTHER INFORMATION

Further information
Revision Date: 01/29/2019

Full text of other abbreviations

Further information

Other information : The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances. This MSDS has been prepared by the Solenis Environmental Health and Safety Department.

Sources of key data used to compile the Safety Data Sheet
Key literature references and sources of data
SOLENIS Internal data
SOLENIS internal data including own and sponsored test reports

The UNECE administers regional agreements implementing harmonised classification for labelling (GHS) and transport.

Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

US / EN

MATERIAL SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT and COMPANY IDENTIFICATION

ANIONIC POLYACRYLAMIDE FLOCCULANT

DATE ISSUED: 06/12/13
SUPERSEDES: 08/25/10

DESCRIPTION: Anionic polyacrylamide flocculant, viscosity builder/shale inhibitor for mineral and mining applications.

SECTION 2 - COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS NUMBER
Copolymer of Acrylamide and Acrylate	25085-02-3

SECTION 3 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: White, free flowing dry powder with little or no odor. Spills are very slippery. Avoid contact with skin, eyes and clothing. Contact with eyes may produce irritation and/or redness. Inhaled dust may cause some respiratory irritation.

POTENTIAL HEALTH EFFECTS
EFFECTS OF OVEREXPOSURE - EYE CONTACT: Eye contact may produce slight irritation and/or redness.

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: Not available.

EFFECTS OF OVEREXPOSURE - INHALATION: Inhaled dust may cause some respiratory irritation.

EFFECTS OF OVEREXPOSURE: INGESTION: Not available. CHRONIC HAZARDS: Not available.

PRIMARY ROUTE OF ENTRY: Eyes, Inhalation.

SECTION 4 - FIRST AID MEASURES

INHALATION: Remove patient to fresh air.

SKIN: Remove contaminated clothing and launder before reuse. Wash affected area with soap and water for at least 15 minutes.

EYE CONTACT: Flush with water at least 15 minutes with eyelids open. Call a physician.

INGESTION: Do not give an emetic unless directed by a physician. Never give anything by mouth to an unconscious person.

SECTIONS 5 - FIRE FIGHTING MEASURES

FLASHPOINT: NA; FLAMMABILITY: NA; AUTO FLAMMABILITY: NA

EXPLOSION HAZARD: Dust in sufficient concentration can result in an explosive mixture in air.

EXPLOSIVE LIMITS: LOWER: NA; UPPER: NA

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical or foam to extinguish.

EXTINGUISHING MEDIA WHICH MUST NOT BE USED: Care must be taken when using water, as spilled product is extremely slippery when wet.

SPECIAL EXPOSURE HAZARDS IN A FIRE: ln fire situation, may liberate oxides of nitrogen or carbon and hydrogen chloride. Keep containers cool by spraying with water if exposed to fire.

SPECIAL PROTECTIVE EQUIPMENT FOR A FIRE: Self-contained breathing apparatus should be worn.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

ENVIRONMENTAL PRECAUTIONS: Avoid runoff into storm sewers and ditches which lead to waterways.

METHODS FOR CLEANUP: Product becomes slippery and difficult to handle when wet; spills are best handled while dry. Sweep up and collect dry product. Absorb wet product with vermiculite or other inert material then water wash area to waste treatment.

OTHER INSTRUCTIONS: Dispose of solidified material in accordance with federal, state, local or other applicable laws and regulations.

SECTION 7 - HANDLING AND STORAGE

HANDLING: Avoid contact with eyes, skin and clothing.
STORAGE: Avoid extremes of temperature: wet damp or humid conditions.

SECTION 8 - EXPOSURE CONTROLS and PERSONAL PROTECTION

ENGINEERING CONTROLS: General ventilation is recommended. Eyewash and safety shower stations are recommended.

EXPOSURE GUIDELINES: No MAC values have been established.

PERSONAL PROTECTIVE EQUIPMENT: See below; RESPIRATORY PROTECTION: Use NIOSH approved dust respirator (ANSI Z 882.1980) or equivalent, as required to control exposure.

HAND PROTECTION: Wear impervious gloves. EYE PROTECTION: Wear chemical splash goggles or face mask.

SKIN PROTECTION: If clothing is contaminated, wash skin and launder clothing,.

NOTE: Before eating, drinking or smoking, wash face and hands thoroughly with soap and water.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE, COLOR AND ODOR: White free flowing dry powder with little or no odor.

pH as is: NA; MELTING POINT/RANGE: NA; SPECIFIC GRAVITY: 0.8-1.0

WATER SOLUBILITY: Completely soluble

SECTION 10 - STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable. CONDITIONS TO AVOID: None.

MATERIALS TO AVOID: Strong oxidants such as liquid chlorine, enriched gaseous or liquid oxygen and sodium or calcium hypochlorite.

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of carbon and nitrogen, ammonia and/or hydrogen chloride. Vapor may be harmful or irritating.

SECTION 11 - TOXICOLOGICAL INFORMATION

ACUTE TOXICITY: Not listed as a carcinogen by IARC, NTP, OSHA or ACGIH. The OSHA 8-hour TWA for total dust is 15 mg/M^3 (5 mg/M^3 for the respirable fraction). The ACGIH TLV-TWA is 10 mg/m^3.

IRRITANCY AND CORROSIVENESS: May be slightly irritating to skin and eyes on prolonged exposure. No evidence of corrosiveness.

SENSITIZATION: None known.

SUBACUTE, SUBCHRONIC AND PROLONGED TOXICITY: No information available.

EMPIRICAL DATA ON EFFECTS ON HUMANS: Considered non-toxic in normal use.

SECTION 12 - ECOLOGICAL INFORMATION

AQUATIC TOXICITY: This product may be toxic to fish.

OTHER INFORMATION: Discharge of this product must be in accordance with all federal, state, local or other

applicable laws and regulations.

SECTION 13 - DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Recycle if possible. If not, absorb spilled material on inert absorbent and dispose of solidified material in accordance with federal, state, local or other applicable laws and regulations.

SECTION 14 - TRANSPORTATION INFORMATION

Non-Hazardous, Non-Regulated

SECTION 15 - REGULATORY INFORMATION

U. S FEDERAL REGULATIONS: CERCLA-SARA Hazard Category:

No SARA Section 313 components exist in this product.

INVENTORY INFORMATION:

EEC EINECS: All components of this product are included on the European Inventory of Existing Chemical Substances (EINECS) in compliance with Council Directive 67/548/EEC as amended.

US TSCA: This product is manufactured in compliance with all provisions of the Toxic Substances Control Act, 15 U.S.C.

CANADA DSL: Components of this product have been reported to Environment Canada in accordance with subsection 25 of the Canadian Environmental Protection Act and are included on the Domestic Substances List.

SECTION 16 - OTHER INFORMATION

HMIS RATINGS: HEALTH: 0; FLAMMABILITY: 1; REACTIVITY: 0; PROTECTION: F

The information contained herein is to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, Tramfloc, Inc. makes no guarantee for results obtained, and assumes no responsibility for damages incurred by use of this product. It is the responsibility of the user to comply with all federal, state, and local laws and regulations.

SAFETY DATA SHEET

CARBON SALES INC.

1. Product and Company Identification

Product identifier **Anthracite Coal**

Other means of identification Not available

Recommended use Water Treatment Filter Media

Recommended restrictions None known.

Manufacturer

Carbon Sales, Inc.
375 Johnson Street
Wilkes Barre Twp., PA 18702 USA
Phone 1- 800-233-8355
Emergency Phone: 1-800-233-8355

2. Hazards Identification

Physical hazards Not classified.

Health hazards Specific target organ toxicity, repeated exposure Category 2

Environmental hazards Not classified.

OSHA defined hazards Combustible dust

Label elements



Signal word Warning

Hazard statement May form combustible dust concentrations in air.
May cause damage to organs through prolonged or repeated exposure.

Precautionary statement

Prevention Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Do not breathe dust. Prevent dust accumulation to minimize explosion hazard.

Response Get medical advice/attention if you feel unwell.

Storage Store away from incompatible materials.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information Not applicable.

3. Composition/Information on Ingredients

Mixture

Chemical name	Common name and synonyms	CAS number	%
Coal, anthracite		8029-10-5	60-100

Composition comments US GHS: The exact percentage (concentration) of composition has been withheld as a trade secret in accordance with paragraph (i) of §1910.1200.

4. First Aid Measures

Inhalation If dust from the material is inhaled, remove the affected person immediately to fresh air. Call a physician if symptoms develop or persist.

Skin contact Brush away excess of dry material. Flush with cool water. Wash with soap and water. Obtain medical attention if irritation persists.

Eye contact Do not rub eyes. Rinse with water. Get medical attention if irritation develops and persists. Flush with cool water. Remove contact lenses, if applicable, and continue flushing. Obtain medical attention if irritation persists.

Ingestion Do not induce vomiting. Never give anything by mouth if victim is unconscious, or is convulsing. Obtain medical attention.

Most important symptoms/effects, acute and delayed	Dusts may irritate the respiratory tract, skin and eyes. Prolonged exposure may cause chronic effects.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. If you feel unwell, seek medical advice (show the label where possible). Show this safety data sheet to the doctor in attendance. Avoid contact with eyes and skin. Keep out of reach of children.

5. Fire Fighting Measures

Suitable extinguishing media	Dry chemical, CO_2, water spray or regular foam. Apply extinguishing media carefully to avoid creating airborne dust.
Unsuitable extinguishing media	None known.
Specific hazards arising from the chemical	Explosion hazard: Avoid generating dust; fine dust dispersed in air in sufficient concentrations and in the presence of an ignition source is a potential dust explosion hazard. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Firefighters should wear full protective clothing including self contained breathing apparatus.
Fire-fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. In the event of fire, cool tanks with water spray. Move containers from fire area if you can do so without risk.
Specific methods	Cool containers exposed to flames with water until well after the fire is out.
General fire hazards	May form combustible dust concentrations in air.
Hazardous combustion products	May include and are not limited to: Oxides of carbon. Oxides of nitrogen. Oxides of sulfur.
Explosion data	
Sensitivity to mechanical impact	Not available.
Sensitivity to static discharge	Not available.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep out of low areas. Keep people away from and upwind of spill/leak. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Use only non-sparking tools. Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Avoid inhalation of dust from the spilled material. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Take precautionary measures against static discharge. Use only non-sparking tools. Large Spills: If sweeping of a contaminated area is necessary use a dust suppressant agent which does not react with the product. Collect dust using a vacuum cleaner equipped with HEPA filter. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Minimize dust generation and accumulation. Prevent entry into waterways, sewer, basements or confined areas. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground. Prevent entry into waterways, sewers, basements or confined areas.

7. Handling and Storage

Precautions for safe handling	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Combustible dust clouds may be created where operations produce fine material (dust). Avoid significant deposits of material, especially on horizontal surfaces, which may become airborne and form combustible dust clouds and may contribute to secondary explosions. Minimize dust generation and accumulation. Handling and processing operations should be conducted in accordance with 'best practices' (e.g. NFPA-654). Provide appropriate exhaust ventilation at places where dust is formed. Use only with adequate ventilation. Avoid contact with skin and eyes. In case of insufficient ventilation, wear suitable respiratory equipment. Wear appropriate personal protective equipment. Observe good industrial hygiene practices. Practice good housekeeping. Wash thoroughly after handling.
Conditions for safe storage, including any incompatibilities	Keep away from heat, sparks and open flame. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres. Keep containers tightly closed in a dry, cool and well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS). Guard against dust accumulation of this material. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Keep out of reach of children.

8. Exposure Controls/Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Ventilation should be sufficient to effectively remove and prevent buildup of any dusts or fumes that may be generated during handling or thermal processing. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen-deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Rubber gloves. Confirm with a reputable supplier first.
Other	Wear suitable protective clothing. As required by employer code.
Respiratory protection	Where exposure guideline levels may be exceeded, use an approved NIOSH respirator. Wear respirator with dust filter.
Thermal hazards	Not applicable.
General hygiene considerations	When using, do not eat, drink or smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance	Particles
Physical state	Solid.
Form	Powder.
Color	Black
Odor	Odorless
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Pour point	Not available.
Specific gravity	1.6 (water = 1)
Partition coefficient (n-octanol/water)	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	Insoluble
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.

10. Stability and Reactivity

Reactivity	None known.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Chemical stability	Stable under recommended storage conditions.
Conditions to avoid	Keep away from heat, sparks and open flame. Do not mix with other chemicals. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Minimize dust generation and accumulation.
Incompatible materials	Oxidizers.
Hazardous decomposition products	May include and are not limited to: Oxides of carbon. Oxides of nitrogen. Oxides of sulfur.

11. Toxicological Information

Routes of exposure	Eye, Skin contact, Inhalation, Ingestion.

Information on likely routes of exposure

Ingestion	Expected to be a low ingestion hazard.
Inhalation	May cause damage to organs by inhalation. Excessive, long-term exposure by inhalation to coal dust may lead to a condition called workers' pneumoconiosis (or "Black Lung"). This condition may be characterized by cough, shortness of breath, reduction in pulmonary function, pulmonary hypertension, bronchitis, emphysema and premature death.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Dust in the eyes will cause irritation.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity

Components	Species	Test Results
Coal, anthracite (CAS 8029-10-5)		
Acute		
Inhalation		
LC50	Not available	
Oral		
LD50	Not available	

Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Exposure minutes	Not available.
Erythema value	Not available.
Oedema value	Not available.
Serious eye damage/eye irritation	Dust in the eyes will cause irritation.
Corneal opacity value	Not available.

Iris lesion value	Not available.
Conjunctival reddening value	Not available.
Conjunctival oedema value	Not available.
Recover days	Not available.
Respiratory or skin sensitization	
Respiratory sensitization	Not available.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	Non-hazardous by WHMIS/OSHA criteria.
Mutagenicity	Non-hazardous by WHMIS/OSHA criteria.
Carcinogenicity	See below.
Reproductive toxicity	Non-hazardous by WHMIS/OSHA criteria.
Teratogenicity	Non-hazardous by WHMIS/OSHA criteria.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	May cause damage to organs through prolonged or repeated exposure.
Aspiration hazard	Not available.
Chronic effects	Prolonged or repeated exposure may cause lung injury. May cause damage to organs through prolonged or repeated exposure.
Further information	Not available.
Name of Toxicologically Synergistic Products	Not available.

12. Ecological Information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Mobility in general	Not available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal Considerations

Disposal instructions	Review federal, state/provincial, and local government requirements prior to disposal. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport Information

General	Canada: TDG Proof of Classification: In accordance with Part 2.2.1 (SOR/2014-152) of the Transportation of Dangerous Goods Regulations, we certify that the classification of this product is correct as of the SDS date of issue. If applicable, the technical name and the classification of the product will appear below.

U.S. Department of Transportation (DOT)

Not regulated as dangerous goods.

Transportation of Dangerous Goods (TDG - Canada)

Not regulated as dangerous goods.

15. Regulatory Information

Canadian federal regulations This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.

WHMIS status Controlled

WHMIS classification Class D - Division 2B

WHMIS labeling



US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance Yes

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Safe Drinking Water Act (SDWA) Not regulated.

Food and Drug Administration (FDA) Not regulated.

US state regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

US - Texas Effects Screening Levels: Listed substance

Coal, anthracite (CAS 8029-10-5) Listed.

US. Massachusetts RTK - Substance List

Not regulated.

US. Pennsylvania RTK - Hazardous Substances

Not regulated.

US. Rhode Island RTK

Not regulated.

Inventory status

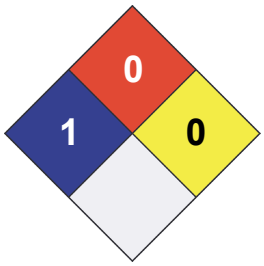
Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information

LEGEND	
Severe	4
Serious	3
Moderate	2
Slight	1
Minimal	0





Disclaimer

The data contained in this material safety data sheet was obtained from sources that were technically accurate, reliable, and state of the art when this document was prepared. If data was unavailable to complete certain sections, the absence of that data is identified in this document. Because the supplier cannot know the exact circumstances during actual use of this product, other hazards, exposure scenarios, disposal considerations, and regulations may apply and it is the responsibility of the user to read and understand the product label and this document before use. Do not use the product for purposes other than those stated in Section 1.

Issue date

07-April-2015

Effective date

07-April-2015

Expiry date

07-April-2018

Further information

Refer to NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for safe handling. For an updated SDS, please contact the supplier/manufacturer listed on the first page of the document.

Prepared by

Carbon Sales, Inc. 1-800-233-8355

Other information

This Safety Data Sheet was prepared to comply with the current OSHA Hazard Communication Standard (HCS) adoption of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).
This SDS conforms to the ANSI Z400.1/Z129.1-2010 Standard.

SECTION 1. IDENTIFICATION

Product identifier

Trade name : Drewfloc™ 2410
polymer
™ Trademark, Solenis or its subsidiaries or affiliates, registered in various countries

Recommended use of the chemical and restrictions on use

Details of the supplier of the safety data sheet	**Emergency telephone number**
Solenis LLC 500 Hercules Road Wilmington, Delaware 19808 United States of America (USA) RegulatoryRequestsNA@solenis.com	1-844-SOLENIS (844-765-3647) **Product Information** Contact your local Solenis representative

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200

Serious eye damage : Category 1

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : H318 Causes serious eye damage.

Precautionary statements :

Prevention:

P280 Wear eye protection/ face protection.

Response:

P305 + P351 + P338 + P310 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/doctor.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Components

Chemical name	CAS-No.	Classification	Concentration (%)
ALIPHATIC HYDROCARBON	Trade Secret	Flam. Liq. 4; H227 Asp. Tox. 1; H304	>= 20 - < 30
ALCOHOL ALKOXYLATES	Trade Secret	Acute Tox. 4; H302 Eye Dam. 1; H318	>= 1.5 - < 5

Actual concentration is withheld as a trade secret

SECTION 4. FIRST AID MEASURES

General advice : Move out of dangerous area.
Consult a physician.
Show this safety data sheet to the doctor in attendance.
Do not leave the victim unattended.

If inhaled : If breathed in, move person into fresh air.
If unconscious, place in recovery position and seek medical advice.
If symptoms persist, call a physician.

In case of skin contact : First aid is not normally required. However, it is recommended that exposed areas be cleaned by washing with soap and water.

In case of eye contact : In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Continue rinsing eyes during transport to hospital.
Remove contact lenses.
Protect unharmed eye.

If swallowed : Obtain medical attention.
Do NOT induce vomiting.
Do not give milk or alcoholic beverages.
Never give anything by mouth to an unconscious person.
If symptoms persist, call a physician.

Most important symptoms and effects, both acute and delayed : Causes serious eye damage.
Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include:
stomach or intestinal upset (nausea, vomiting, diarrhea)
irritation (nose, throat, airways)
Lung irritation
confusion

irregular heartbeat
Convulsions
Inhalation of high concentrations of this material, as could occur in enclosed spaces or during deliberate abuse, may be associated with cardiac arrhythmias. Sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to this material.
This material is an aspiration hazard. Potential danger from aspiration must be weighed against possible oral toxicity when deciding whether to induce vomiting.

Notes to physician : No hazards which require special first aid measures.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Water spray
Foam
Carbon dioxide (CO2)
Dry chemical

Unsuitable extinguishing media : High volume water jet

Specific hazards during firefighting : Do not allow run-off from fire fighting to enter drains or water courses.

Hazardous combustion products : Carbon monoxide
Carbon dioxide (CO2)
Nitrogen oxides (NOx)
Hydrocarbons

Specific extinguishing methods : Product is compatible with standard fire-fighting agents.

Further information : Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Use personal protective equipment.
Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed.
Comply with all applicable federal, state, and local regulations.

Environmental precautions : Prevent product from entering drains.
Prevent further leakage or spillage if safe to do so.

If the product contaminates rivers and lakes or drains inform respective authorities.

Methods and materials for containment and cleaning up : Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).
Keep in suitable, closed containers for disposal.

SECTION 7. HANDLING AND STORAGE

Advice on protection against fire and explosion : Normal measures for preventive fire protection.

Advice on safe handling : Do not breathe vapours/dust.
Container hazardous when empty.
Avoid contact with skin and eyes.
Smoking, eating and drinking should be prohibited in the application area.
For personal protection see section 8.
Dispose of rinse water in accordance with local and national regulations.

Conditions for safe storage : Keep container tightly closed in a dry and well-ventilated place.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Electrical installations / working materials must comply with the technological safety standards.

Further information on storage stability : No decomposition if stored and applied as directed.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
ALIPHATIC HYDROCARBON	Trade Secret	TWA (Mist)	5 mg/m3	OSHA Z-1
		TWA	200 mg/m3 (total hydrocarbon vapor)	ACGIH
		TWA (Mist)	5 mg/m3	OSHA P0
		TWA (Mist)	5 mg/m3	NIOSH REL
		ST (Mist)	10 mg/m3	NIOSH REL

Engineering measures : Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below exposure guidelines (if applicable) or below levels that cause known, suspected or apparent adverse effects.

Personal protective equipment

Hand protection

Remarks	:	The suitability for a specific workplace should be discussed with the producers of the protective gloves.
Eye protection	:	Safety glasses
Skin and body protection	:	Wear resistant gloves (consult your safety equipment supplier). Wear as appropriate: Impervious clothing Safety shoes Choose body protection according to the amount and concentration of the dangerous substance at the work place.
Hygiene measures	:	Wash hands before breaks and at the end of workday. When using do not eat or drink. When using do not smoke.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	yellow
Odour	:	No data available
Odour Threshold	:	No data available
pH	:	No data available
Melting point/freezing point	:	No data available
Initial boiling point and boiling range	:	217 °F / 103 °C
Flash point	:	> 212 °F / > 100 °C
Evaporation rate	:	No data available
Flammability (solid, gas)	:	No data available
Self-ignition	:	No data available
Upper explosion limit / Upper flammability limit	:	No data available

Lower explosion limit / Lower flammability limit	:	No data available
Vapour pressure	:	No data available
Relative vapour density	:	No data available
Relative density	:	No data available
Density	:	1.03 g/cm3 (77 °F / 25 °C)
Bulk density	:	1.03 g/cm3 (68 °F / 20 °C)
Solubility(ies)		
Water solubility	:	No data available
Solubility in other solvents	:	No data available
Partition coefficient: n-octanol/water	:	No data available
Decomposition temperature	:	No data available
Viscosity		
Viscosity, dynamic	:	< 4,000 mPa.s (68 °F / 20 °C)
		> 7 mPa.s (104 °F / 40 °C)
Viscosity, kinematic	:	> 21 mm2/s (104 °F / 40 °C)
Oxidizing properties	:	No data available

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	No decomposition if stored and applied as directed.
Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	Product will not undergo hazardous polymerization.
Conditions to avoid	:	Heat, flames and sparks.
Incompatible materials	:	Strong oxidizing agents strong reducing agents
Hazardous decomposition products	:	Carbon monoxide Carbon dioxide (CO2) Nitrogen oxides (NOx) Hydrocarbons

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Not classified based on available information.

Components:

ALIPHATIC HYDROCARBON:

Acute oral toxicity	:	LD 50 (Rat): > 5,000 mg/kg
Acute inhalation toxicity	:	LC 50 (Rat, male and female): > 5.28 mg/l Exposure time: 4 h Test atmosphere: vapour Method: OECD Test Guideline 403 Assessment: No adverse effect has been observed in acute inhalation toxicity tests.
Acute dermal toxicity	:	LD 50 (Rabbit): > 2,000 mg/kg Assessment: No adverse effect has been observed in acute dermal toxicity tests.

ALCOHOL ALKOXYLATES:

Acute oral toxicity	:	LD 50 (Rat): 1,380 mg/kg

Skin corrosion/irritation

Not classified based on available information.

Components:

ALIPHATIC HYDROCARBON:

Result	:	Mildly irritating to skin

ALCOHOL ALKOXYLATES:

Result	:	Not irritating to skin

Serious eye damage/eye irritation

Causes serious eye damage.

Product:

Remarks	:	May cause irreversible eye damage.

Components:

ALIPHATIC HYDROCARBON:

Result	:	Mildly irritating to eyes

ALCOHOL ALKOXYLATES:

Result : Risk of serious damage to eyes.

Respiratory or skin sensitisation

Skin sensitisation

Not classified based on available information.

Respiratory sensitisation

Not classified based on available information.

Germ cell mutagenicity

Not classified based on available information.

Carcinogenicity

Not classified based on available information.

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

NTP No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Not classified based on available information.

STOT - single exposure

Not classified based on available information.

STOT - repeated exposure

Not classified based on available information.

Aspiration toxicity

Not classified based on available information.

Components:

ALIPHATIC HYDROCARBON:

The substance or mixture is known to cause human aspiration toxicity hazards or has to be regarded as if it causes a human aspiration toxicity hazard.

Further information

Product:

Remarks : No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish : LC 50 (Pimephales promelas (fathead minnow)): 14.72 mg/l
Exposure time: 96 h
Test Type: static test
Test substance: Test conducted with a similar formulation
Method: OECD Test Guideline 203
GLP: no

LC 50 (Leuciscus idus (Golden orfe)): 17.32 mg/l
Exposure time: 96 h
Test Type: static test
Test substance: Test conducted with a similar formulation
Method: OECD Test Guideline 203
GLP: no

Toxicity to daphnia and other aquatic invertebrates : EC 50 (Daphnia magna (Water flea)): 0.58 mg/l
Exposure time: 48 h
Test Type: static test
Test substance: Test conducted with a similar formulation
Method: OECD Test Guideline 202
GLP: no

Ecotoxicology Assessment

Acute aquatic toxicity : Acute aquatic toxicity Category 1; Very toxic to aquatic life.

Chronic aquatic toxicity : Not classified based on available information.

Components:

ALIPHATIC HYDROCARBON:

Ecotoxicology Assessment

Acute aquatic toxicity : No toxicity at the limit of solubility

Chronic aquatic toxicity : No toxicity at the limit of solubility

ALCOHOL ALKOXYLATES:

Toxicity to fish : LC50 (Fish): > 1 - 10 mg/l
Exposure time: 96 h
Test Type: static test

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia (water flea)): > 1 - 10 mg/l
Exposure time: 48 h
Test Type: static test

Toxicity to daphnia and other : EC50 (Daphnia (water flea)): 0.17 mg/l

aquatic invertebrates (Chronic toxicity)		Exposure time: 21 d

Ecotoxicology Assessment

Chronic aquatic toxicity	:	Harmful to aquatic life with long lasting effects.

Persistence and degradability

Components:

ALCOHOL ALKOXYLATES:

Biodegradability	:	Result: Readily biodegradable.

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

Product:

Additional ecological information	:	An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Do not contaminate ponds, waterways or ditches with chemical or used container. Send to a licensed waste management company. Dispose of in accordance with all applicable local, state and federal regulations.
Contaminated packaging	:	Empty remaining contents. Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

National Regulations

49 CFR
Not regulated as a dangerous good

Special precautions for user
The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

SARA 304 Extremely Hazardous Substances Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
ACRYLAMIDE	79-06-1	5000	*

*: Calculated RQ exceeds reasonably attainable upper limit.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Serious eye damage or eye irritation

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

The components of this product are reported in the following inventories:

DSL : This product contains one or more components that are not on the Canadian DSL and have annual quantity limits.

AICS : On the inventory, or in compliance with the inventory

ENCS : Not in compliance with the inventory

KECI : On the inventory, or in compliance with the inventory

PICCS : On the inventory, or in compliance with the inventory

IECSC : On the inventory, or in compliance with the inventory

TCSI	:	On the inventory, or in compliance with the inventory
TSCA	:	All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16. OTHER INFORMATION

Further information

Revision Date	:	01/28/2020

Full text of H-Statements

H227	:	Combustible liquid.
H302	:	Harmful if swallowed.
H304	:	May be fatal if swallowed and enters airways.
H318	:	Causes serious eye damage.

Full text of other abbreviations

Acute Tox.	:	Acute toxicity
Asp. Tox.	:	Aspiration hazard
Eye Dam.	:	Serious eye damage
Flam. Liq.	:	Flammable liquids
ACGIH	:	USA. ACGIH Threshold Limit Values (TLV)
NIOSH REL	:	USA. NIOSH Recommended Exposure Limits
OSHA P0	:	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
OSHA Z-1	:	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
ACGIH / TWA	:	8-hour, time-weighted average
NIOSH REL / TWA	:	Time-weighted average concentration for up to a 10-hour workday during a 40-hour workweek
NIOSH REL / ST	:	STEL - 15-minute TWA exposure that should not be exceeded at any time during a workday
OSHA P0 / TWA	:	8-hour time weighted average
OSHA Z-1 / TWA	:	8-hour time weighted average

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous

Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Sources of key data used to compile the Safety Data Sheet
Key literature references and sources of data
SOLENIS Internal data
SOLENIS internal data including own and sponsored test reports
The UNECE administers regional agreements implementing harmonised classification for labelling (GHS) and transport.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. This SDS has been prepared by the Solenis Environmental Health and Safety Department.

US / EN

1300 129 990

Safety Data Sheet : Garnet Abrasive

Issue Date: 18th August, 2014

Section 1 - IDENTIFICATION: PRODUCT IDENTIFIER AND CHEMICAL IDENTITY

Product Name: **GARNET**

Recommended Use of the Chemical and Restriction on Use:
Blast cleaning abrasive, water jet cutting abrasive, water filtration, aggregate and surface preparation.

Details of Manufacturer or Importer:

Abrasive Media Supplies
Unit 6 12 Daintree Drive
Redland Bay QLD 4165

Phone Number: 1300 129 990

Emergency telephone number: 0411 591 001

Section 2 – HAZARDOUS IDENTIFICATION

Hazardous Nature:



Health hazard

STOT RE 2 H373 May cause damage to organs through prolonged or repeated exposure.

Label Elements

Signal Word Warning

Hazard Statements H373 May cause damage to organs through prolonged or repeated exposure.

Precautionary Statements
P260 Do not breathe dust/fume/gas/mist/vapours/spray. P314 Get medical advice/attention if you feel unwell. P501 Dispose of contents/container in accordance with local/regional/national regulations.

Additional Information
The product as supplied contains traces of quartz (crystalline silica) which when used as an abrasive can break down to respirable dust size (particles small enough to go into deep parts of the lung when breathed in). Respirable crystalline silica is a listed carcinogenic substance which may cause silicosis and cancer. The product is dominantly garnet (hard rock Almandine variety), a non-hazardous substance. Traces of dust in the unused product is from calcium carbonate which is also non-dangerous and non-hazardous.

Section 3 – COMPOSITION AND INFORMATION ON INGREDIENTS

Chemical Characterization: Mixtures
Description:

This material is a natural mixture of almandine garnet with the chemical composition or formula of $(Fe_{2+}Mg)_3\,Al_2(SiO_4)_3$ and other trace minerals as per CAS No. for Almandine garnet 1302-62-1.

Hazardous Components:		
1302-62-1	Almandine Garnet (Fe^{2+}Mg) Al (SiO)	>95%
103170-28-1	Ilmenite (Fe^{2+}TiO), reaction products with carbon monoxide	<2%
471-34-1	Carbonic acid, calcium salt (1:1)	<1.5%
149040-68-2	Zircon (ZrSiO4)	<0.2%
14808-60-7	Quartz (SiO)	<0.5%

Additional information:

Typical Chemical Composition:
Silica (SiO_2): 34-38%
Iron (Fe_2O_3+FeO): 25-30%
Alumina (Al_2O_3): 18-22%
Magnesium (MgO): 4-6%
Calcium (CaO): 1-9%
Manganese Dioxide (MnO): 1-2%
Titanium Oxide (TiO_2): 1-2%

Section 4 – FIRST AID MEASURES

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Seek medical attention if breathing problems develop.

Skin Contact:
In case of skin contact, immediately wash affected areas with mild soap and lukewarm water. Seek medical attention if symptoms occur.

Eye Contact:
In case of eye contact, hold eyelids open and rinse with lukewarm water for at least 15 minutes to flush out particles, moving the eyelids by occasionally lifting the upper and lower lids. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention if symptoms persist.

Ingestion:
If swallowed, immediately rinse mouth and drink some water. Never give anything by mouth to an unconscious person. Seek medical attention if symptoms occur.

Information for Doctor

Symptoms Caused by Exposure:
Inhalation: May cause throat and lung irritation, coughing or shortness of breath.
Eye contact: May cause eye irritation resulting in redness, watering or/and an infection.

Section 5 – FIRE FIGHTING MEASURES

Suitable Extinguishing Media:
Use fi re extinguishing methods suitable to surrounding conditions.

Specific Hazards Arising from the Chemical:
This material is non-flammable and does not support combustion. Ensure adequate ventilation to prevent dust explosions.

Special Protective Equipment and Precautions for Fire Fighters:
Wear Safe Work Australia approved self-contained breathing apparatus and full protective clothing.

Section 6 – ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures:
Wear Safe Work Australia approved dust/particulate filter respirator and full protective clothing. Evacuate all non-essential personnel from affected area. Do not breathe dust. Ensure adequate ventilation. Avoid generating dust.

Environmental Precautions:
In the event of a major spill, prevent spillage from entering drains or water courses.

Methods and Materials for Containment and Cleaning Up:
Stop leak if safe to do so. Cover the material with a tarpaulin and secure to the ground in order to protect against dust emissions and gravitational flows into waterways. Clean up the spilled material immediately once the site is secured, avoiding generating dust. Use vacuum equipment with HEPA filters or wet sweeping/dust suppressant if sweeping is required. Collect in suitable, closed containers for subsequent disposal.

Section 7 – HANDLING AND STORAGE

Precautions for Safe Handling:
Use of safe work practices are recommended to avoid eye or skin contact and inhalation of dust. Food, beverages and tobacco products should not be stored or consumed where this material is in use. Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use. Provide eyewash fountains and safety showers in close proximity to points of potential exposure.
Conditions for Safe Storage:
Store in a cool, dry and well-ventilated area. Keep container tightly closed to prevent dust exposure. Do not store near a heat source. Avoid dust generation. Regularly vacuum enclosed areas where the product is used or install a dust extraction system.

Section 8 – EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Standards:	
471-34-1 Carbonic acid, calcium salt (1:1)	
NES	TWA: 10mg/m_3
14808-60-7 Quartz (SiO2)	
NES	TWA: 0.1 mg/m_3 respirable dust

Nuisance dust: TWA - 10 mg/m_3 (total dust) TWA - 2 mg/m_3 (respirable dust)
Engineering Controls:
Ensure adequate ventilation of the workplace. Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below the limits. Local exhaust is recommended if dusts are generated.
Personal Protective Equipment (PPE):
Respiratory Protection:
Where an inhalation risk exists, wear a Class P1 (particulate) respirator. At high dust levels, wear a powered air purifying respirator (PAPR) with Class P3 (Particulate) filter or an air-line respirator or a full-face Class P3 (particulate) respirator. Industrial abrasive blasting operations should use an AS 175 approved air fed abrasive blasting hood, such as a NOVA 2000. See Australian/New Zealand Standards AS/NZS 1715 and 1716 for more information.
Hearing protection should also be worn when using this material for blasting.
Skin Protection:
Leather/pigskin, rubber, neoprene or nitrile gloves. See Australian/New Zealand Standard AS/NZS 2161 for more information. When selecting hand protection, the product should comply with relevant performance criteria. For example, gloves should meet a suitable level of abrasion resistance to provide protection against hazards of a workplace. Occupational protective clothing, e.g. full-length protective trousers and shirts, heavy duty protective suit and safety boots (depending on conditions in which it has to be used, in particular as regards the period for which it is worn, which shall be determined on the basis of the seriousness of the risk, the frequency of exposure to the risk, the characteristics of the workstation of each worker and the performance of the protective clothing). See Australian/New Zealand Standard AS/NZS 4501 for more information.
Eye and Face Protection:
Eye and face protectors for protection against dust. Low impact goggles with indirect ventilation (HT or CT with C, D optional) are typically most appropriate and commonly used for this material. See Australian/New Zealand Standard AS/NZS 1337 for more information.

Section 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	
Form:	Granular and solid (free flowing sand/rough grit)
Colour:	Reddish brown to pink
Odour:	Odourless
Odour Threshold:	No information available
pH-Value:	7 (Neutral)
Melting point/Melting range:	1250-1315 °C
Initial Boiling Point/Boiling Range:	Not applicable
Flash Point:	Not applicable
Flammability:	Product is not flammable
Auto-ignition Temperature:	No information available
Decomposition Temperature:	No information available
Explosion Limits:	
Lower:	Not applicable
Upper:	Not applicable
Vapour Pressure:	Not applicable
Bulk Density:	1.9-2.4 g/cm$_3$
Relative Density:	3.8-4.2 g/cm$_3$ (water=1)
Vapour Density:	Not applicable
Evaporation Rate:	Not applicable
Solubility in Water:	Insoluble
Solubility in Acid:	Less than 1%

Additional Information:

Particle Size Range:	0.05mm-5mm
Particle Shape:	Sub-rounded to Angular
Free Flow:	>90%
Moisture:	<0.2%
Hardness:	7.5-8.0 Mohs
Reactivity:	Inert
Radioactivity:	Non detectable above background levels
Conductivity:	Less than 25ms/m
Corrosiveness:	Non corrosive
Cleanness:	Sa 2.5
Roughness:	<75
Mean Refractive Index:	1.77-1.79

Section 10 – STABILITY AND REACTIVITY

Possibility of Hazardous Reactions: Hazardous polymerisation will not occur.
Chemical Stability: Stable at ambient temperature and under normal conditions of use.
Conditions to Avoid: None known.
Incompatible Materials: None known.
Hazardous Decomposition Products: Not applicable.

Section 11 – TOXICOLOGICAL INFORMATION

Toxicity:

LD_{50}/LC_{50} Values Relevant for Classification:		
471-34-1 Carbonic acid, calcium salt (1:1)		
Oral	LD_{50}	6450 mg/kg (rat)

Acute Health Effects
Inhalation: May cause throat and lung irritation, coughing or shortness of breath.
Skin: May cause skin irritation.
Eye: May cause eye irritation resulting in redness, watering or/and an infection.
Ingestion: Ingestion is unlikely through normal use, however, swallowing any amount of this product may cause immediate or delayed abdominal discomfort due to abrasion.
Skin Corrosion / Irritation: Based on classification principles, the classification criteria are not met.
Serious Eye Damage / Irritation: Based on classification principles, the classification criteria are not met.
Respiratory or Skin Sensitisation: No sensitising effects known.
Germ Cell Mutagenicity: Based on classification principles, the classification criteria are not met.
Carcinogenicity:
Silica dust, crystalline, in the form of quartz or cristobalite is classified by IARC as Group 1 - Carcinogenic to humans.
Reproductive Toxicity: Based on classification principles, the classification criteria are not met.
Specific Target Organ Toxicity (STOT) - Single Exposure:
Based on classification principles, the classification criteria are not met.
Specific Target Organ Toxicity (STOT) - Repeated Exposure:
Causes damage to organs through prolonged or repeated exposure.
Aspiration Hazard: Based on classification principles, the classification criteria are not met.
Chronic Health Effects:
Prolonged inhalation of crystalline silica may result in silicosis, a disabling pulmonary fibrosis characterized by fibrotic changes and miliary nodules in the lungs, a dry cough, shortness of breath, emphysema, decreased chest expansion, and increased susceptibility to tuberculosis. In advanced stages, loss of appetite, pleuritic pain, and total incapacity to work. Advanced silicosis may result in death due to cardiac failure or destruction of lung tissue.
Existing Conditions Aggravated by Exposure:
Chronic respiratory, bronchitis, emphysema and other lung diseases may be aggravated by exposure to nuisance dust.

Section 12 – ECOLOGICAL INFORMATION

Ecotoxicity:
This material is a naturally occurring mineral with no known ecotoxicity. It is insoluble in water and unlikely to contaminate waterways or food chains.
Aquatic toxicity: No information available
Persistence and Degradability: No information available
Bio accumulative Potential: No information available
Mobility in Soil: No information available

Section 13 – DISPOSAL CONSIDERATIONS

Disposal Methods and Containers: Dispose according to applicable local and state government regulations.
Special Precautions for Landfill or Incineration:
Please consult your state Land Waste Management Authority for more information.

Section 14 – TRANSPORT INFORMATION

UN Number	Not regulated
Proper Shipping Name	Not regulated
Dangerous Goods Class	Not regulated
Packing Group	Not regulated

Section 15 – REGULATORY INFORMATION

Australian inventory of Chemical Substances:	
103170-28-1	Ilmenite ($Fe_{2+}TiO_3$), reaction products with carbon monoxide
471-34-1	Carbonic acid, calcium salt (1:1)
14808-60-7	Quartz (SiO_2)

Section 16 – OTHER INFORMATION

Creation Date: 18.08.2014
Prepared by: MSDS.COM.AU Pty Ltd www.msds.com.au
Abbreviations and acronyms:
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
IARC: International Agency for Research on Cancer
STEL: Short Term Exposure Limit
TWA: Time Weighted Average
NES: National Exposure Standard (Safe Work Australia - Workplace Exposure Standards For Airborne Contaminants)

Disclaimer

This MSDS is prepared in accord with the Safe Work Australia document "Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals - December 2011". The information contained in this material safety data sheet is provided in good faith and is believed to be accurate at the date of issuance. Abrasive Media Supplies makes no representation of the accuracy or comprehensiveness of the information and to the full extent allowed by law excludes all liability for any loss or damage related to the supply or use of the information in this material safety data sheet. MSDS.COM.AU Pty Ltd is not in a position to warrant the accuracy of the data herein. The user is cautioned to make their own determinations as to the suitability of the information provided to the particular circumstances in which the product is used.

Methyl Isobutyl Carbinol

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations
Issue date: 8/29/2022 Revision date: 8/29/2022 Supersedes: 5/7/2021 Version: 1.1

SECTION 1: Identification

1.1. Identification

Product form	:	Substance
Trade name	:	Methyl Isobutyl Carbinol
Chemical name	:	Methyl Isobutyl Carbinol
CAS-No.	:	108-11-2
Product code	:	HP-040788-FP
Formula	:	C6H14O
Synonyms	:	2-Methyl-4-pentanol / Pentan-2-ol, 4-methyl- / 4-Pentanol, 2-methyl- / 4-Methyl-2-pentanol / 4-Methylpentan-2-ol / 1,3-Dimethyl-1-butanol / MIBC / Methylisobutylcarbinol / 4-Methyl-2-amyl alcohol / Methyl isobutyl carbinol / Methyl(2-methylpropyl)carbinol / 4-METHYLPENTAN-2-OL / Methyl amyl alcohol

1.2. Recommended use and restrictions on use

Use of the substance/mixture	:	Solvent, organic synthesis, brake fluids
Use of the substance/mixture	:	Solvent

1.3. Supplier

Monument Chemical
16717 Jacintoport Blvd.
Houston, TX, 77015
USA
T 832-376-2000
sds@monumentchemical.com - www.monumentchemical.com

1.4. Emergency telephone number

Emergency number	:	24 HR CHEMTREC: 1-800-424-9300 (International +1 703-741-5970); 24 HR Emergency Assistance: 1-832-376-2026

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

GHS US classification

Flammable liquids Category 3	H226	Flammable liquid and vapor
Serious eye damage/eye irritation Category 2A	H319	Causes serious eye irritation
Specific target organ toxicity – Single exposure, Category 3, Respiratory tract irritation	H335	May cause respiratory irritation

Full text of H statements : see section 16

2.2. GHS Label elements, including precautionary statements

GHS US labeling

Hazard pictograms (GHS US) :



Signal word (GHS US) : Warning

Hazard statements (GHS US) : H226 - Flammable liquid and vapor
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation

Precautionary statements (GHS US) : P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233 - Keep container tightly closed.
P240 - Ground/Bond container and receiving equipment.
P241 - Use explosion-proof electrical, lighting, ventilating equipment.
P242 - Use only non-sparking tools.
P243 - Take precautionary measures against static discharge.
P261 - Avoid breathing dust, fume, gas, mist, spray, vapors.
P264 - Wash hands, forearms and face thoroughly after handling.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear eye protection, protective clothing, protective gloves.
P303+P361+P353 - If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a doctor, a POISON CENTER if you feel unwell.
P337+P313 - If eye irritation persists: Get medical advice/attention.
P370+P378 - In case of fire: Use alcohol resistant foam, carbon dioxide (CO2), dry extinguishing powder, Water spray to extinguish.
P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
P403+P235 - Store in a well-ventilated place. Keep cool.
P405 - Store locked up.
P501 - Dispose of contents/container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation.

2.3. Other hazards which do not result in classification

No additional information available

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/Information on ingredients

3.1. Substances

Substance type : Mono-constituent

Name	Product identifier	%
Methyl Isobutyl Carbinol	CAS-No.: 108-11-2	≥ 99

Full text of hazard classes and H-statements : see section 16

3.2. Mixtures

Not applicable

SECTION 4: First-aid measures

4.1. Description of first aid measures

First-aid measures general : Call a poison center/doctor/physician if you feel unwell. Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation	:	Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor/physician if you feel unwell. Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
First-aid measures after skin contact	:	Rinse skin with water/shower. Remove/Take off immediately all contaminated clothing.
First-aid measures after eye contact	:	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. If eye irritation persists: Consult an eye specialist. Get medical advice/attention.
First-aid measures after ingestion	:	Call a poison center/doctor/physician if you feel unwell. Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects (acute and delayed)

Potential Adverse human health effects and symptoms	:	Based on available data, the classification criteria are not met.
Symptoms/effects after inhalation	:	May cause respiratory irritation.
Symptoms/effects after skin contact	:	Slight irritation. Red skin. Dry skin. Itching.
Symptoms/effects after eye contact	:	Irritation of the eye tissue. Eye irritation. Causes serious eye irritation.
Symptoms/effects after ingestion	:	Vomiting. Abdominal pain. AFTER INGESTION OF HIGH QUANTITIES: Dizziness. Headache. Disturbances of consciousness.
Chronic symptoms	:	No effects known.

4.3. Immediate medical attention and special treatment, if necessary

Treat symptomatically.

SECTION 5: Fire-fighting measures

5.1. Suitable (and unsuitable) extinguishing media

Suitable extinguishing media	:	Water spray. Dry powder. Foam. Carbon dioxide. Sand.
Unsuitable extinguishing media	:	Do not use a heavy water stream.

5.2. Specific hazards arising from the chemical

Fire hazard	:	Flammable liquid and vapor.
Explosion hazard	:	May form flammable/explosive vapor-air mixture.
Hazardous decomposition products in case of fire	:	Toxic fumes may be released.

5.3. Special protective equipment and precautions for fire-fighters

Firefighting instructions	:	Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.
Protection during firefighting	:	Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing. Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures	:	Remove ignition sources. Use special care to avoid static electric charges. No open flames. No smoking.

6.1.1. For non-emergency personnel

Protective equipment	:	Gloves (EN 374). Protective clothing (EN 14605 or EN 13034). Large spills/in enclosed spaces: self-contained breathing apparatus (EN 136 + EN 137).

Emergency procedures	:	Ventilate spillage area. No open flames, no sparks, and no smoking. Avoid breathing dust/fume/gas/mist/vapors/spray. Avoid contact with skin and eyes. Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment	:	Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection". Equip cleanup crew with proper protection.
Emergency procedures	:	Ventilate area.

6.2. Environmental precautions

Avoid release to the environment. Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment	:	Contain released product, collect/pump into suitable containers. Plug the leak, cut off the supply. Dam up the liquid spill. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills. Heating: dilute combustible gas/vapour with water curtain.
Methods for cleaning up	:	Take up liquid spill into absorbent material. Notify authorities if product enters sewers or public waters. Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.
Other information	:	Dispose of materials or solid residues at an authorized site.

6.4. Reference to other sections

For further information refer to section 13. See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed	:	Handle empty containers with care because residual vapors are flammable.
Precautions for safe handling	:	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Flammable vapors may accumulate in the container. Use explosion-proof equipment. Wear personal protective equipment. Use only outdoors or in a well-ventilated area. Avoid breathing dust/fume/gas/mist/vapors/spray. Avoid contact with skin and eyes. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. No open flames. No smoking.
Hygiene measures	:	Observe normal hygiene standards. Keep container tightly closed. Do not eat, drink or smoke when using this product. Always wash hands after handling the product. Wash hands, forearms and face thoroughly after handling.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures	:	Ground/bond container and receiving equipment. Proper grounding procedures to avoid static electricity should be followed. Use explosion-proof electrical/ventilating/lighting equipment.
Storage conditions	:	Store in a well-ventilated place. Keep cool. Keep container tightly closed. Store locked up. Keep only in the original container in a cool, well ventilated place away from : Heat sources, Ignition sources, Incompatible materials.
Incompatible products	:	Strong bases. Strong acids.
Incompatible materials	:	Sources of ignition. Direct sunlight. Heat sources.
Heat-ignition	:	KEEP SUBSTANCE AWAY FROM: heat sources. ignition sources.
Information on mixed storage	:	KEEP SUBSTANCE AWAY FROM: oxidizing agents. (strong) acids. (strong) bases. amines.
Storage area	:	Ventilation at floor level. Fireproof storeroom. Provide for a tub to collect spills. Provide the tank with earthing. Store at ambient temperature. Meet the legal requirements.
Special rules on packaging	:	SPECIAL REQUIREMENTS: closing. clean. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.

Packaging materials : SUITABLE MATERIAL: steel. stainless steel. carbon steel. aluminium. iron. zinc. polyethylene. glass. tin.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Methyl Isobutyl Carbinol (108-11-2)	
USA - ACGIH - Occupational Exposure Limits	
Local name	Methyl isobutyl carbinol
ACGIH OEL TWA [ppm]	25 ppm [SKIN]
ACGIH OEL STEL [ppm]	40 ppm
Remark (ACGIH)	URT & eye irr; CNS impair
Regulatory reference	ACGIH 2022
USA - OSHA - Occupational Exposure Limits	
Local name	Methyl isobutyl carbinol
OSHA PEL (TWA) [1]	100 mg/m³
OSHA PEL (TWA) [2]	25 ppm [SKIN]
Limit value category (OSHA)	prevent or reduce skin absorption
Regulatory reference (US-OSHA)	OSHA Annotated Table Z-1
USA - IDLH - Occupational Exposure Limits	
IDLH [ppm]	400 ppm
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL (TWA)	100 mg/m³
NIOSH REL TWA [ppm]	25 ppm [SKIN]
NIOSH REL (STEL)	165 mg/m³
NIOSH REL STEL [ppm]	40 ppm
US-NIOSH chemical category	Potential for dermal absorption

8.2. Appropriate engineering controls

Appropriate engineering controls : Ensure good ventilation of the work station.
Environmental exposure controls : Avoid release to the environment.

8.3. Individual protection measures/Personal protective equipment

Personal protective equipment:
Avoid all unnecessary exposure.

Materials for protective clothing:
Good resistance: butyl rubber. Polyvinylchloride (PVC). Neoprene. Nitrile rubber

Hand protection:
Protective gloves. Wear protective gloves.

Eye protection:
Safety glasses. Chemical goggles or safety glasses

Skin and body protection:
Protective clothing

Respiratory protection:
In case of insufficient ventilation, wear suitable respiratory equipment. Wear appropriate mask

Personal protective equipment symbol(s):



Other information:
Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Appearance	:	Clear, colorless liquid.
Color	:	Colorless
Odor	:	mild
Odor threshold	:	No data available
pH	:	No data available
Melting point	:	-90 °C
Freezing point	:	-90 °C ; -130.0 °F
Boiling point	:	132 °C ; 269.6 °F
Critical temperature	:	291 °C
Flash point	:	41 °C ; 105.8 °F closed cup
Relative evaporation rate (butyl acetate=1)	:	0.3
Relative evaporation rate (ether=1)	:	33
Flammability (solid, gas)	:	Not applicable.
Vapor pressure	:	2.8 mm Hg (at 25 °C)
Vapor pressure at 50 °C	:	36 hPa (Antoine equation)
Relative vapor density at 20 °C	:	3.5
Relative density	:	0.82
Relative density of saturated gas/air mixture	:	1
Density	:	807.5 kg/m³ (at 20 °C)
Molecular mass	:	102.2 g/mol
Solubility	:	Moderately soluble in water. Soluble in ethanol. Soluble in ether. Water: 2 g/100ml (at 25 °C)
Partition coefficient n-octanol/water (Log Pow)	:	1.43 (at 25 °C)
Auto-ignition temperature	:	305 °C ; 581 °F
Decomposition temperature	:	No data available
Viscosity, kinematic	:	5.045 mm²/s
Viscosity, dynamic	:	4.074 mPa.s (25 °C)
Explosion limits	:	1 – 5.5 vol % 42 – 235 g/m³ Lower explosion limit: 1 vol % Upper explosion limit: 6 vol %
Explosive properties	:	No data available
Oxidizing properties	:	No data available

9.2. Other information

Specific conductivity : 70000 pS/m
Saturation concentration : 25 g/m³
VOC content : 100 %
Other properties : Gas/vapour heavier than air at 20°C. Clear. Slightly volatile. Neutral reaction. May generate electrostatic charges.

SECTION 10: Stability and reactivity

10.1. Reactivity

Reacts with (some) acids: (increased) risk of fire/explosion. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Flammable liquid and vapor.

10.2. Chemical stability

Stable under normal conditions. Flammable liquid and vapor. May form flammable/explosive vapor-air mixture.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use. Not established.

10.4. Conditions to avoid

Avoid contact with hot surfaces. Heat. No flames, no sparks. Eliminate all sources of ignition. Direct sunlight. Extremely high or low temperatures. Open flame. Overheating. Sparks.

10.5. Incompatible materials

Strong acids. Strong bases.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced. fume. Carbon monoxide. Carbon dioxide. May release flammable gases.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity (oral) : Not classified
Acute toxicity (dermal) : Not classified
Acute toxicity (inhalation) : Not classified

Methyl Isobutyl Carbinol (108-11-2)	
LD50 oral rat	2600 mg/kg
LD50 dermal rabbit	2880 mg/kg
LC50 Inhalation - Rat	> 16 mg/l air Animal: rat, Guideline: OECD Guideline 403 (Acute Inhalation Toxicity)
ATE US (oral)	2600 mg/kg body weight
ATE US (dermal)	2880 mg/kg body weight

Skin corrosion/irritation : Not classified
Serious eye damage/irritation : Causes serious eye irritation.
Respiratory or skin sensitization : Not classified
Germ cell mutagenicity : Not classified
Carcinogenicity : Not classified
Reproductive toxicity : Not classified

STOT-single exposure : May cause respiratory irritation.

Methyl Isobutyl Carbinol (108-11-2)	
STOT-single exposure	May cause respiratory irritation.

STOT-repeated exposure : Not classified

Aspiration hazard : Not classified

Viscosity, kinematic : 5.045 mm²/s

Methyl Isobutyl Carbinol (108-11-2)	
Viscosity, kinematic	5.045 mm²/s

Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

Symptoms/effects after inhalation : May cause respiratory irritation.

Symptoms/effects after skin contact : Slight irritation. Red skin. Dry skin. Itching.

Symptoms/effects after eye contact : Irritation of the eye tissue. Eye irritation. Causes serious eye irritation.

Symptoms/effects after ingestion : Vomiting. Abdominal pain. AFTER INGESTION OF HIGH QUANTITIES: Dizziness. Headache. Disturbances of consciousness.

Chronic symptoms : No effects known.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Not classified as dangerous for the environment according to the criteria of Regulation (EC) No 1272/2008.

Ecology - air : Not included in the list of substances which may contribute to the greenhouse effect (IPCC). Not included in the list of fluorinated greenhouse gases (Regulation (EU) No 517/2014). Not classified as dangerous for the ozone layer (Regulation (EC) No 1005/2009).

Methyl Isobutyl Carbinol (108-11-2)	
LC50 - Fish [1]	360 mg/l 24hr; Goldfish

12.2. Persistence and degradability

Methyl Isobutyl Carbinol (108-11-2)	
Persistence and degradability	Not established.
Biochemical oxygen demand (BOD)	2.12 g O_2/g substance
Chemical oxygen demand (COD)	2.6 g O_2/g substance
ThOD	2.8 g O_2/g substance
BOD (% of ThOD)	0.76 (Calculated value)

12.3. Bioaccumulative potential

Methyl Isobutyl Carbinol (108-11-2)	
Partition coefficient n-octanol/water (Log Pow)	1.43 (at 25 °C)
Bioaccumulative potential	Not established.

12.4. Mobility in soil

Methyl Isobutyl Carbinol (108-11-2)	
Ecology - soil	No (test)data on mobility of the substance available.

12.5. Other adverse effects

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Disposal methods

Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.

Product/Packaging disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Dispose of contents/container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation.

Additional information : Flammable vapors may accumulate in the container. Handle empty containers with care because residual vapors are flammable.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT / IMDG / IATA

14.1. UN number

DOT NA No : UN2053

UN-No. (IMDG) : 2053

UN-No. (IATA) : 2053

14.2. UN proper shipping name

Proper Shipping Name (DOT) : Methyl isobutyl carbinol

Proper Shipping Name (IMDG) : METHYL ISOBUTYL CARBINOL

Proper Shipping Name (IATA) : Methyl isobutyl carbinol

Transport document description (DOT) : UN2053 Methyl isobutyl carbinol, 3, III

Transport document description (IMDG) : UN 2053 METHYL ISOBUTYL CARBINOL, 3, III (41°C c.c.)

Transport document description (IATA) : UN 2053 Methyl isobutyl carbinol, 3, III

14.3. Transport hazard class(es)

DOT

Transport hazard class(es) (DOT) : 3

Hazard labels (DOT) : 3



IMDG

Transport hazard class(es) (IMDG) : 3

Hazard labels (IMDG) : 3



IATA

Transport hazard class(es) (IATA) : 3

Hazard labels (IATA) : 3



14.4. Packing group

Packing group (DOT)	:	III
Packing group (IMDG)	:	III
Packing group (IATA)	:	III

14.5. Environmental hazards

Other information	:	No supplementary information available.

14.6. Special precautions for user

DOT

UN-No.(DOT)	:	UN2053
DOT Special Provisions (49 CFR 172.102)	:	B1 - If the material has a flash point at or above 38 C (100 F) and below 93 C (200 F), then the bulk packaging requirements of 173.241 of this subchapter are applicable. If the material has a flash point of less than 38 C (100 F), then the bulk packaging requirements of 173.242 of this subchapter are applicable. IB3 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1 and 31HA2, 31HB2, 31HN2, 31HD2 and 31HH2). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized, except for UN2672 (also see Special Provision IP8 in Table 2 for UN2672). T2 - 1.5 178.274(d)(2) Normal..... 178.275(d)(3) TP1 - The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = 97 / 1 + a (tr - tf) Where: tr is the maximum mean bulk temperature during transport, and tf is the temperature in degrees celsius of the liquid during filling.
DOT Packaging Exceptions (49 CFR 173.xxx)	:	150
DOT Packaging Non Bulk (49 CFR 173.xxx)	:	203
DOT Packaging Bulk (49 CFR 173.xxx)	:	242
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	:	60 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	:	220 L
DOT Vessel Stowage Location	:	A - The material may be stowed ‘‘on deck’’ or ‘‘under deck’’ on a cargo vessel and on a passenger vessel.

IMDG

Limited quantities (IMDG)	:	5 L
Excepted quantities (IMDG)	:	E1
Packing instructions (IMDG)	:	P001, LP01
IBC packing instructions (IMDG)	:	IBC03
Tank instructions (IMDG)	:	T2
Tank special provisions (IMDG)	:	TP1
EmS-No. (Fire)	:	F-E - FIRE SCHEDULE Echo - NON-WATER-REACTIVE FLAMMABLE LIQUIDS
EmS-No. (Spillage)	:	S-D - SPILLAGE SCHEDULE Delta - FLAMMABLE LIQUIDS
Stowage category (IMDG)	:	A
Flash point (IMDG)	:	41°C c.c.

IATA

PCA Excepted quantities (IATA)	:	E1
PCA Limited quantities (IATA)	:	Y344
PCA limited quantity max net quantity (IATA)	:	10L
PCA packing instructions (IATA)	:	355
PCA max net quantity (IATA)	:	60L

CAO packing instructions (IATA)	:	366
CAO max net quantity (IATA)	:	220L
ERG code (IATA)	:	3L

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1. US Federal regulations

All components of this product are present and listed as Active on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture is not known to contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations

CANADA

Methyl Isobutyl Carbinol (108-11-2)

Listed on the Canadian DSL (Domestic Substances List)

Methyl Isobutyl Carbinol (108-11-2)

Listed on the Canadian DSL (Domestic Substances List)

EU-Regulations

Methyl Isobutyl Carbinol (108-11-2)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

Methyl Isobutyl Carbinol (108-11-2)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

National regulations

Methyl Isobutyl Carbinol (108-11-2)

Listed introduction on Australian Industrial Chemicals Introduction Scheme (AICIS Inventory)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)
Listed on the Japanese ENCS (Existing New Chemical Substances) inventory
Listed on KECL/KECI (Korean Existing Chemicals Inventory)
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on the Japanese ISHL (Industrial Safety and Health Law)
Listed on INSQ (Mexican National Inventory of Chemical Substances)
Listed on the TCSI (Taiwan Chemical Substance Inventory)
Listed on the NCI (Vietnam - National Chemical Inventory)

Methyl Isobutyl Carbinol (108-11-2)
Listed introduction on Australian Industrial Chemicals Introduction Scheme (AICIS Inventory)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)
Listed on the Japanese ENCS (Existing New Chemical Substances) inventory
Listed on KECL/KECI (Korean Existing Chemicals Inventory)
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Listed on INSQ (Mexican National Inventory of Chemical Substances)
Listed on the TCSI (Taiwan Chemical Substance Inventory)
Listed on the NCI (Vietnam - National Chemical Inventory)

15.3. US State regulations

Methyl Isobutyl Carbinol (108-11-2)	
State or local regulations	U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List

WARNING: This product can expose you to Methyl Isobutyl Ketone, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Component	State or local regulations
Methyl Isobutyl Carbinol(108-11-2)	U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations; U.S. - New Jersey - Right to Know Hazardous Substance List; U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Revision date : 08/29/2022

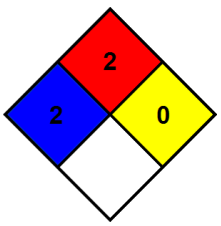
Other information : None.

Full text of H-phrases	
H226	Flammable liquid and vapor
H319	Causes serious eye irritation
H335	May cause respiratory irritation

NFPA health hazard : 2 - Materials that, under emergency conditions, can cause temporary incapacitation or residual injury.

NFPA fire hazard : 2 - Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.

NFPA reactivity : 0 - Material that in themselves are normally stable, even under fire conditions.



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SAFETY DATA SHEET
POTASSIUM AMYL XANTHATE 90%
REVISION 4, DATE 20 AUG 2021

1. IDENTIFICATION

Product Name	**Potassium Amyl Xanthate 90%**
Other Names	Potassium amyl xanthate [CAS#2720-73-2]; Potassium isopentyl dithiocarbonate
Uses	A collector used in mining industry.
Chemical Family	No Data Available
Chemical Formula	C6H11KOS2
Chemical Name	Potassium isoamyl xanthate
Product Description	Technical Grade

Contact Details of the Supplier of this Safety Data Sheet

Organisation	Location	Telephone
Redox Ltd	2 Swettenham Road Minto NSW 2566 Australia	+61-2-97333000
Redox Ltd	11 Mayo Road Wiri Auckland 2104 New Zealand	+64-9-2506222
Redox Inc.	3960 Paramount Boulevard Suite 107 Lakewood CA 90712 USA	+1-424-675-3200
Redox Chemicals Sdn Bhd	Level 2, No. 8, Jalan Sapir 33/7 Seksyen 33, Shah Alam Premier Industrial Park 40400 Shah Alam Sengalor, Malaysia	+60-3-5614-2111

Emergency Contact Details

For emergencies only; DO NOT contact these companies for general product advice.

Organisation	Location	Telephone
Poisons Information Centre	Westmead NSW	1800-251525 131126
Chemcall	Australia	1800-127406 +64-4-9179888
Chemcall	Malaysia	+64-4-9179888
Chemcall	New Zealand	0800-243622 +64-4-9179888
National Poisons Centre	New Zealand	0800-764766
CHEMTREC	USA & Canada	1-800-424-9300 CN723420 +1-703-527-3887

2. HAZARD IDENTIFICATION

Poisons Schedule (Aust)	Not Scheduled

Globally Harmonised System

Hazard Classification

Hazardous according to the criteria of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS)

Hazard Categories

Self-heating Substances and Mixtures - Category 1

Acute Toxicity (Oral) - Category 4

Acute Toxicity (Dermal) - Category 4

Skin Corrosion/Irritation - Category 2

Serious Eye Damage/Irritation - Category 2A

Long-term Hazard To The Aquatic Environment - Category 2

Pictograms



Signal Word

Danger

Hazard Statements

H251	Self-heating; may catch fire.
H302 + H312	Harmful if swallowed or in contact with skin.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H411	Toxic to aquatic life with long lasting effects.

Precautionary Statements

Prevention	**P280**	Wear protective gloves/protective clothing/eye protection/face protection.
	P273	Avoid release to the environment.
	P235 + P410	Keep cool. Protect from sunlight.
	P270	Do not eat, drink or smoke when using this product.
Response	**P312**	Call a POISON CENTER or doctor if you feel unwell.
	P302 + P352	IF ON SKIN: Wash with plenty of water/...
	P337 + P313	If eye irritation persists: Get medical advice/attention.
	P391	Collect spillage.
	P330	Rinse mouth.
	P332 + P313	If skin irritation occurs: Get medical advice/attention.
	P362	Take off contaminated clothing.
	P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Storage	**P407**	Maintain air gap between stacks or pallets.
	P420	Store separately.
Disposal	**P501**	Dispose of contents/container in accordance with local / regional / national / international regulations.

National Transport Commission (Australia)

Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

Dangerous Goods Classification

Dangerous Goods according to the criteria of the Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Chemical Entity	Formula	CAS Number	Proportion
Potassium isoamyl xanthate	C6H11KOS2	2720-73-2	>=90 %
Water	H2O	7732-18-5	<=3 %
Potassium hydroxide	KOH	1310-58-3	<=0.2 %

4. FIRST AID MEASURES

Description of necessary measures according to routes of exposure

Swallowed IF SWALLOWED: Rinse mouth. Do not induce vomiting. Call a Poison Centre or doctor/physician for advice. Never give anything by mouth to an unconscious person.

Eye IF IN EYES: Immediately flush eyes with running water for several minutes, holding eyelids open and occasionally lifting the upper and lower lids. Remove contact lenses if present and easy to do. Continue rinsing for at least 15 minutes. If eye irritation persists, get medical advice/attention.

Skin IF ON SKIN: Remove and isolate contaminated clothing and shoes. Immediately flush skin with running water for at least 15 minutes. Call a Poison Centre or doctor/physician for advice. Wash contaminated clothing and shoes before reuse. Get medical advice/attention if skin irritation occurs or if you feel unwell.

Inhaled IF INHALED: Move victim to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms persist, get medical advice/attention. Give artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult.

Advice to Doctor Treat symptomatically. Symptoms may be delayed. Immediate medical attention is required. Show this safety data sheet (SDS) to the doctor in attendance. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. Keep victim calm and warm.

Medical Conditions Aggravated by Exposure No information available.

5. FIRE FIGHTING MEASURES

General Measures Move containers from fire area if you can do it without risk. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers or in contact with substance. Cool containers with flooding quantities of water until well after fire is out.

Flammability Conditions Spontaneously combustible material. Self-heating; may catch fire.

Extinguishing Media Do NOT use water, Carbon dioxide (CO2) or foam on material itself. For Xanthates, use FLOODING AMOUNTS OF WATER for small and large fires to stop the reaction. Smothering will NOT work for these materials - they do not need air to burn. *CAUTION: UN3342, when flooded with water will continue to evolve flammable Carbon disulfide vapours.

Fire and Explosion Hazard Risk of violent reaction or explosion! May burn with rapid flare-burning effect. May react vigorously or explosively on contact with water. May decompose explosively when heated or involved in a fire. May re-ignite after fire is extinguished. Containers may explode when heated.
*Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Hazardous Products of Combustion Fire will produce irritating, corrosive and/or toxic gases, including Carbon disulfide.

Special Fire Fighting Instructions Contain runoff from fire control or dilution water - Runoff may pollute waterways. Runoff may create fire or explosion hazard.

Personal Protective Equipment Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will provide thermal protection but provides only limited chemical protection.

Flash Point	No Data Available
Lower Explosion Limit	No Data Available
Upper Explosion Limit	No Data Available
Auto Ignition Temperature	No Data Available
Hazchem Code	1Y

6. ACCIDENTAL RELEASE MEASURES

General Response Procedure	Ensure adequate ventilation. ELIMINATE all ignition sources (no smoking, sparks or flames in immediate area). Do not touch or walk through spilled material. Avoid generating dust. Avoid breathing vapours/dust and contact with eyes, skin and clothing.
Clean Up Procedures	Use clean, non-sparking tools to collect material and place it into loosely covered containers for later disposal (see SECTION 13). *For spills of Xanthates (UN3342), dissolve in 5 parts water and collect for proper disposal.
Containment	Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Cover with dry earth, dry sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
Decontamination	After cleaning, flush away any residual traces with water.
Environmental Precautionary Measures	Spillages and decontamination runoff should be prevented from entering drains and watercourses. If contamination of sewers or waterways has occurred advise local emergency services.
Evacuation Criteria	Immediately isolate spill or leak area. Evacuate personnel to safe areas. Stay upwind and/or uphill. Keep unauthorized personnel away.
Personal Precautionary Measures	Wear protective equipment to prevent skin and eye contact and breathing in vapours/dust (see SECTION 8). Fully encapsulating, vapour protective clothing should be worn for spills and leaks with no fire.

7. HANDLING AND STORAGE

Handling	Safety showers and eyewash facilities should be provided within the immediate work area for emergency use. Ensure adequate ventilation, especially in confined areas. Handle in accordance with good industrial hygiene and safety practice. Minimise dust generation and accumulation. Avoid breathing vapours/dust and contact with eyes, skin and clothing. Do not ingest. Wear protective gloves/protective clothing/eye protection/face protection (see SECTION 8). WARNING: May form combustible dust concentrations in air (during processing). Keep away from heat, hot surfaces, sparks, open flames and other ignition sources - No smoking. To prevent fire caused by electrostatic discharge, ground and bond container and receiving equipment. Use explosion-proof equipment and non-sparking tools. Take action to prevent static discharges. Avoid release to the environment - Collect spillage (see SECTION 6).
Storage	Store in a cool, dry and well-ventilated place. Protect from direct sunlight. Keep containers tightly closed when not in use - check regularly for spills. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources - No smoking. Keep away from incompatible materials (see SECTION 10) and foodstuff containers. Maintain air gap between stacks/pallets. *Keep dry - reacts with water, may lead to drum rupture.
Container	Keep in the original container.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

General	No value assigned for this specific material by Safe Work Australia. DECOMPOSITION PRODUCT: Carbon disulphide (CAS No. 75-15-0): - Safe Work Australia Exposure Standard: TWA = 10 ppm (31 mg/m3); Absorption through the skin may be a significant source of exposure (Sk).
Exposure Limits	No Data Available

Biological Limits	No information available.
Engineering Measures	Use explosion-proof electrical/ventilating/lighting equipment. Ensure ventilation is adequate and that air concentrations of components are controlled below quoted Workplace Exposure Standards. Design equipment to avoid the build up or storage of dust. Explosions are controlled by containment, venting or inerting.
Personal Protection Equipment	- Respiratory protection: If exposure limits are exceeded or if irritation or other symptoms are experienced, wear respiratory protection. Recommended: Use a full-face respirator with multi-purpose combination or type AXBEK respirator cartridges (refer to AS/NZS 1715 & 1716). - Eye/face protection: Wear appropriate eye protection to avoid eye contact. Recommended: Tightly fitting safety goggles. - Hand protection: Wear protective gloves. Recommended: Butyl rubber. - Skin/body protection: Wear appropriate personal protective clothing to avoid skin contact. Recommended: Wear fire/flame resistant/retardant clothing and antistatic boots.
Special Hazards Precaustions	No information available.
Work Hygienic Practices	Do not eat, drink or smoke when using this product. Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	Granules, pellets
Odour	Irritant
Colour	Yellowish or laurel-green
pH	No Data Available
Vapour Pressure	No Data Available
Relative Vapour Density	No Data Available
Boiling Point	No Data Available
Melting Point	No Data Available
Freezing Point	No Data Available
Solubility	No Data Available
Specific Gravity	No Data Available
Flash Point	No Data Available
Auto Ignition Temp	No Data Available
Evaporation Rate	No Data Available
Bulk Density	No Data Available
Corrosion Rate	No Data Available
Decomposition Temperature	No Data Available
Density	No Data Available
Specific Heat	No Data Available
Molecular Weight	No Data Available
Net Propellant Weight	No Data Available
Octanol Water Coefficient	No Data Available
Particle Size	No Data Available
Partition Coefficient	No Data Available
Saturated Vapour Concentration	No Data Available
Vapour Temperature	No Data Available
Viscosity	No Data Available
Volatile Percent	No Data Available
VOC Volume	No Data Available

Additional Characteristics	No information available.
Potential for Dust Explosion	Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.
Fast or Intensely Burning Characteristics	Risk of violent reaction or explosion! May burn with rapid flare-burning effect. May decompose explosively when heated or involved in a fire. May re-ignite after fire is extinguished.
Flame Propagation or Burning Rate of Solid Materials	No information available.
Non-Flammables That Could Contribute Unusual Hazards to a Fire	May react vigorously or explosively on contact with water.
Properties That May Initiate or Contribute to Fire Intensity	Spontaneously combustible material. Self-heating; may catch fire.
Reactions That Release Gases or Vapours	Fire/decomposition will produce irritating, corrosive and/or toxic gases, including Carbon disulfide.
Release of Invisible Flammable Vapours and Gases	No information available.

10. STABILITY AND REACTIVITY

General Information	Reacts exothermically on dilution with water. Can react with water producing carbon disulfide.
Chemical Stability	Stable under proper operation and storage conditions.
Conditions to Avoid	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources.
Materials to Avoid	Incompatible/reactive with oxidising agents, combustible materials, acids, water, phosgene, sulfur chlorides, copper, copper alloys.
Hazardous Decomposition Products	Fire/decomposition will produce irritating, corrosive and/or toxic gases, including Carbon disulfide, Hydrogen sulfide, oxide of Sulfur, oxides of Carbon.
Hazardous Polymerisation	Hazardous polymerisation will not occur.

11. TOXICOLOGICAL INFORMATION

General Information

- Acute toxicity: Harmful if swallowed and in contact with skin. Swallowing can result in nausea, vomiting, diarrhoea, abdominal pain, convulsions and loss of consciousness. Death may occur if large amounts are ingested. Will liberate Carbon disulfide upon contact with moist skin. Carbon disulfide can be absorbed through the skin with resultant adverse effects.
- Skin corrosion/irritation: Causes skin irritation. Corrosive to skin in aqueous solution (based on the pH, which is > 11.5 at maximum concentration of 25 % water solution).
- Eye damage/irritation: Causes serious eye irritation. Corrosive to eyes in aqueous solution (based on the pH, which is > 11.5 at maximum concentration of 25 % water solution).
- Respiratory/skin sensitisation: No information available.
- Germ cell mutagenicity: No information available.
- Carcinogenicity: Not listed as carcinogenic according to the International Agency for Research on Cancer (IARC).
- Reproductive toxicity: DECOMPOSITION PRODUCT: Carbon disulfide (CAS No. 75-15-0) Suspected of damaging fertility. Suspected of damaging the unborn child. The weight of evidence on decomposition of the target substance and the measured and estimated exposure of workers during mining application indicates safe use of the substance. Based on this data there is currently no need for classification of potassium isoamyl xanthate concerning toxicity to reproduction or teratogenicity [ECHA].
- STOT (single exposure): Breathing in dust may result in respiratory irritation. Breathing in high concentrations can produce central nervous system depression, which can lead to loss of co-ordination, impaired judgement and if exposure is prolonged,
unconsciousness. Breathing in high concentrations may result in an irregular heart beat and prove suddenly fatal.
- STOT (repeated exposure): Substance accumulation in the human body may occur and may cause some concern following repeated or log-term occupational exposure. DECOMPOSITION PRODUCT: Carbon disulfide (CAS No. 75-15-0) Causes damage to organs through prolonged or repeated exposure if inhaled. The intrinsic properties of potassium

	isoamyl xanthate are related to the most hazardous degradation product; carbon disulphide. Based on the observations made after the subchronic carbon disulphide exposures in humans by inhalation route, exposure calculations and measured concentrations in mining processes there is no need for classification of the target substance [ECHA]. - Aspiration toxicity: No information available.
Carcinogen Category	None

12. ECOLOGICAL INFORMATION

Ecotoxicity	Aquatic toxicity: COMPONENT: Potassium amyl xanthate (CAS No. 928-70-1): - LC50, Fish: 217 mg/L (96 h).
Persistence/Degradability	No information available.
Mobility	No information available.
Environmental Fate	Toxic to aquatic life with long lasting effects - Avoid release to the environment.
Bioaccumulation Potential	No information available.
Environmental Impact	No Data Available

13. DISPOSAL CONSIDERATIONS

General Information	Dispose of contents/container in accordance with local/regional/national regulations. The use of incineration disposal recommended for waste chemicals.
Special Precautions for Land Fill	Containers may still present a chemical hazard when empty. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. Recycle, if possible.

14. TRANSPORT INFORMATION

Land Transport (Australia)
ADG Code

Proper Shipping Name	XANTHATES
Class	4.2 Flammable Solids - Substances liable to spontaneous combustion
Subsidiary Risk(s)	No Data Available
EPG	25 Spontaneously Combustible Substances (Air And/Or Water Reactive)
UN Number	3342
Hazchem	1Y
Pack Group	III
Special Provision	No Data Available

Land Transport (Malaysia)
ADR Code

Proper Shipping Name	XANTHATES
Class	4.2 Flammable Solids - Substances liable to spontaneous combustion
Subsidiary Risk(s)	No Data Available
EPG	25 Spontaneously Combustible Substances (Air And/Or Water Reactive)

UN Number	3342
Hazchem	1Y
Pack Group	III
Special Provision	No Data Available

Land Transport (New Zealand)
NZS5433

Proper Shipping Name	XANTHATES
Class	4.2 Flammable Solids - Substances liable to spontaneous combustion
Subsidiary Risk(s)	No Data Available
EPG	25 Spontaneously Combustible Substances (Air And/Or Water Reactive)
UN Number	3342
Hazchem	1Y
Pack Group	III
Special Provision	No Data Available

Land Transport (Papua New Guinea)

Proper Shipping Name	XANTHATES
Class	4.2 Flammable Solids - Substances liable to spontaneous combustion
Subsidiary Risk(s)	No Data Available
EPG	25 Spontaneously Combustible Substances (Air And/Or Water Reactive)
UN Number	3342
Hazchem	1Y
Pack Group	III
Special Provision	No Data Available

Land Transport (United States of America)
US DOT

Proper Shipping Name	XANTHATES
Class	4.2 Flammable Solids - Substances liable to spontaneous combustion
Subsidiary Risk(s)	No Data Available
ERG	135 Substances - Spontaneously Combustible
UN Number	3342
Hazchem	1Y
Pack Group	III
Special Provision	No Data Available

Sea Transport
IMDG Code

Proper Shipping Name	XANTHATES
Class	4.2 Flammable Solids - Substances liable to spontaneous combustion
Subsidiary Risk(s)	No Data Available
UN Number	3342
Hazchem	1Y
Pack Group	III
Special Provision	No Data Available
EMS	F-A, S-J

Marine Pollutant	No

Air Transport
IATA DGR

Proper Shipping Name	XANTHATES
Class	4.2 Flammable Solids - Substances liable to spontaneous combustion
Subsidiary Risk(s)	No Data Available
UN Number	3342
Hazchem	1Y
Pack Group	III
Special Provision	No Data Available

National Transport Commission (Australia)
Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

Dangerous Goods Classification	Dangerous Goods according to the criteria of the Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

15. REGULATORY INFORMATION

General Information	No Data Available
Poisons Schedule (Aust)	Not Scheduled

Environmental Protection Authority (New Zealand)
Hazardous Substances and New Organisms Amendment Act 2015

Approval Code	Not Assessed

National/Regional Inventories

Australia (AIIC)	Listed
Canada (DSL)	Not Determined
Canada (NDSL)	Not Determined
China (IECSC)	Not Determined
Europe (EINECS)	Not Determined
Europe (REACh)	Not Determined
Japan (ENCS/METI)	Not Determined
Korea (KECI)	Not Determined
Malaysia (EHS Register)	Not Determined
New Zealand (NZIoC)	Not Determined
Philippines (PICCS)	Not Determined

Switzerland (Giftliste 1)	Not Determined
Switzerland (Inventory of Notified Substances)	Not Determined
Taiwan (NCSR)	Not Determined
USA (TSCA)	Not Determined

16. OTHER INFORMATION

Related Product Codes	POAMXA1000, POAMXA1001, POAMXA1002, POAMXA1003, POAMXA1004, POAMXA1005, POAMXA1006, POAMXA1007, POAMXA1008, POAMXA1009, POAMXA1010, POAMXA1011, POAMXA1012, POAMXA1013, POAMXA1014, POAMXA1015, POAMXA1016, POAMXA1017, POAMXA1018, POAMXA1019, POAMXA1020, POAMXA1021, POAMXA1022, POAMXA1023, POAMXA1024, POAMXA1025, POAMXA1026, POAMXA1027, POAMXA1028, POAMXA1029, POAMXA1030, POAMXA1031, POAMXA1032, POAMXA1033, POAMXA1034, POAMXA1035, POAMXA1036, POAMXA1200, POAMXA1500, POAMXA2000, POAMXA2001, POAMXA2100, POAMXA2500, POAMXA2600, POAMXA2601, POAMXA3000, POAMXA3001, POAMXA4000, POAMXA4500, POAMXA5000, POAMXA5100, POAMXA5500, POAMXA6000, POAMXA7000, POAMXA8000, POAMXA8001, POAMXA8002, POAMXA8600, POAMXA8649, POAMXA8650, POAMXA8651, POAMXA8652, POAMXA8655, POAMXA8656, POAMXA8660, POAMXA8670, POAMXA8677, POAMXA8700, POAMXA8701, POAMXA9000, POAMXA9001, POAMXA9002, POAMXA9500, POAMXA9600, POAMXA9700
Revision	4
Revision Date	20 Aug 2021
Reason for Issue	SDS updated
Key/Legend	< Less Than > Greater Than **AICS** Australian Inventory of Chemical Substances **atm** Atmosphere **CAS** Chemical Abstracts Service (Registry Number) **cm^2** Square Centimetres **CO2** Carbon Dioxide **COD** Chemical Oxygen Demand **deg C (°C)** Degrees Celcius **EPA (New Zealand)** Environmental Protection Authority of New Zealand **deg F (°F)** Degrees Farenheit **g** Grams **g/cm^3** Grams per Cubic Centimetre **g/l** Grams per Litre **HSNO** Hazardous Substance and New Organism **IDLH** Immediately Dangerous to Life and Health **immiscible** Liquids are insoluable in each other. **inHg** Inch of Mercury **inH2O** Inch of Water **K** Kelvin **kg** Kilogram **kg/m^3** Kilograms per Cubic Metre **lb** Pound **LC50** LC stands for lethal concentration. LC50 is the concentration of a material in air which causes the death of 50% (one half) of a group of test animals. The material is inhaled over a set period of time, usually 1 or 4 hours. **LD50** LD stands for Lethal Dose. LD50 is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals. **ltr** or **L** Litre **m^3** Cubic Metre **mbar** Millibar **mg** Milligram **mg/24H** Milligrams per 24 Hours **mg/kg** Milligrams per Kilogram **mg/m^3** Milligrams per Cubic Metre **Misc** or **Miscible** Liquids form one homogeneous liquid phase regardless of the amount of either component present.

mm Millimetre
mmH2O Millimetres of Water
mPa.s Millipascals per Second
N/A Not Applicable
NIOSH National Institute for Occupational Safety and Health
NOHSC National Occupational Heath and Safety Commission
OECD Organisation for Economic Co-operation and Development
Oz Ounce
PEL Permissible Exposure Limit
Pa Pascal
ppb Parts per Billion
ppm Parts per Million
ppm/2h Parts per Million per 2 Hours
ppm/6h Parts per Million per 6 Hours
psi Pounds per Square Inch
R Rankine
RCP Reciprocal Calculation Procedure
STEL Short Term Exposure Limit
TLV Threshold Limit Value
tne Tonne
TWA Time Weighted Average
ug/24H Micrograms per 24 Hours
UN United Nations
wt Weight

SAFETY DATA SHEET

Version 6.8
Revision Date 09/07/2024
Print Date 09/08/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Salicylaldoxime

Product Number : 84172
Brand : Aldrich
CAS-No. : 94-67-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

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Short-term (acute) aquatic hazard (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Warning

Hazard Statements

H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H401	Toxic to aquatic life.

Precautionary Statements

P261	Avoid breathing dust.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	2-Hydroxybenzaldehyde oxime
Formula	:	$C_7H_7NO_2$
Molecular weight	:	137.14 g/mol
CAS-No.	:	94-67-7
EC-No.	:	202-353-8

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Component	Classification	Concentration
salicylaldehyde oxime		
	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; Aquatic Acute 2; H302, H315, H319, H335, H401	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Nitrogen oxides (NOx)
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

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5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry.

Storage class
Storage class (TRGS 510): 11: Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

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8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P2
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Color: white

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b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 59 - 61 °C (138 - 142 °F) Melting point/ range: 57 - 59 °C (135 - 138 °F)
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

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10.3 Possibility of hazardous reactions
Violent reactions possible with:
Strong oxidizing agents

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Acute toxicity estimate Oral - 500.1 mg/kg
(Expert judgment)
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
Remarks: Causes skin irritation.

Serious eye damage/eye irritation
Remarks: Causes serious eye irritation.

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.
Remarks: **Specific target organ toxicity - repeated exposure**
No data available

Aspiration hazard
No data available

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11.2 Additional Information

RTECS: VN5775000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 3.23 mg/l - 96 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

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IATA
Not dangerous goods

Further information
Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

CERCLA Reportable Quantity
This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards	:	Acute Health Hazard
SARA 313	:	This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know
No components are subject to the Massachusetts Right to Know Act.

Maine Chemicals of High Concern
Product does not contain any listed chemicals

Vermont Chemicals of High Concern
Product does not contain any listed chemicals

Washington Chemicals of High Concern
Product does not contain any listed chemicals

The ingredients of this product are reported in the following inventories:

TSCA	:	All substances listed as active on the TSCA inventory

TSCA list
No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

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SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.8 Revision Date: 09/07/2024 Print Date: 09/08/2024

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NATURAL SOURCING™
Specialists in Cosmeceutical Ingredients

SAFETY DATA SHEET

CLAYBENT34US35
VERSION NO. 3

BENTONITE CLAY

Prepared to US OSHA, CMA, ANSI, Canadian WHMIS Standards, Australian WorkSafe, Japanese Industrial Standard JIS Z 7250:2000, and European Directives

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 Trade Name (as labeled):	Bentonite Clay
Botanical Name:	N/A
INCI Name:	Bentonite Clay
Synonyms:	N/A
CAS No:	Mixture
EINECS No:	Not listed
FEMA No:	Not available
1.2 Product Use:	Personal Care Formulations
1.3 Company Name:	**Natural Sourcing, LLC.**
Company Address:	341 Christian Street, Oxford, CT 06478, USA
Business Phone:	(800) 340-0080
Website:	www.naturalsourcing.com
Email:	info@naturalsourcing.com
1.4 Emergency Telephone Number:	**Chemtrec: (800) 262-8200**
Date of Current Revision:	September 22, 2022
Date of Last Revision:	August 16, 2015

2 HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a light tan to gray dry powder with no odor. Minimize dust generation and breathing of dust.

Health Hazards: May cause skin, eye and respiratory irritation. May cause cancer.

Flammability Hazards: Non-flammable.

Reactivity Hazards: None.

Environmental Hazards: The environmental effects of this product have not been investigated, however release may cause adverse environmental effects.

US DOT Symbols: Non-Regulated Material

EU and GHS Symbols:



Signal Word: Danger

2.1 EU Labeling and Classification:

This product does meet the definition of a hazardous su bstance or preparation as defined by the European Union Council Directives 67/548/EEC, 1999/45/EC, 1272/2008/EC and subsequent Directives.

Components Contributing to Classification: Quartz

2.2 Label Elements:

GHS Hazard Classifications: Carcinogenicity Category 1A

Hazard Statements: H350 May cause cancer

Precautionary Statements: P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Response Statements: P308+P313 IF exposed or concerned: Get medical advice/attention.

Storage Statements: P405 Store locked up.

Disposal Statements: P501 Dispose of contents/container in accordance with local regulations.

2.3 Health Hazards or Risks From Exposure:

Symptoms of Overexposure by Route of Exposure:

The most significant routes of overexposure for this product are by contact with skin, eyes, and respiratory system. The symptoms of overexposure are described in the following paragraphs.

Acute:

Inhalation: Excessive quantities may cause respiratory irritation.

Skin Contact: Prolonged or repeated exposure may cause skin irritation.

Eye Contact: May cause eye irritation upon direct contact.

Ingestion: No data available.

Chronic: No data available.

Target Organs:

Acute: Skin, Eyes, and Respiratory System

Chronic: No data available

3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 Type of Product: Natural Sourcing Cosmetic Clays

Ingredients:	WT%	CAS No.	EINECS No.	Hazard Classification
Bentonite	98-100	1302-78-9	215-108-5	Not Classified
Silicon Dioxide	<2%	7631-869-9	231-545-4	Not Classified
Quartz	<2%	14808-60-7	238-878-4	Carcinogenicity Category 1

Note: All WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2010 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives and the Japanese Industrial Standard JIS Z 7250:2000

4 FIRST AID MEASURES

4.1 Description of First Aid Measures:

Eye Contact: If product enters the eyes, flush with plenty of water or eye wash solution for several minutes. Seek medical attention if irritation persists.

Skin Contact: Wash skin thoroughly with soap and water after handling. Seek medical attention if irritation develops and persists.

Inhalation: If breathing becomes difficult, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention.

Ingestion: If product is swallowed, call physician or poison center if you feel unwell. If professional advice is not available, do not induce vomiting. Never induce vomiting or give dilutents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice. Take a copy of the label and/or SDS with the victim to the health professional.

Medical Conditions Generally Aggravated by Exposure: No data available

4.2 Symptoms and Effects Both Acute and Delayed: Contact with skin, eyes, and respiratory system may cause irritation.

4.3 Recommendations to Physicians: Treat symptoms and eliminate overexposure.

5 FIRE FIGHTING MEASURES

5.1 Fire Extinguishing Materials:

Use the following fire extinguishing materials:

Water Spray: Yes
Foam: Yes
Halon: Yes
Carbon Dioxide: Yes
Dry Chemical: Yes
Other: Any "C" Class

5.2 Unusual Fire and Exposion Hazards:

Irritating and toxic fumes may be produced at high temperatures. Use of water may result if the formation of a toxic aqueous solution. Do not allow run-off from fire fighting to enter drains or water courses.

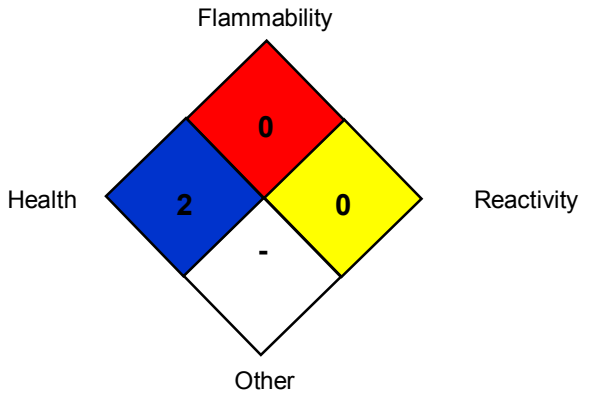
Explosive Sensitivity to Mechanical Impact: No

Explosive Sensitivity to Static Discharge: No

5.3 Special Fire-Fighting Procedures:

- Incipient fire responders should wear eye protection.
- Structural firefighters must wear Self-Contained Breathing Apparatus (SCBA) and full protective equipment.
- Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk; otherwise, cool with carefully applied water spray.
- If possible, prevent run-off water from entering storm drains, bodies of water, or other environmentally sensitive areas.

NFPA RATING SYSTEM



HMIS RATING SYSTEM

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD (BLUE)	**2**
FLAMMABILITY HAZARD (RED)	**0**
PHYSICAL HAZARD (YELLOW)	**0**

PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
	See Sect 8		See Sect 8

Hazard Scale: 0 = Minimum 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic Hazard

6 ACCIDENTAL RELEASE MEASURES (STEPS FOR SPILLS)

6.1 Personal Precautions, Protective Equipment and Emergency Procedures:

Use cautious judgment when cleaning up spill. Wear suitable protective clothing, gloves, and eye/face protection.

6.2 Environmental Precautions:

If water is introduced, construct a dike to prevent spreading. Keep out of sewers, storm drains, surface waters, and soils.

6.3 Spill and Leak Response:

Small Spills:

- Collect material via broom or mop. Place in tightly sealed containers for proper disposal.

Large Spills:

- Approach spill areas with caution.
- If liquid was introduced, create a dike or trench to contain material. Soak up with absorbent material such as clay, sand or other suitable non-reactive material.
- Place in leak-proof containers. Seal tightly for proper disposal.
- Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations and those of Canada and its Provinces, those of Australia, Japan and EU Member States (see Section 13, Disposal Considerations).

7 HANDLING AND STORAGE

7.1 Precautions for Safe Handling:

To prevent skin contact under the foreseeable conditions of use, wear appropriate safety gloves. Wash thoroughly after handling.

7.2 Storage and Handling Practices:

Minimize dust generation and accumulation.

7.3 Specific Uses:

Comply with the regulations and product data sheet. No specific recommendations. Apply the above handling guidelines.

8 EXPOSURE CONTROL/PERSONAL PROTECTION

8.1 Exposure Parameters:

Ingredients	CAS No.	OSHA PEL	NIOSH PEL
Bentonite	1302-78-9	15 mg/m^3(Total dust), 5 mg/m^3(Respirable dust)	No data available
Silicon Dioxide	7631-869-9	80 mg/m^3	6 mg/m^3
Quartz	14808-60-7	30 mg/m^3	0.05 mg/m^3

8.2 Exposure Controls:

Ventilation and Engineering Controls: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided above.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states (including EN 149 for respiratory PPE, and EN 166 for face/eye protection), and those of Japan. Please reference applicable regulations and standards for relevant details.

Respiratory Protection:

Not required for properly ventilated areas.

Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, or EU member states.

Eye Protection:

Safety glasses or goggles are recommended.

If necessary, refer to U.S. OSHA 29 CFR 1910.133, Canadian Standards, and the European Standard EN166, Australian Standards, or relevant Japanese Standards.

Hand Protection:

Chemical resistant gloves are recommended to prevent skin contact.

If necessary, refer to U.S. OSHA 29 CFR 1910.138, the European Standard DIN EN 374, the appropriate Standards of Canada, Australian Standards, or relevant Japanese Standards.

Body Protection:

Use body protect appropriate to task being performed.

If necessary, refer to appropriate Standards of Canada, or appropriate Standards of the EU, Australian Standards, or relevant Japanese Standards. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on Basic Physical and Chemical Properties:

Appearance (Physical State and Color): This product is a light tan to gray dry powder
Odor: Odorless
Odor Threshold: Not Available
pH: Not Available
Melting/Freezing Point: Not Available
Boiling Point: Not Available
Flash Point: Not Applicable
Evaporation Rate: Not Available
Flammability (Solid; Gas): Not Available
Upper/Lower Flammability or Explosion Limits: Not Available
Vapor Pressure (mm Hg @ 20°C (68° F): Not Available
Vapor Density: Not Available
Relative Density: Not Available
Specific Gravity: 2.45-2.6
Solubility in Water: Insoluble
Weight per Gallon: Not Available
Partition Coefficient (n-octanol/water): Not Available
Auto-Ignition Temperature: Not Available
Decomposition Temperature: Not Available
Viscosity: Not Available

9.2 Other Information: No additional information available at this time.

10 STABILITY AND REACTIVITY

10.1 Reactivity:	This product is not reactive.
10.2 Stability:	Stable under conditions of normal storage and use.
10.3 Possibility of Hazardous Reactions:	Will not occur.
10.4 Conditions to Avoid:	None
10.5 Incompatible Substances:	None
10.6 Hazardous Decomposition Products:	None

11 TOXICOLOGICAL INFORMATION

11.1 Information on Toxicological Effects:

Bentonite	1302-78-9	LD50 – Intravenous-Rat	35 mg/kg
Silicon Dioxide	7631-86-9	LD50 -Oral-Rat	3,160 mg/kg

Suspected Cancer Agent: Ingredients within this product are found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, or CAL/OSHA and therefore are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

Irritancy: Skin: May cause irritation.
Eyes: May cause irritation.
Inhalation: May cause irritation.

Sensitization to the Product: This product is not expected to cause skin sensitization.

Reproductive Toxicity:	No specific information is available concerning the effects of this product and its components on the human reproductive system.

12 ECOLOGICAL INFORMATION

12.1 Toxicity:	No data available
12.2 Persistence and Degradability:	No specific data available on this product.
12.3 Bioaccumulative Potential:	No specific data available on this product.
12.4 Mobility in Soil:	No specific data available on this product.
12.5 Results of PBT and vPvB Assessment:	No specific data available on this product.
12.6 Other Adverse Effects:	No data available
12.7 Water Endangerment Class:	At present, there are no ecotoxicological assessments for this product.

13 DISPOSAL CONSIDERATIONS

13.1 Waste Treatment Methods:	Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations, those of Canada, Australia, EU Member States and Japan.
13.2 EU Waste Code:	Not determined

14 TRANSPORTATION INFORMATION

US DOT, IATA, IMO, ADR:

14.1 U.S. Department of Transportation (DOT) Shipping Regulations:

This product is classified (per 49 CFR 172.101) by the U.S. Department of Transportation, as follows.

UN Identification Number:	None
Proper Shipping Name:	Non-Regulated Material
Hazard Class Number and Description:	None
Packing Group:	None
DOT Label(s) Required:	None
North American Emergency Response Guidebook Number:	None
RQ Quantity:	None

14.2 Environmental Hazards:

Marine Pollutant:	The components of this product are not designated by the Department of Transportation to be Marine Pollutants (49 CFR 172.101, Appendix B).

14.3 Special Precaution for User:	None
14.4 International Air Transport Association Shipping Information (IATA):	This product is not considered as dangerous goods.
14.5 International Maritime Organization Shipping Information (IMO):	This product is not considered as dangerous goods.
14.6 Transport in Bulk According to Annex II of Marpol 73/78 and IBC Code:	
European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR:)	This product is not considered by the United Nations Economic Commission for Europe to be dangerous goods.

15 REGULATORY INFORMATION

15.1 Safety, Health and Environmental Regulations Specific for the Substance or Mixture:

United States Regulations:

U.S. SARA Reporting Requirements:
The components of this product are subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act as follows: None

U.S. SARA Threshold Planning Quantity:
There are no specific Threshold Planning Quantities for the components of this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs (4,540 kg) therefore applies, per 40 CFR 370.20.

U.S. CERCLA Reportable Quantity:
None

U.S. TSCA Inventory Status:
The components of this product are listed on the TSCA Inventory or are exempted from listing.

Other U.S. Federal Regulations:

None known

California Safe Drinking Water and Toxic Enforcement Act (Proposition 66):
This product does contain ingredients on the Proposition 65 Lists.
Crystalline Silica(CAS# 7631-86-9 & 14808-60-7)

15.2 Canadian Regulations:

Canadian DSL/NDSL Inventory Status:

Components are DSL Listed, NDSL Listed and/or are exempt from listing

Other Canadian Regulations:
Not applicable

Canadian Environmental Protection Act (CEPA) Priorities Substances Lists:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian WHMIS Classification and Symbols:
This product is a classified per WHMIS 2015 Controlled Product Regulations.

15.3 European Economic Community Information:

This product meets the definition of a hazardous substance or preparation as defined by the European Union Council Directives 67/548/EEC, 1999/45/EC, 1272/2008/EC and subsequent Directives. See Section 2 for Details.

Chemical Safety Assessment:
No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

15.4 Australian Information for Product:
Components of this product are listed on the International Chemical Inventory list.

15.5 Japanese Information for Product:
Japanese Minister of International Trade and Industry (MITI) Status: The components of this product are not listed as Class I Specified Chemical Substances, Class II Specified Chemical Substances, or Designated Chemical Substances by the Japanese MITI.

15.6 International Chemical Inventories:
Listing of the components on individual country Chemical Inventories is as follows:
Australian Inventory of Chemical Substances (AICS): Listed
Korean Existing Chemicals List (ECL): Listed
Japanese Existing and New Chemical Substances Inventory (ENCS): Listed
Philippines Inventory of Chemicals and Chemical Substances (PICCS): Listed
U.S. TSCA: Listed

16 ADDITIONAL INFORMATION

Prepared By: Natural Sourcing
Date of Printing: September 22, 2022

The information contained herein is believed to be accurate but is not warranted to be so. Data and calculations are based on information furnished by the manufacturer of the product and manufacturers of the components of the product. Users are advised to confirm in advance of the need that information is current, applicable and suited to the circumstances of use. This safety sheet cannot cover all possible situations which the user may experience during processing. Each aspect of your operation should be examined to determine if, or where, additional precautions may be necessary. All health and safety information contained in this bulletin should be provided to your employees or customers. Natural Sourcing, LLC. assumes no responsibility for injury to vendee or third party person proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Furthermore, Natural Sourcing, LLC assumes no responsibility for injury caused by abnormal use of this material even if reasonable safety procedures are followed. Compliance with all applicable federal, state, and local laws and local regulations remains the responsibility of the user.

END OF SDS SHEET

SAFETY DATA SHEET
COBALT SULPHATE

The safety data sheet is in accordance with Commission Regulation (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

SECTION 1: Identification of the substance / mixture and of the company / undertaking

Date issued	14.06.2017

1.1. Product identifier

Product name	COBALT SULPHATE
REACH Reg. No.	01-2119517426-41-0003
CAS no.	10026-24-1
EC no.	233-334-2
Extended SDS with ES incorporated	Yes

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/preparation	•Use of cobalt sulfate in the production of cobalt carbonate • surface treatment processes (intermediate use) • inorganic pigments & frits, glass and ceramic ware (intermediate use) • dyes for the textile, leather, wood and/or paper industry (intermediate use) •industrial use of cobalt sulfate in the manufacture of chemicals and in other wet-chemical processes as intermediate • fertilizers and/or feed grade materials • catalyst in synthesis processes • fermentation processes and/or biogas production •Formulation and industrial use of as water treatment chemical, oxygen scavenger, corrosion inhibitor •Manufacture and industrial use of batteries using cobalt sulfate (intermediate use) •Professional use of fertilizers containing cobalt sulfate
Uses advised against	None.

1.3. Details of the supplier of the safety data sheet

Manufacturer

Company name	Norilsk Nickel Harjavalta Oy
Postal address	Teollisuuskatu 1
Postcode	29200
City	Harjavalta
Country	Finland
Tel	+358 2 537 11
E-mail	product.safety@nornickel.fi
Enterprise no.	FI15917284

1.4. Emergency telephone number

Emergency telephone	Description: 3E EH&S Mission Control Center: +44 20 35147487 / Access Code: 334656

SECTION 2: Hazards identification

2.1. Classification of substance or mixture

Classification according to Regulation (EC) No 1272/2008 [CLP / GHS]	Acute tox. 4; H302,H302 Eye Irrit. 2; H319,H319 Resp. Sens. 1A; H334,H334 Skin Sens. 1; H317,H317 Repr. 1B; H360F,H360F Muta. 2; H341,H341 Carc. 1B; H350i,H350i Aquatic Acute 1; H400,H400 Aquatic Chronic 1; H410,H410

2.2. Label elements

Hazard Pictograms (CLP)



Signal word	Danger
Hazard statements	H302 Harmful if swallowed. H319 Causes serious eye irritation. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H317 May cause an allergic skin reaction. H360F May damage fertility. H341 Suspected of causing genetic defects H350i May cause cancer by inhalation. H400 Very toxic to aquatic life. H410 Very toxic to aquatic life with long lasting effects. H410 Very toxic to aquatic life with long lasting effects.
Precautionary statements	P202 Do not handle until all safety precautions have been read and understood. P261 Avoid breathing dust / fume / gas / mist / vapours / spray. P270 Do not eat, drink or smoke when using this product. P280 Wear protective gloves / protective clothing / eye protection / face protection. P309+P311 IF exposed or if you feel unwell: Call a POISON CENTER or doctor / physician. P273 Avoid release to the environment.

2.3. Other hazards

PBT / vPvB	The PBT and vPvB criteria of Annex XIII to the regulation does not apply to inorganic substances.

SECTION 3: Composition/information on ingredients

3.1. Substances

Substance	Identification	Classification	Contents
Cobalt sulphate heptahydrate	CAS no.: 10026-24-1 EC no.: 233-334-2 REACH Reg. No.: 01-2119517426-41-0003	Carc. 1B; H350i Muta. 2; H341 Repr. 1B; H360F Acute tox. 4; H302 Resp. Sens. 1; H334 Skin Sens. 1; H317 Eye Irrit. 2; H319 Aquatic Acute 1; H400; M-factor 10 Aquatic Chronic 1; H410; M-factor 10	> 99,9 %
Substance comments	$CoSO4 \cdot 7H2O$		

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation	Remove affected person from the immediate area. Ensure supply of fresh air. If breathing is irregular or stopped, administer artificial respiration. Consult a physician.
Skin contact	Wash off with soap and plenty of water. Remove soiled or soaked clothing immediately. Wash contaminated clothing before re-use.
Eye contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If easy to do, remove contact lens, if worn. If eye irritation persists, consult a specialist.
Ingestion	Rinse mouth. Consult a physician.

4.2. Most important symptoms and effects, both acute and delayed

General symptoms and effects	If inhaled : Cough ; Shortness of breath If swallowed : Vomiting ; Abdominal pain Eyes / Skin : Redness If symptoms persist, call a physician. Treat symptomatically.

4.3. Indication of any immediate medical attention and special treatment needed

Medical treatment	None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	The product itself does not burn. Powder. Carbon dioxide ($CO2$). Water spray.
Improper extinguishing media	None.

5.2. Special hazards arising from the substance or mixture

Fire and explosion hazards	In case of fire, toxic gases may be formed. Sulphurous gases (SOx). Cobalt oxides

5.3. Advice for firefighters

Personal protective equipment	Use personal protective equipment as required.
Other Information	Collect contaminated fire extinguishing water separately. Do not discharge into the drains/surface waters/groundwater.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures	Avoid contact with skin, eyes and clothing. Ensure adequate ventilation. Avoid dust formation. Avoid breathing dust.

6.2. Environmental precautions

Environmental precautionary measures	Do not allow to enter drains, sewers or watercourses.

6.3. Methods and material for containment and cleaning up

Other information	Send in suitable containers for recovery or disposal.

6.4. Reference to other sections

Other instructions	See also section 7, 8,13

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Handling	Take note of Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work. Avoid inhalation of dust and contact with skin and eyes. Use mechanical ventilation in case of handling which causes formation of dust. Avoid spread of dust.

Protective Safety Measures

Advice on general occupational hygiene	Private clothes and working clothes should be kept separately.

7.2. Conditions for safe storage, including any incompatibilities

Storage	Store in tightly closed original container in a dry, cool and well-ventilated place.
Conditions to avoid	Keep away from Strong oxidizing agents.

7.3. Specific end use(s)

Specific use(s)	Industrial use ; professional use

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Substance	Identification	Value	TWA Year
Cobalt and its inorganic compounds*		TWA (8h): 0,02 mg/m³ **Exposure Limit Letter** Letter description: Co Source: HTP Finland	TWA Year: 2012

DNEL / PNEC

Substance	Cobalt sulphate heptahydrate
DNEL	**Group:** Consumer **Route of exposure:** Long-term inhalation (local) **Value:** 16.6 µg/m³ **Group:** Professional **Route of exposure:** Long-term inhalation (local)

	Value: 105,2 µg/m³
	Value: 25 µg/kg bw/day **Comment :** long-term oral (local)
PNEC	**Route of exposure:** Saltwater **Value:** 2,36 µg Co/L
	Route of exposure: Freshwater **Value:** 0.51 µg/L
	Route of exposure: Freshwater sediments **Value:** 9,5 mg Co/kg dw
	Route of exposure: Saltwater sediments **Value:** 9,5 mg Co/kg dw
	Comment : PNEC Soil = 7.9 mg/kg dw Water treatment plant micro organisms = 0.373 µg Co/l

8.2. Exposure controls

Precautionary measures to prevent exposure

Product-related measures to prevent exposure	Avoid contact with skin and eyes. Do not breathe dust.

Eye / face protection

Suitable Eye Protection	Wear tight-fitting goggles or face shield.

Hand protection

Suitable gloves type	Wear protective gloves. Avoid prolonged skin contact.
Suitable materials	Butyl rubber. Polyvinyl chloride (PVC).

Skin protection

Suitable protective clothing	Wear appropriate clothing to prevent reasonably probable skin contact. Wear special protective clothing.

Respiratory protection

Recommended type of equipment	Use respiratory equipment with particle filter, type P3.

Hygiene / environmental

Specific hygiene measures	Wash contaminated clothing before reuse. Personal protection must be kept separate from other clothes. When using do not eat, drink or smoke.

Appropriate environmental exposure control

Environmental exposure controls	The employer shall fulfill requirements of IPPC Directive.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	Crystals or crystalline.

Colour	Red.
Odour	Odourless.
Odour limit	Comments: Not relevant.
pH	Status: In delivery state Comments: 5.11 (100 g/l)
Melting point / melting range	Comments: 96.8°C $CoSO4 \cdot 7H2O$
Boiling point / boiling range	Comments: Not relevant.
Flash point	Comments: Not relevant.
Evaporation rate	Comments: Not relevant.
Flammability (solid, gas)	does not ignite
Vapour pressure	Comments: No data available.
Vapour density	Comments: No data available.
Density	Value: 1.948 g/cm³ Comments: ($CoSO4 \cdot 7H2O$)
Solubility	Medium: Water Value: 376,7 g/l Temperature: 20 °C
Partition coefficient: n-octanol/water	Comments: Not applicable.
Spontaneous combustability	Comments: Not applicable.
Decomposition temperature	Comments: No data available.
Viscosity	Comments: Not applicable. Solid
Explosive properties	Not explosive
Oxidising properties	no oxidizing

9.2. Other information

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity	No specific reactivity hazards associated with this product.

10.2. Chemical stability

Stability	Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.

10.4. Conditions to avoid

Conditions to avoid	Heat.

10.5. Incompatible materials

Materials to avoid	Strong oxidizing agents

10.6. Hazardous decomposition products

Hazardous decomposition products	Sulphurous gases (SOx). Cobalt oxides

Other information

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Other information regarding health hazards

Assessment of acute toxicity classification	LD50/oral/rat = 768 mg/kg
Assessment of skin corrosion / irritation, classification	Not classified as Corrosive. Causes serious eye irritation.
Sensitisation	May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.
Mutagenicity	Suspected of causing genetic defects.
Carcinogenicity	May cause cancer by inhalation. Animal experiments showed a statistically significant number of tumours. Concentration 0,3 mg/m3
Reproductive toxicity	May damage fertility
Assessment of specific target organ toxicity RE, classification	No data available.
Aspiration hazard, comments	Not relevant.

SECTION 12: Ecological information

12.1. Toxicity

Ecotoxicity	LC50/96t/mutu (Fathead minnows) = 3.61 mg/L (CoSO4) LC50/96h/Salmo gairdneri: 1.5 mg/l (CoCl2) NOEC: 351.4 mg/L (Fresh water , fish)(Chemical Safety Report) NOEC: 31802 mg/L (Sea water , fish) (Chemical Safety Report) EC/LC50: 0.61 mg/L (Fresh water , Invertebrates.) (Chemical Safety Report) EC/LC50: 2.23 mg/L(Sea water , Invertebrates.) (Chemical Safety Report)

12.2. Persistence and degradability

Persistence and degradability	No data available.

12.3. Bioaccumulative potential

Bioaccumulative potential	Cobalt water plants BCF: > 100 – 5000 Invertebrates. , Water BCF < 300 fish Fresh water BCF/BAF : <10 fish Sea water BCF/BAF : <10

12.4. Mobility in soil

Mobility	No data available.

12.5. Results of PBT and vPvB assessment

PBT assessment results	The PBT and vPvB criteria of Annex XIII to the regulation does not apply to inorganic substances.

12.6. Other adverse effects

Other adverse effects / Remarks	no data available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Specify the appropriate methods of disposal	Contaminated packaging should be emptied as far as possible. Packaging that cannot be cleaned should be disposed as special waste in compliance with local and national regulations.
Other Information	Contact manufacturer. Dispose of as special waste in compliance with local and national regulations.

SECTION 14: Transport information

14.1. UN number

Comments	UN3077

14.2. UN proper shipping name

Comments	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Cobalt sulphate)

14.3. Transport hazard class(es)

Class Code IMDG	9

14.4. Packing group

Comments	III

14.5. Environmental hazards

Comments	Environmentally hazardous substance – marine pollutant

14.6. Special precautions for user

Special safety precautions for user	None. Tunnel restriction code (-)

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Transport In Bulk Value (Yes/No)	No

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Legislation and regulations	Candidate list : Cobalt sulphate EC no 233-334-2 http://echa.europa.eu/web/guest/candidate-list-table

15.2. Chemical safety assessment

Chemical safety assessment performed	Yes

SECTION 16: Other information

List of relevant H-phrases (Section 2 and 3).	H302 Harmful if swallowed. H317 May cause an allergic skin reaction. H319 Causes serious eye irritation. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H341 Suspected of causing genetic defects H350i May cause cancer by inhalation. H360F May damage fertility. H400 Very toxic to aquatic life. H410 Very toxic to aquatic life with long lasting effects.
Classification according to Regulation (EC) No 1272/2008 [CLP / GHS]	Acute tox. 4; H302,H302 Eye Irrit. 2; H319,H319 Resp. Sens. 1A; H334,H334 Skin Sens. 1; H317,H317 Repr. 1B; H360F,H360F Muta. 2; H341,H341 Carc. 1B; H350i,H350i Aquatic Acute 1; H400,H400 Aquatic Chronic 1; H410,H410
Additional information	Disclaimer The information in this document is believed to be correct as of the date issued. However, no warranty of merchantability, fitness for any particular purpose, or any other warranty is expressed or is to be implied regarding the accuracy or completeness of this information, the results to be obtained from the use of this information or the product, the safety of this product, or the hazards related to its use. This information and product are furnished on the condition that the person receiving them shall make his own determination as to the suitability of the product for his particular purpose and on the condition that he assume the risk of his use thereof.
Key literature references and sources for data	Chemical Safety Report
Exposure scenario	ES_0_COBALT SULPHATE [FI-FIN].pdf

Safety Data Sheet

according to the (US) Hazard Communication Standard (29 CFR 1910.1200)

Revision date: 31.05.2023	*Version: 6.1*	*Print date: 31.05.2023*

SECTION 1: Identification

Product identifier

Trade name/designation:	Sulfuric acid 95-98%
Product No.:	BDH3074
Synonyms:	none
CAS No.:	7664-93-9

Relevant identified uses of the substance or mixture and uses advised against

Recommended use	For Further Manufacturing Use Only
Uses advised against	Not for Human or Animal Drug Use

Details of the supplier of the safety data sheet

Supplier

VWR International LLC

Street	100 Matsonford Road Radnor Corporate Center, Building One, Suite 200 P. O. Box 6660
Postal code/City	Radnor, PA 19087
Telephone	+1-800-932-5000 toll-free within US/Canada +1-610-386-1700
Telefax	+1-610-728-2103

Emergency phone number

Telephone +1-800-424-9300 (Chemtrec, 24 hrs/day, 7 days/week, USA)

Preparation Information

VWR International - Product Information Compliance

E-mail SDS@avantorsciences.com

SECTION 2: Hazard identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910.1200 (OSHA HCS)

Hazard classes and hazard categories	Hazard statements
Substance or mixture corrosive to metals, category 1	H290
Skin corrosion, category 1A	H314
Serious eye damage, category 1	H318

2.2 Label elements

Labelling in accordance with 29 CFR 1910.1200 (OSHA HCS)

Hazard pictograms



Signal word: Danger

Hazard statements	
H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.

Precautionary statements	
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P264	Wash … thoroughly after handling.
P234	Keep only in original container.
P301+P330+P331	IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P363	Wash contaminated clothing before reuse.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER/doctor/…
P321	Specific treatment (see … on this label).
P390	Absorb spillage to prevent material damage.
P405	Store locked up.
P406	Store in corrosive resistant container with a resistant inner liner.
P501	Dispose of contents/container to …

Hazard(s) not otherwise classified (HNOC)
none

SECTION 3: Composition/information on ingredients

3.1 Substances

not applicable

3.2 Mixtures

Hazardous ingredients Classification according to the OSHA Hazard Communication Standard 29 CFR 1910.1200

Substance name	Concentration	Identifier	Hazard classes and hazard categories
Sulfuric acid	93 - 98%	CAS No.: 7664-93-9	Met. Corr. 1 - H290 Skin Corr. 1A - H314

SECTION 4: First aid measures

4.1 Description of first aid measures

General information

IF exposed: Immediately call a POISON CENTER/doctor. If unconscious but breathing normally, place in recovery position and seek medical advice. Never give anything by mouth to an unconscious person or a person with cramps. Change contaminated, saturated clothing. Do not leave affected person unattended.

In case of inhalation

Immediately call a POISON CENTER/doctor. Remove casualty to fresh air and keep warm and at rest. If breathing is irregular or stopped, administer artificial respiration.

In case of skin contact

After contact with skin, wash immediately with plenty of water and soap. Remove contaminated, saturated clothing immediately. Immediate medical treatment required because corrosive injuries that are not treated are hard to cure.

After eye contact:

In case of contact with eyes flush immediately with plenty of flowing water for 10 to 15 minutes holding eyelids apart and consult an ophthalmologist. Protect uninjured eye. Remove contact lenses, if present and easy to do. Continue rinsing.

In case of ingestion

Immediately call a POISON CENTER/doctor. Do NOT induce vomiting. Rinse mouth thoroughly with water. Give nothing to eat or drink.

Self-protection of the first aider

First aider: Pay attention to self-protection!

4.2 Most important symptoms/effects, acute and delayed

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Causes severe skin burns and eye damage. After inhalation: Cough. Dyspnoea. Pulmonary oedema. After skin contact: Causes poorly healing wounds. Occurrence of severe chemical burns resembling a burn. After eye contact: Risk of blindness. After ingestion: Risk of stomach perforation if swallowed.

4.3 Indication of any immediate medical attention and special treatment needed

After inhalation, immediate application of glucocorticoids (inhalative), administration of oxygen and immobilization of the affected person are indicated. If necessary, all further measures of pulmonary edema prophylaxis. After vapor inhalation cardiovascular and pulmonary functions should be carefully monitored. After decontamination of the skin pain treatment and shock prophylaxis. After swallowing: Do not induce vomiting. No oral administration of fluids, activated charcoal, or laxatives, no gastric lavage, but aspiration of the fluid from the stomach via a nasogastric tube, avoiding intubation, if this is possible within 60 minutes.

SECTION 5: Fire fighting measures

5.1 Extinguishing media

Suitable extinguishing media

Co-ordinate fire-fighting measures to the fire surroundings.
Water spray.
ABC-powder
Carbon dioxide (CO2).
Nitrogen

Extinguishing media which must not be used for safety reasons

Full water jet

5.2 Specific hazards arising from the chemical

Fire may produce irritating, corrosive and/or toxic gases.
In case of fire may be liberated:
Sulphur oxides

5.3 Advice for firefighters

Non-combustible corrosive substances (liquid).
Causes severe skin burns and eye damage.

In case of fire and/or explosion do not breathe fumes.
Protective equipment and precautions for firefighters:
Wear a self-contained breathing apparatus and chemical protective clothing.
Use water spray/stream to protect personnel and to cool endangered containers.
DO NOT fight fire when fire reaches explosives.
Do not allow run-off from fire-fighting to enter drains or water courses.
Do not inhale explosion and combustion gases.
Use caution when applying carbon dioxide in confined spaces. Carbon dioxide can displace oxygen.
Use water spray/stream to protect personnel and to cool endangered containers.
In case of fire: Evacuate area.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel: Wear personal protection equipment (refer to section 8). Avoid contact with skin, eyes and clothes. Remove victim out of the danger area. Stop leak if safe to do so. Provide adequate ventilation. First Aid, decontamination, treatment of symptoms.

6.2 Environmental precautions

Avoid release to the environment. Do not allow to enter into surface water or drains. Cover drains. Advise Authorities if spillage has entered water course or sewer or has contaminated soil or vegetation.

6.3 Methods and material for containment and cleaning up

Large spills: Dike or dam to contain for later disposal. Take up mechanically, placing in appropriate containers for disposal. Take precautionary measures against static discharges. Small spills: Absorb with liquid-binding material (sand, diatomaceous earth, acid- or universal binding agents). Dispose according to legislation.

6.4 Reference to other sections

Personal protection equipment (PPE): see section 8 Disposal information: see section 13

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advices on safe handling
Use extractor hood (laboratory).
Use only in well-ventilated areas.
Avoid breathing dust/fume/gas/mist/vapors/spray.
Avoid contact with eyes and skin.
Use personal protective equipment as required.
Measures to prevent fire, aerosol and dust generation
Usual measures for fire prevention.
Use only in well-ventilated areas.
Measures required to protect the environment
Do not empty into drains.
Collect spillage.

Wash hands before breaks and after work. Avoid contact with eyes and skin. When using do not eat, drink or smoke. Provide eye shower and label its location conspicuously.

7.2 Conditions for safe storage, including any incompatibilities

Recommended storage temperature: 15-25 °C

Store in a well-ventilated place. Keep container tightly closed. Packaging materials: High density polyethylene (HDPE) Unsuitable container/equipment material: Metal container

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredient (Designation)	Source	Country	parameter	Limit value
Sulfuric acid	NIOSH	US	LTV	1 mg/m³
Sulfuric acid	OSHA	US	LTV	1 mg/m³

8.2 Engineering controls

Appropriate engineering controls

Technical measures and the application of suitable work processes have priority over personal protection equipment. If handled uncovered, arrangements with local exhaust ventilation have to be used.

Personal protection equipment (PPE)

Wear suitable protective clothing. When handling with chemical substances, protective clothing must be worn.

Eye/face protection

Eye glasses with side protection

Skin protection

Wear suitable gloves. When handling with chemical substances, protective gloves must be worn. In the case of wanting to use the gloves again, clean them before taking off and air them well. Check leak tightness/impermeability prior to use.

By short-term hand contact	
Suitable material:	NBR (Nitrile rubber)
Thickness of the glove material:	0,12 mm
Breakthrough time	480 min

By long-term hand contact	
Suitable material:	NBR (Nitrile rubber)
Thickness of the glove material:	0,38 mm
Breakthrough time	480 min

Respiratory protection

Respiratory protection necessary at: aerosol or mist formation If exposure limits are exceeded or irritation is experienced, NIOSH approved respiratory protection should be worn.

Additional information

Wash hands before breaks and after work. Avoid contact with eyes and skin. When using do not eat, drink or smoke. Provide eye shower and label its location conspicuously.

Environmental exposure controls
no data available

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

(a) Appearance	
Physical state:	liquid
Color:	colorless
(b) Odor:	no data available
(c) Odor threshold:	no data available

Safety relevant basic data

(d) pH:	no data available
(e) Melting point/freezing point:	-32 °C
(f) Initial boiling point and boiling range:	279 °C (1013 hPa)
(g) Flash point:	no data available
(h) Evaporation rate:	no data available
(i) Flammability (solid, gas):	not applicable
(j) Flammability or explosive limits	
Lower explosion limit:	no data available
Upper explosion limit:	no data available
(k) Vapor pressure:	no data available
(l) Vapor density:	no data available
(m) Density:	1.835 g/cm³ (20 °C)
(n) Solubility(ies)	
Water solubility:	soluble (20°C)
(o) Partition coefficient: n-octanol/water:	no data available
(p) Auto-ignition temperature:	no data available
(q) Decomposition temperature:	340 °C (1013 hPa)
(r) Viscosity	
Kinematic viscosity:	no data available
Dynamic viscosity:	11.0 mPa*s (25 °C)
(s) Explosive properties:	not applicable
(t) Oxidising properties:	not applicable
(u) Particle characteristics:	does not apply to liquids

9.2 Other information

Bulk density:	no data available
Refraction index:	no data available
Dissociation constant:	no data available
Surface tension:	no data available
Henry's Law Constant:	no data available

SECTION 10: Stability and reactivity

10.1 Reactivity

Corrosive to metals
Strong dehydrating effect (hygroscopic).

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature).
Reacts with water in an unusual or dangerous manner

10.3 Possibility of hazardous reactions

Explosive reaction with:
Alkali metals
Alkaline earth metal
Alkali (lye)
Violent reaction with:
light metals
Powdered metals
Exothermic reaction with:
Water.
Substance, organic

10.4 Conditions to avoid

Humidity

10.5 Incompatible materials

Metal.

10.6 Hazardous decomposition products

no data available

10.7 Additional information

no data available

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute effects
Acute oral toxicity:
Sulfuric acid - LD50: > 2140 mg/kg - Rat - (Merck KGaA)

Acute dermal toxicity:
no data available

Acute inhalation toxicity:
Sulfuric acid - LC50: 375 mg/m³ - Rat - (IUCLID)

Irritant and corrosive effects:
Primary irritation to the skin:
Causes severe skin burns and eye damage.

Irritation to eyes:
Causes serious eye damage.

Irritation to respiratory tract:
not applicable

Respiratory or skin sensitization
In case of skin contact: not sensitizing
In case of inhalation: not sensitizing

STOT-single exposure
not applicable

STOT-repeated exposure
not applicable

CMR effects (carcinogenicity, mutagenicity and toxicity for reproduction)
Carcinogenicity
No indication of human carcinogenicity.

Germ cell mutagenicity
No indications of human germ cell mutagenicity exist.

Reproductive toxicity
No indications of human reproductive toxicity exist.

Aspiration hazard
not applicable

Other adverse effects
no data available

Additional information
no data available

SECTION 12: Ecological information

12.1 Ecotoxicity

Fish toxicity:
no data available

Daphnia toxicity:
Sulfuric acid - LC50: 42.5 mg/l (48 h) - Portmann, J.E., and K.W. Wilson 1971. The Toxicity of 140 Substances to the Brown Shrimp and Other Marine Animals. Shellfish Information Leaflet No.22 (2nd Ed.), Ministry of Agric.Fish.Food, Fish.Lab.Burnham-on-Crouch: 12p.

Algae toxicity:
no data available

Bacteria toxicity:
no data available

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
Partition coefficient: n-octanol/water: no data available

12.4 Mobility in soil:
no data available

12.5 Results of PBT/vPvB assessment
not applicable

12.6 Endocrine disrupting properties
This product does not contain a substance that has endocrine disrupting properties with respect to the environment.

12.7 Other adverse effects
no data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Appropriate disposal / Product
Dispose according to legislation. Consult the appropriate local waste disposal expert about waste disposal. Product is an acid. Before disposal it needs to be neutralised.

Waste code product: no data available

Appropriate disposal / Package
Dispose according to legislation. Handle contaminated packages in the same way as the substance itself.

Additional information
no data available

SECTION 14: Transport information

Land transport (DOT)

UN-No.:	UN1830
Proper Shipping Name:	SULFURIC ACID
Class(es):	8
Hazard label(s):	8
Packing group:	II
Environmental hazards:	No
Marine pollutant:	No
Special precautions for user:	

Sea transport (IMDG)

UN-No.:	1830
Proper Shipping Name:	SULPHURIC ACID
Class(es):	8
Hazard label(s):	8
Packing group:	II
Environmental hazards:	No
Marine pollutant:	No
Special precautions for user:	
Segregation group:	1
EmS-No.	F-A S-B

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
not relevant

Air transport (ICAO-TI / IATA-DGR)

UN-No.:	1830
Proper Shipping Name:	SULPHURIC ACID
Class(es):	8
Classification code:	
Hazard label(s):	8
Packing group:	II
Special precautions for user:	

SECTION 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Toxic Substances Control Act (TSCA)

- Sulfuric acid - CAS No.: 7664-93-9

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
Does not contain listed substances.

SARA 313 Components
- Sulfuric acid - CAS No.: 7664-93-9

US State Regulations

Massachusetts Right To Know Components
- Sulfuric acid - CAS No.: 7664-93-9

Pennsylvania Right To Know Components
- Sulfuric acid - CAS No.: 7664-93-9

New Jersey Right To Know Components
- Sulfuric acid - CAS No.: 7664-93-9

California Prop. 65 Components

Does not contain listed substances.

SECTION 16: Other information

Abbreviations and acronyms

ACGIH - American Conference of Governmental Industrial Hygiensts
DOT - Department of Transportation
IARC - International Agency for Research on Cancer
IATA-DGR - International Air Transport Association-Dangerous Goods Regulations
ICAO-TI - International Civil Aviation Organization-Technical Instructions
IMDG - International Maritime Code for Dangerous Goods
LTV - Long Term Value
NIOSH - National Institute for Occupational Safety and Health
NTP - National Toxicology Program
OSHA - Occupational Safety & Health Administration
PBT - Persistent, Bioaccumulative and Toxic
PEL - Permissible Exposure Limit
STV - Short Term Value
SVHC - Substances of Very High Concern
TDG - Transport of Dangerous Goods
TLV - Threshold Limit Value
vPvB - very Persistent, very Bioaccumulative

Key literature references and sources for data

This Safety Data Sheet has been prepared based on information available for public as TOXNET information, European Chemicals Agency (ECHA) substance dossier, papers from international cancer research institutes (IARC Monographs), U.S. National Toxicology Program data, U.S. Agency for Toxic Substances and Disease Control (ATSDR), PubChem websites and SDS from our raw material manufacturers.

Revision date	Version	Print date
31.05.2023	6.1	31.05.2023

Additional information

Indication of changes	Section 2: Revision of P-phrases, review and revision of Sections 4, 5, 6, 7 and 10. If you need an explanation of the change, contact the supplier (SDS@avantorsciences.com).

The above information is believed to be correct but does not purport to be all-inclusive and shall be used only as a guidance. The information in this document is based on the present state knowledge and is applicable to the product with regard to appropriate safty precautions. It does not represent any guarantee of the properties of the product. VWR International and his Affiliates shall not be held liable for any damage resulting from handling.

TEXAS LIME COMPANY
SAFETY DATA SHEET

1. Product and Company Identification

Product Name: Lime Kiln Dust CaO

Other Means of Identification: LKD, Cyclone Dust, Hi-Cal Lime Kiln Dust

Recommended Use:
Environmental: suitable for drying and chemically stabilizing many wastes, including heavy metal contamination.
Civil engineering: soil stabilization to improve the quality of problematic soils.
Agricultural: Use in light doses and makes an excellent ag lime because of the high calcium lime component.
List is not all inclusive.

Company Identification:

Texas Lime Company
P.O. Box 76031
Cleburne, TX 76031

Information: (817) 641-4433

Emergency: (800) 772-8000

2. Hazards Identification

Hazard Classification: Eye Damage Category -1, Skin Irritation Category -2, Specific Target Organ Toxicity Singe Exposure 3 (Respiratory Syatem), Carcinogen – 1.

Emergency Overview: Lime Kiln Dust is an odorless white or grayish-white granular powder. Contact can cause irritation to eyes, skin, respiratory system, and gastrointestinal tract. LKD may react violently with water, releasing heat which may ignite combustible materials in certain instances.

Potential Health Effects

Eyes: Contact can cause severe irritation or burning of eyes, including permanent damage.

Skin: Contact can cause severe irritation or burning of skin, especially in the presence of moisture.

Ingestion: This product can cause severe irritation or burning of gastrointestinal tract if swallowed.

Inhalation: This product can cause severe irritation of the respiratory system. Long-term exposure may cause permanent damage. Lime Kiln Dust is not listed by MSHA, OSHA, or IARC as a carcinogen, but this product may contain trace amounts of crystalline silica in the form of quartz or crystobalite, which has been classified by IARC as (Group I) carcinogenic to humans when inhaled. Inhalation of silica can also cause a chronic lung disorder, silicosis.

Medical Conditions Aggravated by Exposure: Contact may aggravate disorders of eyes, skin, gastrointestinal tract, and respiratory system.

Potential Environmental Effects: This material is alkaline and if released into water or moist soil will cause an increase in pH.

Signal Word: Danger

Hazard Statements: Danger! Causes skin irritation. Causes serious eye damage. May cause cancer through inhalation. May cause respiratory irritation. Reacts violently with water releasing heat which can ignite combustible materials. Causes damage to lungs through prolonged or repeated exposure.

Symbols:



Precautionary Statements:

Do not breathe dust. Do not eat, drink or smoke when using this product.

Wear protective gloves and eye protection. Wash exposed skin thoroughly after handling. Avoid breathing dust. Use only outdoors or in a well-ventilated area. Keep only in original container. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.

If on skin; wash exposed skin with plenty of water. If skin irritation occurs: Get medical attention. Take off contaminated clothing and wash it before reuse.

If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing. Seek medical attention immediately. In Inhaled: Remove person(s) to fresh air and keep comfortable for breathing. Seek medical attention if you feel unwell.

If exposed or concerned: Get medical advice.

Store in a corrosive resistant container. Do not store or ship in aluminum container.

Dispose of contents or containers in accordance with applicable regulations. Do not use water on material spills.

Hazards not otherwise classified: Lime Kiln Dust can react violently with water, releasing heat which can ignite combustible materials.

Ingredients with unknown toxicity: Not Applicable

3. Composition/Information on Ingredients

Component	CAS #	% by weight
Calcium Oxide	1305-78-8	55% - 80%
Magnesium Oxide	1309-48-4	<1 %
Crystalline Silica	14808-60-7	<2%

4. First Aid Measures

Eyes: Contact can cause severe irritation or burning of eyes, including permanent damage. Immediately flush eyes with generous amounts of water for at least 15 minutes. Pull back the eyelid to ensure that all lime dust has been washed out. Seek medical attention immediately. Do not rub eyes.

Skin: Contact can cause severe irritation or burning of skin, especially in the presence of moisture. Wash exposed area with large amounts of water. Seek medical attention immediately.

Ingestion: This product can cause severe irritation of the gastrointestinal tract if swallowed. Do not induce vomiting. Seek medical attention immediately. Never give anything by mouth unless instructed to do so by medical personnel.

Inhalation: This product can cause severe irritation of the respiratory system. Move victim to fresh air. Seek medical attention if necessary. If breathing has stopped, give artificial respiration.

Most important symptoms and effects, both acute and delayed: Irritation of skin, eyes, gastrointestinal tract or respiratory tract. Long-term exposure by inhalation may cause permanent damage. This product contains crystalline silica, which has been classified by IARC as (Group 1) carcinogenic to humans when inhaled. Inhalation of silica can also cause a chronic lung disorder, silicosis.

Indication of any immediate medical attention and special treatment needed: See first aid information above. Note to Physicians: Provide general supportive measures and treat symptomatically.

5. Fire Fighting Measures

Extinguishing Media: Use dry chemical fire extinguisher. Do not use water or halogenated compounds, except that large amounts of water may be used to deluge small quantities of quicklime.

Fire Hazards: Quicklime is not combustible or flammable. However, quicklime reacts violently with water, and may release heat sufficient to ignite combustible materials in certain instances. Quicklime is not considered to be an explosion hazard, although reaction with water or other incompatible materials may rupture containers.

Hazardous Combustion Products: None.

Special Protective Equipment and Fire Fighting Instructions: Keep personnel away from and upwind of fire. Wear full fire-fighting turn-out gear (full Bunker gear), and respiratory protection (SCBA).

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Spill /Leak Procedures: Do NOT use water on bulk material spills. Lime reacts violently with water, releasing heat. Use proper protective equipment.

Small Spills: Use dry methods to collect spilled materials. Avoid generating dust. Do not clean up with compressed air. Store collected materials in dry, sealed plastic or metal containers. Residue on surfaces may be water washed.

Large Spills: Use dry methods to collect spilled materials. Evacuate area downwind of clean-up operations to minimize dust exposure. Store spilled materials in dry, sealed plastic or metal containers.

Methods and materials for containment and cleaning up

Containment: For large spills, as much as possible, avoid the generation of dusts. Prevent release to sewers or waterways.

Cleanup: Residual amounts of material can be flushed with large amounts of water. Equipment can be washed with either a mild vinegar and water solution, or detergent and water.

7. Handling and Storage

Precautions for Safe Handling: Keep in tightly closed containers. Protect containers from physical damage. Avoid direct skin contact with the material.

Conditions for Safe Storage, including incompatibilities: Store in a cool, dry, and well-ventilated location. Do not store near incompatible materials (see Section 10 below). Keep away from moisture. Do not store or ship in aluminum containers.

8. Exposure Controls/Personal Protection

Component	CAS #	Exposure Limits
Calcium Oxide	1305-78-8	OSHA PEL: 5 mg/m3 ACGIH TLV: 2 mg/m3
Magnesium Oxide	1309-48-4	OSHA PEL: 10 mg/m3 ACGIH TLV: 10 mg/m3
Crystalline Silica	14808-60-7	OSHA PEL: 10 mg/m3 divided by % quartz + 2 (respirable fraction) ACGIH TLV: 0.025 mg/m3 (respirable)

Engineering Controls: Provide ventilation adequate to maintain PELs.

Individual Protection Measures

Respiratory Protection: Use NIOSH/MSHA approved respirators if airborne concentration exceeds PEL.

Skin Protection: Use appropriate gloves to prevent skin contact. Where there is a risk of skin contact, wear suitable clothing to prevent such contact.

Eye Protection: Use safety glasses with side shields or safety goggles. Contact lenses should not be worn when working with lime products.

Other: Eye wash fountain and emergency showers are recommended.

9. Physical and Chemical Properties

Appearance: White or grayish-white material. **Physical State**: Solid

Odor: Odorless **Odor threshold:** Not applicable

pH at 25 degrees C: 12.45 appox. **Boiling Point**: NA

Melting Point: 4658° F, 2570° C **Flash Point:** Not Applicable

Evaporation Rate: NA **Flammability:** NA

Upper/Lower flammability or explosive limits: NA

Vapor Pressure: N/A **Vapor Density**: N/A

Relative Density: NA **Auto-ignition temperature:** NA

Solubility in Water: Reacts with water to produce Ca(OH)2 and large amounts of heat.
Partition co-efficient: n-octanol/water

Decomposition temperature: NA **Viscosity:** NA

10. Stability and Reactivity

Stability: Chemically stable and reacts vigorously with water to form calcium hydroxide, releasing heat. LKD also reacts with carbon dioxide to form calcium carbonate. See also Incompatibility below.

Chemical stability: LKD is chemically stable

Possibility of hazardous reactions: See above

Conditions to Avoid: Do not allow LKD to come in contact with incompatible materials.

Incompatibility: LKD should not be mixed or stored with the following materials, due to the potential for violent reaction and release of heat:

WATER (unless in a controlled process)
ACIDS (unless in a controlled process)
REACTIVE FLUORIDATED COMPOUNDS
REACTIVE BROMINATED COMPOUNDS
REACTIVE POWERED METALS
ORGANIC ACID ANHYDRIDES
NITRO-ORGANIC COMPOUNDS
REACTIVE PHOSPHOROUS COMPOUNDS
INTERHALOGENATED COMPOUNDS

11. Toxicological Information:

Information on the likely routes of exposure: See First Aid discussion above.

Symptoms related to the physical, chemical and toxological characteristics: See Frist Aid discussion above

Delayed and immediate effects and also chronic effects of exposure: See First Aid discussion above.

Numerical measures of toxicity: No LD50/LC50 has been identified for this product's components.

Carcinogen listing: LKD is not listed by MSHA, OSHA, or IARC as a carcinogen, but this product may contain trace amounts of crystalline silica, which has been classified by IARC as carcinogenic to humans when inhaled in the form of quartz or crystobalite.

12. Ecological Information:

Eco toxicity: Because of the high pH of this product, it would be expected to produce significant Eco toxicity upon exposure to aquatic organisms and aquatic systems in high concentrations.

Environmental Fate: This material shows no bioaccumulation effect or food chain concentration toxicity.

Persistence and degradability:

Bio accumulative: This material shows no bioaccumulation effect or food chain concentration toxicity.

Mobility in soil: High pH values will radidly decrease over time as a result of recarbonation and will show very little mobility in soils.

Other adverse effects (such as hazardous to the ozone layer): This material is alkaline and if released into water or moist soil will cause an increase in pH.

13. Disposal Considerations:

Dispose of in accordance with all applicable federal, state, and local environmental regulations. If this product as supplied, and unmixed, becomes a waste, it will not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act.

14. Transportation Information:

UN number: UN1910 **UN Proper shipping name:** Calcium Oxide Mixture

Transport hazard class: Hazard Class 8-Corrosive - When transported by air only

Packing group: Packing Group III - When transported by air only

Environmental hazards (e.g. Marine pollutant) (Yes/No): This material is alkaline and if released into water or moist soil will cause an increase in pH.

Transport in bulk (according to Annex II of MARPOL 73/79 and the IBC Code:

Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises: When being transported by air, quicklime is classified in the Department of Transportation (DOT) regulations as a hazardous material. (49 CFR 172.101. For aircraft transport only, Calcium Oxide is classified as Hazard Class 8-Corrosive, UN1910, Packing Group III. For passenger aircraft, the maximum net quantity allowed per container is 25 kg. For cargo aircraft, the maximum net quantity allowed per container is 100 kg. For quantities greater than 25 kg up to and including 100 kg, the container shall be labeled with CARGO AIRCRAFT ONLY.) Because express carriers (i.e., Federal Express, Airborne Express, and United Parcel Service) ship by air, quicklime presented to these carriers for shipment must be packaged, marked, and labeled in accordance with IATA requirements, and must be accompanied by the appropriate shipping documentation. Only personnel trained and certified under applicable DOT Hazardous Materials Regulations (contained in Title 49 of the Code of Federal Regulations) may prepare any quicklime product for air transport.

LKD is not classified as a hazardous material by DOT when transported by means other than by air.

15. Regulatory Information:

EPA Regulations:

RCRA Hazardous Waste Number: not listed (40 CFR 261.33)
RCRA Hazardous Waste Classification (40 CFR 261): not classified
CERCLA Hazardous Substance (40 CFR 302.4) unlisted specific per RCRA, Sec. 3001; CWA, Sec. 311 (b) (4); CWA, Sec. 307(a), CAA, Sec. 112
CERCLA Reportable Quantity (RQ), not listed.
SARA 311/312 Codes: not listed.
SARA Toxic Chemical (40 CFR 372.65): not listed.
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed, Threshold Planning Quantity (TPQ): not listed.
All chemical ingredients are listed on the USEPA TSCA Inventory List.

OSHA/MSHA Regulations:

Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): 5 mg/M^3 TWA-8
MSHA: not listed.
OSHA Specifically Regulated Substance (29CFR 1910) not listed.

State Regulations: Consult state and local authorities for guidance.

HMIS: Health Risks 3, Flammability 0, Reactivity 1, Personal Protection, E

NFPA: Health Hazard 3, Fire Hazard 0, Reactivity 0

16. Other Information:
Date of preparation or last revision of this Safety Data Sheet: 05/19/2015

APPENDIX P

SWPPP & SPCC



Milford Mining Company Utah, LLC

Stormwater Pollution Prevention Plan *(SWPPP)*

Prepared By:
Milford Mining Company Utah, LLC.
1208 South 200 West
P.O. Box 608
Milford, Utah 84751

March 2024

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APPENDICES

Appendix A Multi-Sector General Permit and Notice of Intent
Appendix B Location and Site Maps
Appendix C Blank Monthly/Quarterly Visual Inspection Form
Appendix D Completed Monthly Visual Inspections Forms
Appendix E Blank Annual Site Compliance Evaluation Report
Appendix F Completed Annual Site Compliance Evaluation Reports

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Appendix H Completed Quarterly Visual Monitoring Report Forms
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Appendix K Completed Storm Water Discharge Monitoring Reports
Appendix L Spill and Spill Cleanup Reports and Summaries
Appendix M Spill and Spill Cleanup Reports and Summaries (non-hydrocarbon spills)
Appendix N Results of chemical testing on water, overburden, and tailings
Appendix O ASPT Classification
Appendix P Employee Training Records

1.0 Introduction

The purpose of this Storm Water Pollution Prevention Plan (SWPPP) is to comply with Utah Division of Water Qualities (UDWQ) Multi-Sector General Storm Water Permit (MSGP) (UTRI00264), and the industry-specific requirements from MSGP Appendix II.G, *Storm Water Discharges Associated With Industrial Activity From Metal Mining (Ore Mining and Dressing) Facilities.* A copy of the MSGP is located in Appendix A of this SWPPP. A copy of the Notice of Intent requesting coverage is also included in Appendix A.

The purpose of this SWPPP is to identify and prescribe storm water pollution prevention measures or best management practices (BMPs). When constructed and implemented, the BMPs will minimize or eliminate the transport of pollutants generated by the facility to off-site surface water bodies. Revisions to the SWMP and the BMPs will be made at prescribed intervals when operational changes occur and/or as site conditions warrant.

Figures 1 and 2 are location and general site maps, respectively. **Figures 3 and 4** show more detailed information about drainage and BMP structures that have been constructed and are maintained to control storm water that contacts ore and tailings, loose overburden and soil, mining equipment, supplies, materials, and other potential sources of pollution.

1.1 Project Description

The Milford Mining Company Utah, LLC (Operator) Milford Copper Operation (Project; MCO) is located in portions of Sections 5-8, 14-23, 26, 31, 33, and 34 of Township 27 South, Range 11 West, and portions of Sections 1, 2, 11, 12, 13, 14, 23, and 24 of Township 27 South, Range 12 West, Salt Lake Base & Meridian. All sections are located in Beaver County, Utah. Total, this area is approximately 16,640 acres. Proposed impact from mining by the Operator according to the 2015 DOGM NOI is approximately 600 acres. Cumulative impact including previous mining activities and current mining activities within the project is approximately 700 acres.

The Universal Transverse Mercator Geographic Coordinate System (UTM) coordinates for the Mine operations are: Zone 12 Northing 4261885, Easting 314950.

This project is NOT located on designated tribal lands. This project is NOT a federal facility.

Copper and silver are mined from open pits within the MCO using standard mining equipment. At all times berms are maintained along the top of active waste dumps to comply with Mine Safety Health Administration (MSHA) standards, and to redirect water flow back into the pits, instead of allowing the runoff to flow off the dump slopes, which would cause off-site sedimentation and weaken the slope integrity.

Prior to new lands being disturbed, topsoil is removed and stockpiled for later reclamation use. Several topsoil stockpiles exist in the project area. These stockpiles are located near each corresponding area of disturbance. The stockpiles are rounded, support a cover of

vegetative species at a cover percentage similar to surrounding native lands and thus are non-erosive under normal rainfall patterns. In the event of a major rainstorm, any topsoil washed from the stockpiles would be deposited directly adjacent to the stockpiles and would be re-collected once conditions allowed and placed back on the piles.

Mining includes blasting of overburden in place. Overburden rock sizes range from 3 ft. in diameter to minus-½ inch. Blasted overburden is transported out of the pits via loader and/or excavator and 60-ton or 100-ton haul trucks to the respective waste dumps. Exposed ore is then blasted and loaded into 60-ton and 100-ton haul trucks and hauled to the mill. Here, the ore is crushed to minus 10 mesh, then sent to a ball mill to be ground to 150-200 mesh. After the ore is ground in the ball mill, it goes to magnetic separation.

The non-magnetic material moves to the conditioning, reagent, and mixing circuit, where it flows by gravity tank-to-tank, and then into the flotation and thickening circuit. The concentrate is then skimmed off and filtered before being shipped via truck as a concentrate to offsite facilities for further processing.

Currently flotation tailings are sent via pipeline to the acid-leach/counter-current decantation (CCD) circuit where it will undergo leaching with a sulfuric acid solution. The resultant copper-bearing pregnant leach solution (PLS) will be processed in the adjacent SX/EW circuit. Solvent extraction is a process that reacts the copper-bearing weak acid solution with an organic solvent similar to kerosene. The reaction process effectively replaces the copper in the acid solution with hydrogen ion from the organic solvent. In turn, the copper is complexed with the organic solvent. When the extraction to organic solution is completed, the copper is then extracted from the organic solvent using a concentrated sulfuric acid solution, resulting in dissolved copper sulfate. This acid solution is processed electrochemically, in a process known as electrowinning, which results in electroplating to produce copper metal cathodes. The cathodes will be shipped and sold to metal brokers or other end users.

Tailings from the ore beneficiation will be neutralized and sent via pipeline to the intermediate tailings disposal facility (ITDF), which is located in two small canyons east of the process facilities.

No section 313 Water Priority Chemicals (40 CFR 372.65) are used on site, thus there is no need to comply with storm water permit provisions for 313 chemicals. Chemical analyses of soils were completed in 2011, and processed ore and tailings were analyzed in 2013. Results of these tests are included in **Appendix O**.

1.2 Watershed Description

The MCO consists of private land which includes land owned by the Operator and land owned by other entities, state land, and federal land. The mines within the MCO are located on the southern slopes of the Rocky Range Mountains, encompassed within the

Hickory Wash (160300070605) and Beaver Bottoms-Beaver River (160300070610) watersheds. The facilities and tailings ponds are located near the southern portion of the Beaver Lake Mountains, encompassed within the Beaver Lake Mountains (160300070607) watershed (USGS, 2013).

The Hickory Wash watershed is approximately 12,538 acres, with runoff from the Frisco Mountains, Beaver Lake Mountains, and Rocky Range Mountains draining into the Beaver River. The Beaver Bottoms-Beaver River watershed is approximately 17,733 acres, with runoff from the Rocky Range Mountains and Bailey Ridge draining into the Beaver River. The Beaver Lake Mountains watershed is approximately 10,117 acres, with runoff from the Beaver Lake Mountains and Rocky Range Mountains draining into the Beaver River (EPA, 2013).

The entire MCO is located in the Beaver Bottoms-Upper Beaver sub-basin of the Escalante Desert-Sevier Lake Basin. The Escalante Desert-Sevier Lake Basin is bounded on the east by the Escalante Mountains, the Awapa Plateau, and the Wasatch Plateau, and extends west to the House Range, Wah Wah Mountains, Indian Peak Range, and Needle Range. It is bounded on the north by the Tintic Mountains and Mount Nebo, and extends south to the Paunsaugunt and Markagunt plateaus and the Pine Valley Mountains (Banner, et. al., 2009).

Most storm water and snowmelt intercepted by lands above the pits infiltrates or evaporates prior to intercepting the pits. However, a small amount of this water may collect in the pits after a heavy rain, where it stands until it either infiltrates or evaporates.

Storm water and snowmelt are intercepted by existing waste dumps created by recent and past mining and generally infiltrates into these porous surfaces that are a mix of fine and coarse materials. Although many of these waste dumps have been in place for over five years, there is no visible evidence that storm water collects in sufficient volumes on the dumps to flow off or through the dumps at a significant volume. This statement is based on the fact that there is no or very little evidence of a) gullying/rilling on the sides of the dumps, or b) water infiltration of sufficient volume to move through the dumps and exit out the base of the dumps via seeps or flows.

However, storm water intercepted by hardened surfaces such as roads, ready lines, and stockpile pads do shed water after significant precipitation and snowmelt events. The MCO is designed so that storm water falling on, or flowing onto, these areas is captured by the pits or tailings ponds or is directed to ditches located along the outer edges of the haul roads throughout the MCO. Sediment and storm water remain within these areas, with the water evaporating or infiltrating.

As stated above, all haul roads are ditched, and when the grade increases to above two percent, water turn-outs are constructed to prevent erosion of the road base. The ditches and turn-outs are inspected on a daily basis. The ditches are maintained to allow free passage of water to the low points.

1.3 Storm Water Management Team

A key to implementing this SWPPP is the identification of a Storm Water Pollution Prevention Plan team. The team is responsible for developing, implementing, maintaining, and revising the SWPPP for the Operator, and is composed of the Operator's personnel. These individuals are empowered with the ability to commit company resources and to implement action items identified in and required by the SWPPP. The names and specific assignments of the main team members are listed **Table 1**. Additional team members may be assigned on an as-needed basis.

Table 1: Storm Water Management Team

TEAM MEMBER	TITLE	RESPONSIBILITY
Brendan Moseley	CEO	Responsible party Signatory for certifications
John Ngyuen, Rob Clark	Mine Manager, Process Manager	Technical support Contractor supervision
Robert Covington Greg Guzzle	HSE Manager Environmental Engineer	Plan Revisions Oversight on regulatory submittal Annual site compliance evaluation Inspection oversight Inspections On-site spill response Record keeping Employee Training
Ward Thurman, Chris Wright	Mill Superintendent, Maintenance Supervisor	Maintenance oversight BMP Implementation scheduling Maintenance of BMPs

2.0 Operations and Site-Specific BMPs

The operations that occur within the MCO have been categorized into five main categories:

- Process Facilities (green on Figure 2)
- Haul Roads and parking areas (grey on Figure 2)
- Active Mine Areas (yellow on Figure 2)
- Inactive Mine Disturbance (pink on Figure 2)
- Truck Shop (orange on Figure 2)

This section outlines the potential pollutant sources within each activity area, and how the Operator plans to enforce this SWPPP using a variety of area-specific BMPs.

2.1 Process Facilities

The Process Facilities area includes the ore handling and milling circuits, flotation tailings pond, ITDF, mill boneyard, and surrounding roads, **highlighted green on Figure 2**. The outdoor ore processing activities includes the conveying, crushing, and finally the stockpiling of copper ore. Ore is then beneficiated in an enclosed building. The ore undergoes grinding in ball mills, magnetic separation, and flotation. The magnetite that is removed during the magnetic separation process is stockpiled outdoor within the Process Facilities activity area. The final copper concentrate is also stockpiled outdoor within the Process Facilities activity area, until it is collected in trucks and hauled off site for further processing. The tails from the flotation process is sent to the acid leach/CCD and SX/EW circuits. Tails from the acid leach/CCD circuit is neutralized of any residual acid then pumped to the ITDF. All water from the beneficiation process is recycled back through the circuit, or from the ITDF.

There is a boneyard located in the northern portion of the Process Facilities activity area, where obsolete equipment and scrap is stored for later use, or until enough scrap is built up to warrant hauling offsite.

Any runoff from the watershed above the entire Process Facilities activity area are re-directed west-and then south-ward along the western side of the Process Facilities via diversion berm and ditch system. The water is eventually intercepted by a natural drainage located to the west of all disturbances. Runoff from the watershed above the ITDF is diverted to the west and/or east of the ITDF, where the water eventually flows into natural drainages along the perimeter of the ITDF. The diversion ditches around the facilities and ITDF area are designed to divert all water away from the areas of activity.

2.1.1 Run-of-mine and Ore Concentrate Storage

The run-of-mine (ROM) ore, copper concentrate, and magnetite concentrate stockpiles are all located within a bermed ore handling area. This area is located on relatively flat land, with a slight down-gradient to the south.

Potential pollutants from the stockpiles, since they are uncovered, include dust debris, especially during windy days, and sediment transport during precipitation events. The BMPs implemented for the stockpiles include:

- creating diversion ditches around the stockpiles, which direct runoff away from the stockpiles and south to sumps located north of the flotation pond
- spraying the stockpiles using the water truck during dry, windy days

2.1.2 Flotation Tailings Pond

The flotation tailings pond is located in the southern portion of the Process Facilities activity area. The DWQ has determined that operation of this pond under its Permit-by-Rule authority is appropriate. The pond is lined, and the flotation tailings lack significant sulfide minerals since the concentrator removes them as concentrates and the reagents used in the concentrator are not deleterious. The pond is designed as a no-discharge facility and has adequate capacity to contain water from direct precipitation plus any small amount of runoff directed to the pond from the Process Facilities activity area.

The tailings within the flotation tailings pond are mined and sent through the leach circuit. During mining of the tails by previous owners, the liner has been dug up and/or punctured in many places.

Because the outer embankments are still intact, there is a small risk that pollutants may be traveled offsite. These risks are mitigated using the following BMPs:

- Daily monitoring of slopes and berms surrounding the flotation tailings pond
- Diversion controls downslope of the flotation tailings pond so any pollutants will collect in the two decantation ponds located to the south of the flotation tailings pond
- Staged mining practices to limit the disturbed area
- Use of water trucks to limit dust pollution while mining the tails from the flotation tailings pond.

2.1.3 ITDF

The ITDF is constructed in two small canyons east of the mill facilities. The facility is constructed with synthetic liner and leak detection systems. The capacity of the ITDF is well in excess for the proposed quantity of tails to be deposited for the pond's 3 to 4 year life time. Because of this, the ITDF poses little to no risk for pollutants traveling offsite. A full description of the construction design for the ITDF can be found online in the Ground Water Discharge Permit (GWDP), which was revised and received approval from the UDWQ in May, 2021.

Because of the design of the ITDF and the proposed moisture content of the tails themselves, the ITDF does not pose a source of potential pollutants that may be traveled offsite.

2.1.4 Crushing and Screening Equipment

The beneficiation process of the copper ore includes a series of crushing and screening. This equipment is located north of the enclosed flotation mill facility within the Process Facilities activity area. The potential pollutants from the crushing and screening equipment include dust debris, especially during windy days, and sediment transport during precipitation events. The BMPs implemented for the crushing and screening equipment include:

- creating diversion ditches around the equipment, which direct runoff away from the area and south to sumps located north of the flotation tailings pond
- installing spray bars on all conveyor drop points
- Halting crushing on very windy days, when the spray bars do not work sufficiently

2.1.5 Enclosed and Completely Self-Contained Mill Facility

The flotation mill facilities and acid leach circuits are constructed to be completely enclosed. Accompanying the CCD and SX/EW circuits are two lined ponds to the south of the new facilities for storage of PLS and raffinate. The 2-acre PLS and raffinate ponds are constructed with a synthetic liner and leak detection system. These ponds will contain acidic solutions as well as residual SX solvent and reagents. For these reasons, leak detection systems for these ponds are appropriate and represent best management practices. Any precipitation or runoff from the intercepting watersheds will be diverted in the diversion berm located north and upstream of the leach facilities, to a drainage west of the disturbed areas. Any precipitation that falls within the facilities area will be diverted using a series of ditches to sumps located at strategic points throughout the disturbed area.

2.1.6 Boneyard for Obsolete or Unused Equipment

The boneyard is located in the northern-most portion of the Process Facilities activity area. The boneyard is used for storage of obsolete or unused equipment and empty hydrocarbon containers that have not yet been disposed of. The potential pollutants from the boneyard include hydrocarbon contamination, and offsite sediment transport. The BMPs implemented for the boneyard include:

- Ensuring all empty hydrocarbon containers are stored in a compacted earth-bermed area near the fuel tank at the mill facilities.
- Completely draining any equipment containing hydrocarbons prior to storing them in the boneyard.

- Removing obsolete equipment from site regularly, either to a designated facility or to the Truck Shop or main office located in Milford. Both areas have asphalt or concrete surfaces and are completely self-contained.
- Berming and ditching the entire area to direct any precipitation or intercepting runoff away from the boneyard to designated turn-outs, where the water will collect until it either infiltrates or evaporates.

2.1.7 Hydrocarbons and other chemicals associated with vehicles, crushing and screening equipment, and maintenance

Hydrocarbons used at the process facilities include diesel fuel and various oils and lubricants used in the crushing and screening equipment, SX circuit, mining equipment, and pick-ups used by mine and mill personnel. Fuel tanks associated with the process facilities include one 2,500-gallon fuel tank located at the mill facilities, and the mobile fuel truck and equipment. Mining equipment is fueled at the ready lines or within the pits during breaks by the mobile fuel trucks. Stationary vehicle fueling areas are located at the mill facilities and at the Truck Shop.

The potential pollutants from hydrocarbons and other chemicals associated with vehicles, crushing and screening equipment, and maintenance include contamination of runoff through leaking equipment or poor fueling practices. The BMPs implemented for these activities include:

- Storing all hydrocarbons in concrete- or plastic-lined containment islands to prevent seepage. Secondary containment areas are designed to contain more than 110% of the capacity of the largest (highest volume) tank.
- In the event of a spill, the spill reporting guidelines in the Operator's Spill Prevention, Control, and Countermeasures (SPCC) plan will be followed and the spill will be cleaned up accordingly. Contaminated soil will be removed and disposed of in accordance with state and federal regulations.
- In both mobile and stationary fueling, vehicle fueling occurs on hardened surfaces adjacent to the fuel containers. Each fuel tank is fitted with a locking coupler and automatic shut-off valve. Extreme care is taken to avoid fuel spills, such as personnel staying with the vehicle while fueling takes place. In the unlikely event of a spill, staff are trained and equipped to take all necessary actions to contain and clean up the spill quickly and safely. A spill kit is maintained at the mill office and on the equipment fueling truck.

2.2 Haul Roads and Parking Areas

Unpaved roads are located throughout the mine, and are **outlined grey on Figure 2**. These roads could contribute sediment to storm water runoff if not properly maintained. Roads are graveled and are regularly maintained with a crown and at least one side ditch.

Storm water runoff intercepted by roads is directed into ditches alongside the roads where water either gets diverted into pits, evaporates, or infiltrates into the ground. Although not shown on the figures, there is a diversion ditch along all main haul roads that is maintained by means of grading and placement of additional road base where applicable.

2.2.1 Mobile Equipment – Vehicles and Mining Equipment

Mobile equipment used on site includes mine staff vehicles, haul trucks, loaders, excavators/shovels, graders, drill rigs, and other various excavating equipment. A complete list of mobile equipment can be found in **Appendix P**. All heavy equipment and light vehicles related to mining is stored on a ready-line located on the east side of the Hidden Treasure waste dump or at the Truck Shop, located southeast of the active mine areas and process facilities.

All heavy equipment and light vehicles related to beneficiation is stored on a ready-line located around the EW building or at the mobile office located south of the CCD tanks.

The potential pollutants from the mobile equipment include dust debris, especially during windy days, sediment transport during precipitation events, and hydrocarbons from leaking equipment. The BMPs implemented for the mobile equipment include:

- For the Truck Shop parking: creating diversion ditches around the equipment parking areas, which direct runoff away from the area and south to the sump located at the toe of the berm separating the truck shop area from the fuel depot.
- For the office facility parking: creating diversion ditches around the equipment parking areas, which direct runoff away from the area and south to a sump located just north of the flotation tailings pond
- For the equipment ready line: creating diversion ditches to direct runoff around behind the ready line to prevent contamination of the water by fuel or other hydrocarbons
- Check and service the equipment daily or as needed to prevent any fuel, oil, or lubricant leaks. If leaks are detected, the equipment will be repaired promptly, or taken to the Truck Shop for further maintenance.

2.3 Active Mine Area

To be updated upon operational activity and mining status.

2.3.1 Active Open Pits

Exposed slopes above and within the pits could produce sediment that would be transported to the pit floors in response to precipitation events and/or runoff from slopes above. However, rock characterization has indicated that the overlying materials are un-reactive (non-acid forming) and contain little to no deleterious compounds that could leach

out due to contact with precipitation. All pits are topographic low points, in which runoff from intercepting watersheds is diverted.

Because of the rock characterization and design of the pits, there are no potential pollutants related to the active mine pits.

2.3.2 Active Mine Waste Dumps and Stockpiles

Overburden is deposited on the active waste dumps. The rock from the active pits is of various sizes, generally one foot diameter and smaller. The chemical and mineral content of the waste rock do not have significant amounts of sulfur which, accompanied with the high amounts of limestone in the three ore bodies, indicates little to no acid rock drainage potential. There are also numerous low-grade ore and topsoil stockpiles located throughout the MCO.

Low grade ore is stored in flat areas near the main haul road for use in the acid leach circuit once completed. One of the low grade ore stockpiles, the SITLA ore staging area, is located down-stream of an unnamed wash. The stockpile area is completely bermed, re-directing any runoff that flows through the ephemeral wash to the south and east.

The topsoil from all disturbed areas is stockpiled adjacent to the areas of disturbance, for use in reclamation activities. An inactive topsoil stockpile is located at the head of the Big Hickory Wash. This topsoil stockpile is bermed on the intercepting side, re-directing any potential runoff to a sump at the base of the stockpile, so that no potential pollutants reach the Big Hickory Wash.

The potential pollutants from the active mine waste dumps and stockpiles include dust debris, especially during windy days, and sediment transport during precipitation events. The BMPs implemented for the active waste dumps and stockpiles include:

- creating diversion ditches and berms around the stockpiles, which direct runoff away from the stockpiles and either into the adjacent pits, or along the haul roads to designated turn-outs
- seeding the topsoil stockpiles with an interim seed mix to help minimize erosion
- berming the top of all waste dumps so that any direct precipitation or intercepting runoff is re-routed back toward the pits, and not off the sides of the waste dumps. These berms are checked on a daily basis. If the outslopes or the base of the dumps do shed storm water, any runoff and pollutants in this water would be captured behind the rock/dirt berm located at the base of the dump, which is designed to prevent rock fall from getting past the dump base, and to act as a sump and filter for storm water runoff.

2.4 Inactive Mine Disturbance

There are previously mined areas located within the MCO, **highlighted pink on Figure 2**. These areas are located around the active pits, and are outside of the current DOGM bonded area. The previously mined areas are controlled by different parties, or are pre-law, and for that reason are not included in this SWMP.

2.5 Truck Shop

The Truck Shop is located southeast of the active mine areas and facilities, **highlighted orange on Figure 2**. The Truck Shop consists of an enclosed maintenance area with concrete floor, outdoor graveled maintenance area, and a fuel depot.

2.5.1 Equipment Maintenance Areas

The enclosed equipment maintenance area consists of a steel building equipped to service large pieces of heavy machinery. The enclosure has a concrete floor so any spills that may occur during equipment maintenance is completely contained.

The outdoor equipment maintenance area consists of graveled parking areas with berms and ditches around the entire perimeter. Spill kits are located within all heavy equipment and maintenance vehicles, as well as within the enclosed equipment maintenance area.

2.5.2 Fuel Depot

The fuel depot is located south of the equipment maintenance areas, and is completely enclosed within concrete containment. The concrete containment was designed and constructed to hold 110% of the largest volume tank within the containment. There are four fuel tanks within the concrete containment: two 11,000-gallon tanks and two 7,500-gallon tanks.

The potential pollutants from hydrocarbons and other chemicals associated with vehicles and heavy equipment, and maintenance include contamination of runoff through leaking equipment or poor fueling practices. The BMPs implemented for these activities are the same as those listed for hydrocarbons associated with the process facilities.

2.5.3 Boneyard for Obsolete or Unused Equipment

The Truck Shop boneyard is located south of the fuel depot, in an area long-sterilized by previous operations dating back to the mid-20th century. The Truck Shop boneyard is used for storage of obsolete or unused equipment and HDPE pipe. The potential pollutants from the boneyard include hydrocarbon contamination, and offsite sediment transport. The BMPs implemented for the boneyard include:

- Completely draining any equipment containing hydrocarbons prior to storing them in the boneyard.

- Removing obsolete equipment from site regularly, either to a designated facility or main office located in Milford.
- Berming and ditching the entire area to direct any precipitation or intercepting runoff away from the boneyard to designated turn-outs, where the water will collect until it either infiltrates or evaporates.

3.0 Measures and Controls for the Entire MCO

This section describes various BMPs implemented at the MCO that minimize storm water pollutants. Some of these BMPs were briefly described in Section 2.0; others are introduced and fully described below. Unless otherwise noted, all of these practices are currently ongoing at the site.

3.1 Good Housekeeping

Good housekeeping BMPs generally refer to ongoing or regular practices that ensure that areas of the facility with a potential to contribute pollutants to storm water are kept clean and orderly. At the MCO the following good housekeeping practices have been or will be implemented as indicated below:

- Litter is controlled through employee awareness, the use of multiple trash receptacles, and frequent cleanup. A closed trailer is used to store trash until it is transferred to the county landfill. New employees are instructed in litter control as part of their initial training. Any wind-blown litter and other debris at the facility are routinely removed.
- Major repairs to, and servicing of vehicles, are conducted at the closed shop building (Truck Shop) located offsite. Oils are drained prior to servicing using an evacuation system to minimize the opportunity for spills. Used oil is transferred directly from the equipment to a truck-mounted holding tank and transported off-site by a local recycling company. Drip pans and pads are used to absorb small quantities of liquids. A spill maintenance kit is maintained on site and employees are trained in its use, should a spill occur. Any fluids leaking from equipment located at the MCO will be contained. Collected fluids will be discarded or reused in accordance with applicable state and federal regulations. Any fluids that are spilled will be immediately cleaned up and reported as outlined in **Section 3.7**.
- Fueling of vehicles and mobile equipment is conducted using a locking “quick coupler” with an automatic shut off valve to reduce the potential of spills. Fuel tanks are enclosed in metal or concrete containers. A person remains with the vehicle or equipment during fueling in case of an emergency. Absorbents or other clean up materials are available to ensure that any spills are quickly cleaned up.

3.2 Preventive Maintenance

Vehicles, equipment, and machinery are maintained in good working condition to minimize the likelihood of discharging fluids. They are serviced on a regular schedule as appropriate. The maintenance intervals and the inspections or work performed are specific to that piece of equipment.

All access roads are topped with a 12-inch to 16-inch layer of road base derived from overburden rock to minimize fugitive dust generation and sedimentation from roads. The roads are also treated annually or every two years, as needed, with magnesium chloride,

to further help reduce dust generation. Active mine roads all drain to either turn-outs or pits via a system of ditches. Ditches are maintained in good condition to reduce erosion and to minimize the amount of sediment transported by storm water.

3.3 Spill Prevention and Response Procedures

Filling and emptying of storage tanks and oil drums, as well as the fueling of equipment and material handling, represent the largest potential sources of liquid spills at the facility. Spill cleanup equipment and materials are kept on-site. This equipment includes bulldozers or loaders, absorbent materials, and catch basins or drip pans for leaks. Each person that operates equipment, or is responsible for transferring diesel fuel or oil between vessels, will be trained on spill prevention and response.

In the event of a spill or leak, the following action will be taken:

- The person who discovers the spill will stop the spill or leak at the source, if it is safe to do so. They will contain the spread or migration of the spill by using spill response equipment or by building dirt containment berms.
- The person will then notify the site manager.
- The supervisor will report the spill in accordance with the internal reporting procedure outlined in the Operator's SPCC.
- Any contaminated soils will be cleaned up and properly disposed of in accordance with state and federal regulations.
- Follow-up investigation will be conducted to determine the cause of the spill, evaluate the Operator's response, and determine if any measures need to be implemented or adjusted. If these changes affect the SWMP, the plan will be updated.

3.4 Inspections

The Operator is required to perform monthly visual inspections of all BMPs in all active areas of the MCO to ensure that they are operating as intended. The following areas are covered:

- Erosion and sediment control measures are observed to ensure they are operating correctly, such as ditches, sumps, sediment fabric, etc.
- Any evidence of excessive erosion or sedimentation is identified and scheduled for repair.
- Any problem areas or potential pollutant sources that have not been addressed by the SWMP are identified.
- Material handling and storage areas are inspected for signs of erosion.
- Crushing equipment, vehicles, and obsolete or unused equipment are inspected to ensure that they are in good condition and are not leaking any fluids.

- Maintenance areas are inspected to ensure that fluids are properly stored within the maintenance shops.

An inspection form will be completed and signed by the inspector directly after each inspection. Blank inspection forms are located in Appendix C. If deficiencies are noted during an inspection, the deficiencies will be corrected and the SWPPP will be revised, as needed, as soon as possible following the inspection, allowing that materials, manpower and other conditions may preclude corrective action prior to the next storm event. Any BMP, equipment or structures requiring maintenance will be recorded on the inspection form and the appropriate maintenance activities will be performed as soon as possible. A description of these revisions to the SWPPP and the corrective actions that were taken will be documented on the inspection form and retained as part of this plan. Completed inspection forms will be maintained with this SWPPP in Appendix D for a minimum of three years from the date of the inspection.

3.5 Employee Training

Employees who are responsible for implementing activities identified in this plan are responsible for aspects of storm water management or control, or whose activities could result in increased storm water pollution will receive storm water training. Training occurs on an annual basis with each session occurring no later than 12 months after the previous year's training. This training consists of the components of the plan and on the trainee's respective responsibilities under the plan. Additional training topics include spill prevention and response, fueling practices, good housekeeping, and equipment wash down procedures, identification of potential storm water pollution-related issues, and material management practices.

New employees are trained in storm water pollution prevention within one week of their start date. This training consists of:

- A description of the SWPPP and its goals;
- Education on storm water pollution prevention;
- BMPs that may affect the group or an individual employee;
- Spill prevention and response;
- Question and answer; and,
- Other topics considered pertinent during each session.

The training program is reviewed annually and modified as necessary to meet facility conditions. Training records are retained as indicated in Section 3.6.

3.6 Record Keeping Requirements

Many types of records and reports are required by the storm water permit and the SWPPP. The required records and their storage locations are listed in the following table. All records associated with the storm water permit and the SWMP will be retained for at least

3 years from the date that the report or record was generated. Employee training records will be maintained for the length of employment. A copy of this SWMP will be maintained on site at the office facility and will be made available upon request.

Table 2: Records/Reports and their Storage Location

RECORD or REPORT	**STORAGE LOCATION**
Monthly/Quarterly Visual Mine Inspection Forms	Appendix D in SWPPP
Annual Total Site Compliance Evaluation Reports	Appendix F in SWPPP
Quarterly Visual Monitoring Report Forms	Appendix H in SWPPP
Quarterly Analytical Monitoring Report Forms	Appendix J in SWPPP
Storm Water Discharge Monitoring Reports	Appendix L in SWPPP
Spill and Spill Cleanup Reports/Summaries	Appendix M, N in SWPPP
Employee Training Records	Appendix P in SWPPP & Mine Office

3.7 Internal Reporting Procedures

If a spill or storm water contamination occurs, the person who discovers the spill will follow the procedures outlined in the Operator's SPCC. The Site Manager will report the spill or storm water contamination to the appropriate regulatory agencies as required.

3.8 Non-Storm Water Discharges

No process water is produced at the open pit mines within the MCO, and there is no mine drainage. All process water produced during beneficiation is recycled back through the facilities, or stored in the process ponds, emergency storage ponds, or ITDF. The process ponds are double lined with leak detection systems to prevent discharge. The emergency storage ponds are lined with 80-mil textured HDPE.

Non-storm waters present at the MCO includes water from a well on site that is used for beneficiation purposes and to wash vehicles (no soaps are used). The water truck is filled with well water and applies it to roads and stockpiles, where it evaporates or infiltrates. Only enough water is used to wet the material so that water does not runoff and pool on the ground.

As required by the General Permit, Sector G in II.G.4.(g) (iii), the Operator believes it is accurate to state, and hereby certify, that no non-storm water discharges are reaching waters of the state. Therefore, the requirements of these sections (Failure to Certify) are not addressed herein because there is no failure to certify.

To prevent unauthorized non-storm water discharges, the Operator's operation plan either contains non-storm waters within closed systems, or uses these waters in a controlled manner to avoid their release. For example:

- Water is applied to access roads, the processing area, or the mine. No offsite discharges are expected to occur.
- Water is used for vehicle washing (no soaps are applied). Water used for washing is applied only in amounts sufficient for those uses, and in quantities that do not generate runoff. In addition, washing is not done during wet weather periods when mixing with storm water runoff could occur. The General Permit [Section I.A.5.g.(i)] allows for the reasonable discharge of these types of non-storm water sources and allows them to mix with permitted storm water discharges. BMPs that ensure these potential non-storm water discharges are properly managed include: employee training, road drainage systems, sumps, and good housekeeping practices.
- The open pits, tailings impoundments, and process ponds are fully contained and do not release water to the surroundings.
- The Operator surveys at least annually the perimeter of the MCO (DOGM-bonded areas as well as inactive areas contiguous to the active mine) – including the base of waste dumps, locations where roads leave the mine property, and ore storage areas – for the presence of undocumented non-storm water sources. This annual investigation is certified, signed, and documented as required, and the resultant certifications are included in Attachment E, Form G1.

Should these inspections indicate anomalous conditions (i.e. flow during dry weather), thorough and immediate follow up would be done to discover the water source and correct the problem.

Should any new sources of non-storm water be noted, or should known sources be observed to have the potential to discharge, appropriate measures would be taken. The procedures to do so are as follows:

- Inspections described above are undertaken to discover any non-storm water flows within or outside of the mine;
- If such a source is identified during the inspection, the Operator will perform an investigation to determine the source and stop the flow.
- Steps will be taken to prevent a recurrence.

The effectiveness of these procedures will be evaluated and revised if necessary.

3.9 Sediment and Erosion Control

Figures 3 and 4 show the operations site, topographic contours, and storm water flow directions. No surface waters receive storm water from the site.

Currently, erosion is not a significant problem at the MCO, in part due to the arid nature of the landscape. Roadways throughout the property are graveled and regularly maintained to decrease water velocity, should a road shed water. Both graveled and dirt traffic areas at the mine are stabilized by watering. Small turn-outs located throughout the operations area are designed to catch water and allow sediments to settle. These sumps are inspected daily and are cleaned out after any event causes significant sediment to collect. Sediments are removed to the waste dumps or used to create berms around the turnout areas.

All affected lands within the active operations area have effective erosion control. The largest of these affected areas are the Copper Ranch and Hidden Treasure waste dumps, which have a rock and dirt berm along their base. The Hidden Treasure dump has been in place for over five years; there is no evidence of erosion on the dump top or slope.

Ore handling areas (including raw ore piles, crusher area, and beneficiated ore stockpiles) are also a significant disturbance. These are compacted and bermed.

Low grade ore and Topsoil stockpiles are bermed, and so are self-contained.

Associated disturbance, including roads, other waste piles, and undisturbed native lands between the enclosed pits and the ore handling area, are relatively flat and, when applicable, drain into the ditches alongside the haul roads.

3.9.1 Controls

Vegetation is not disturbed except where required for roads, pits, and ore or overburden handling. Eroded material from slopes above the pits stay within the pits and do not leave the site. When mining is completed a reclamation plan will be instituted on those lands bonded by DOGM using salvaged topsoil and vegetation. Details of the reclamation plan are found in the Operator's DOGM NOI. The following storm water runoff controls are in place within the MCO:

- Water draining into the pits stay in the pits.
- All topsoil piles are bermed.
- The ore piles are within a bermed area.
- Active waste dumps are bermed along their rims, and have a bonded, native vegetation area at their bases to capture run-off, sediment, loose rock, etc.
- Water falling on or flowing down roads drains toward the pits, or toward the turn-outs managed to hold storm water runoff.

- Water falling or flowing in or near the ore handling area, facilities area and/or tailings storage areas either infiltrates or collects in sumps or the tailings ponds, where it evaporates or infiltrates.
- All reagents used in the beneficiation process are contained within a lined and/or concrete area that does not allow for contamination to outside areas.

There are no structural controls in the pits, ITDF, emergency ponds, or process ponds, and none are needed. The capacity of these areas to contain storm water and/or snow melt exceeds any reasonable design storm.

3.9.2 Offsite Vehicle Sediment Tracking

The mine site is accessed via a dirt road. Vehicles entering and leaving the operations may track sediment or other material into or out of the site. The main source of traffic is mining employees coming and going from the site for work shifts, and over-the-road haul trucks that haul small amounts from time to time. Mining equipment remains on site. To minimize dust generation and transfer of fines off-site, mine access roads and parking areas are watered on a regular basis. Additional controls such as, magnesium chloride, are warranted on an as needed basis.

3.9.3 Erosion Control Inspections

Erosion controls will be inspected monthly over the mine area to ensure that they are functioning correctly. Any observed condition requiring maintenance will be attended to immediately.

3.10 Reportable Quantity (RQ) Release

The Operator will comply with all federal, state and local regulations for spill prevention and control, and the Special Conditions in Part II B of this permit.

Appendix A

Multi-Sector General Permit
and
Notice of Intent

STATE OF UTAH, DEPARTMENT OF ENVIRONMENTAL QUALITY, DIVISION OF WATER QUALITY
195 North 1950 West, P.O. Box 144870, Salt Lake City, Utah 84114-4870 (801) 536-4300

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY WATER QUALITY

Notice of Intent (NOI) for Coverage Under the UPDES General Multi-Sector Storm Water Permit for Discharges Associated with Industrial Activity, Permit No. UTR000000

NOI

Permit Information

Master Permit Number: UTR000000

UPDES ID: UTRI00264

Eligibility Information

State/territory where your facility is discharging: UT

Does your facility discharge to federally recognized Indian Country lands? No

Which type of form would you like to submit? Notice of Intent (NOI)

By indicating "Yes" below, I confirm that the facility operator intends to be authorized by the UPDES Multi-Sector General Permit (MSGP) for stormwater discharges associated with industrial activity in the State of Utah. I understand that when coverage is granted, all stormwater discharges must comply with the terms and conditions of the permit.
Yes

Have storm water discharges from your project/site been covered previously under an UPDES permit? Yes

If yes, what is the previous UPDES Permit Number: UTR266219

Owner/Operator Information

Owner Information

Owner: Milford Mining Company Utah, LLC.

Status of Owner: Private

Owner Mailing Address

Address Line 1: 1208 S 200 W

Address Line 2: PO Box 827 **City:** Milford

ZIP/Postal Code: 84751 **State:** UT

Owner Point of Contact Information

First Name Middle Initial Last Name: Brendan Moseley

Title: CEO

Phone: 435-387-2000 **Ext.:**

Email: brendan.moseley@milfordmining.com

Operator Information

Is the Operator Information the same as the Owner Information? No

Operator: Milford Mining Company Utah LLC

Operator Mailing Address

Address Line 1: 1208 S 200 W

Address Line 2: PO Box 827 **City:** Milford

ZIP/Postal Code: 84751 **State:** UT

Operator Point of Contact Information

First Name **Middle Initial** **Last Name:** Robert Covington

Title: HSE Manager

Phone: 435-387-2000 **Ext.:**

Email: robert.covington@milfordmining.com

NOI Preparer Information

☐ **This NOI is being prepared by someone other than the certifier.**

Facility Information

Facility Information

Facility Name: Milford Mining Company Utah, LLC.

Facility Address

Address Line 1: Highway 21 West then North

Address Line 2:

City: Milford

ZIP/Postal Code: 84751

State: UT

County or Similar Division: Beaver

Latitude/Longitude for the facility

Coordinate System: Decimal Degrees

Latitude/Longitude: 38.473688°N, 113.124356°W

Is your facility presently inactive and unstaffed? No

Sector Identification

Sector-Specific Information

Primary Regulated Sector: G

Primary Regulated SIC Code: 1021

If you are a Sector G (Metal Mining) facility, do you have discharges from waste rock and overburden piles? Yes

What type(s) of ore do you mine at your facility?

- ☐ Tungsten Ore
- ☐ Nickel Ore
- ☐ Aluminum Ore
- ☐ Mercury Ore
- ☑ Iron Ore
- ☐ Platinum Ore
- ☐ Titanium Ore
- ☐ Vanadium Ore
- ☐ Molybdenum
- ☐ Uranium, Radium, and/or Vanadium Ore
- ☑ Other / Not Listed

Site Activity Information

Municipal Separate Storm Sewer System (MS4) Operator Name: Not Applicable

Receiving Waterbody Information

List all of the receiving waterbodies. For a map of waterbodies go to http://wq.deq.utah.gov (http://wq.deq.utah.gov):

Receiving Water:

Cedar-Beaver

Effluent Limitation Guidelines

Identify the Effluent Limitation Guideline(s) that apply to your stormwater discharges. (See permit conditions in Part E.2 of the applicable Appendix I (https://deq.utah.gov/water-quality/explanation-of-standard-industry-classification-sic-codes-updes-permits) of the MSGP)

There are no guidelines associated with the sector(s) selected in the Facility Information section above.

Are you requesting permit coverage for any stormwater discharges subject to effluent limitation guidelines? No

Is the facility required to do analytical monitoring? (See permit conditions in Part E.1 of the applicable Appendix I (https://deq.utah.gov/water-quality/explanation-of-standard-industry-classification-sic-codes-updes-permits) of the MSGP)

Yes

Is there existing quantitative stormwater discharge data? No

Does this facility site have any other UPDES permits? No

SWPPP Information

Has the SWPPP been prepared in advance of filing this NOI as required? Yes

Certification Information

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. Signing an electronic document on behalf of another person is subject to criminal, civil, administrative, or other lawful action.

Certified By: Greg L. Guzzle

Certifier Title: Environmental Engineer

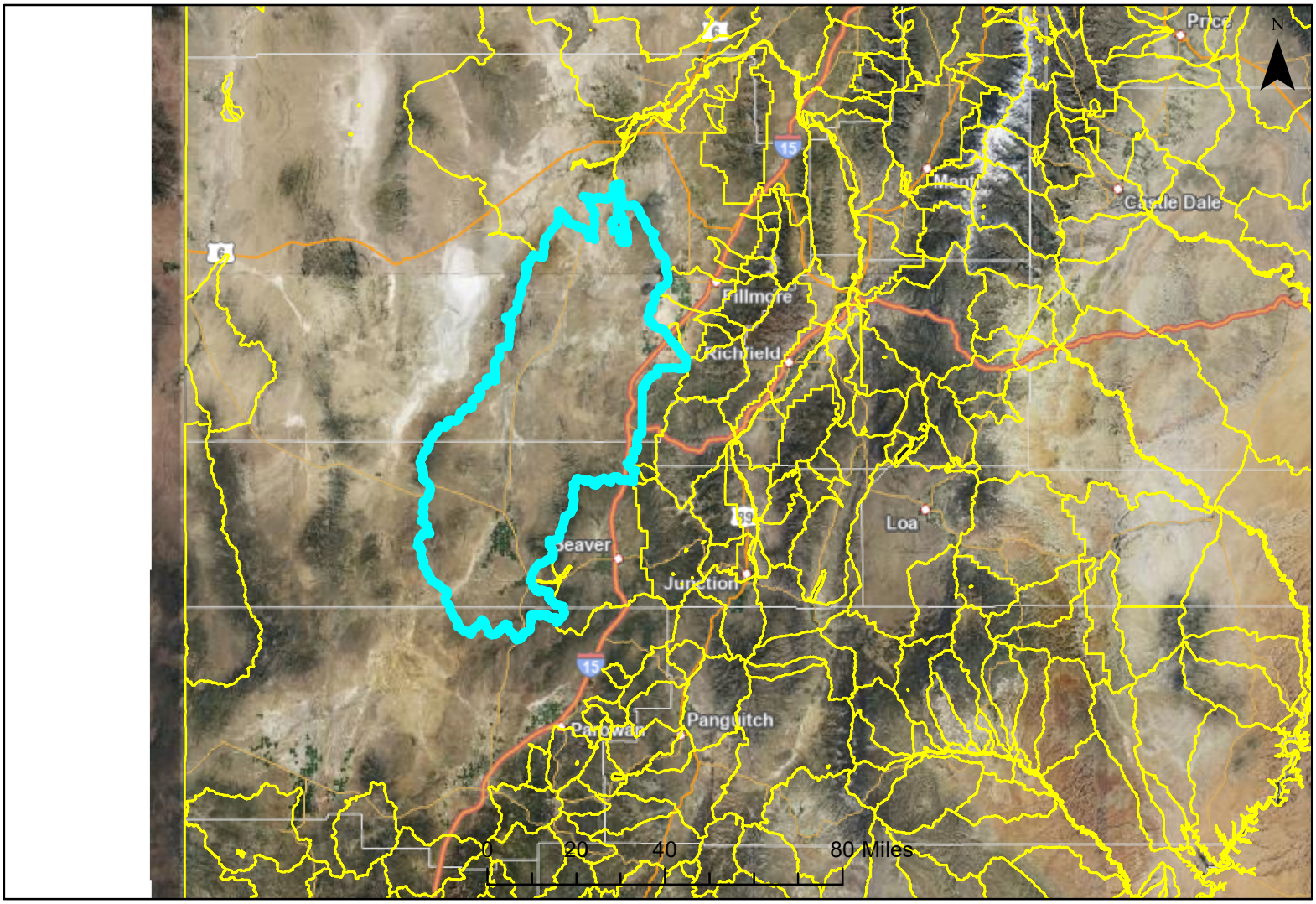
Certifier Email: robert.covington@milfordmining.com

Certified On: 03/13/2024 12:22 PM ET

Beneficial Uses and Water Quality Assessment Map

utah automated geographic reference center

3/11/2024



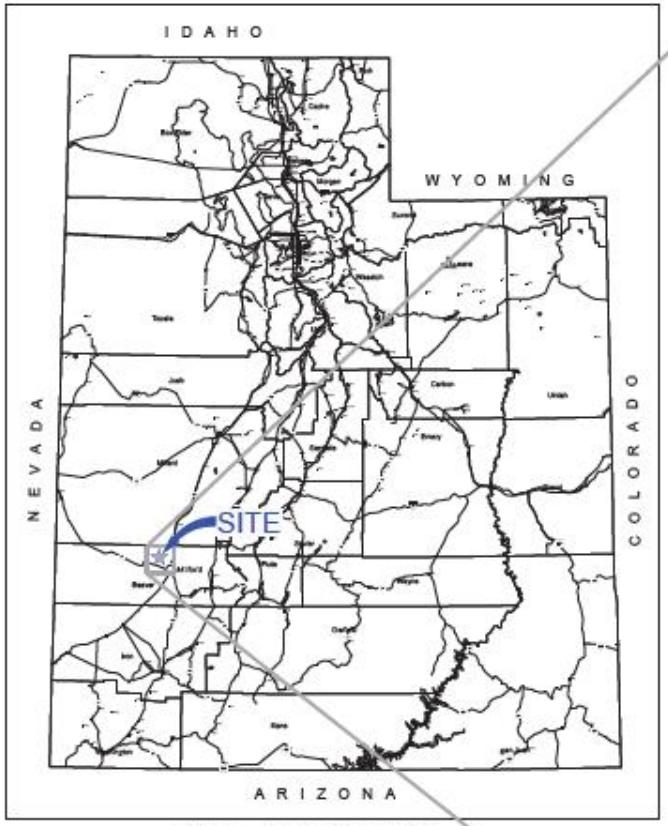
Unit ID: UT-not defined
AU_Type: null
Assessment Unit Name: none
Unit Description: Beneficial uses area only (No AUs): Sevier River and tributaries, from Sevier Lake to Gunnison Bend Reservoir to U.S. National Forest boundary
Beneficial Uses: Use Class 2B = Infrequent Primary Contact Recreation (e.g. wading, fishing); Use Class 3C = Nongame Fishery/Aquatic Life; Use Class 4 = Agriculture (crop irrigation, stock watering)
RIVER_MILE: null
Watershed Management Unit: Cedar-Beaver
2016 Assessment: none: no defined assessment unit(s)
Beneficial Use: Cause of Impairment: null
TMDL Required: 303d Cause of Impairment: null
TMDL Approved: Cause of Impairment: null
Aquatic Habitat Impairment: null
PROTECTED: Use Class 2B = Infrequent Primary Contact Recreation (e.g. wading, fishing), Use Class 3C = Nongame Fishery/Aquatic Life, Use Class 4 = Agriculture (crop irrigation, stock watering)
BLU_Ribbon: null
Anti-Degradation Category: Category 3 = water quality degradation may be allowed for non-Category 1 and 2 waters pursuant to antidegradation review
TMDL Information: null
MAPLABEL: null
New_AUID: null
Perimeter: null
Area_m2: 4995663548.607568

Appendix B

Figures
(Location and Site Maps)

Figure 1 Area Map

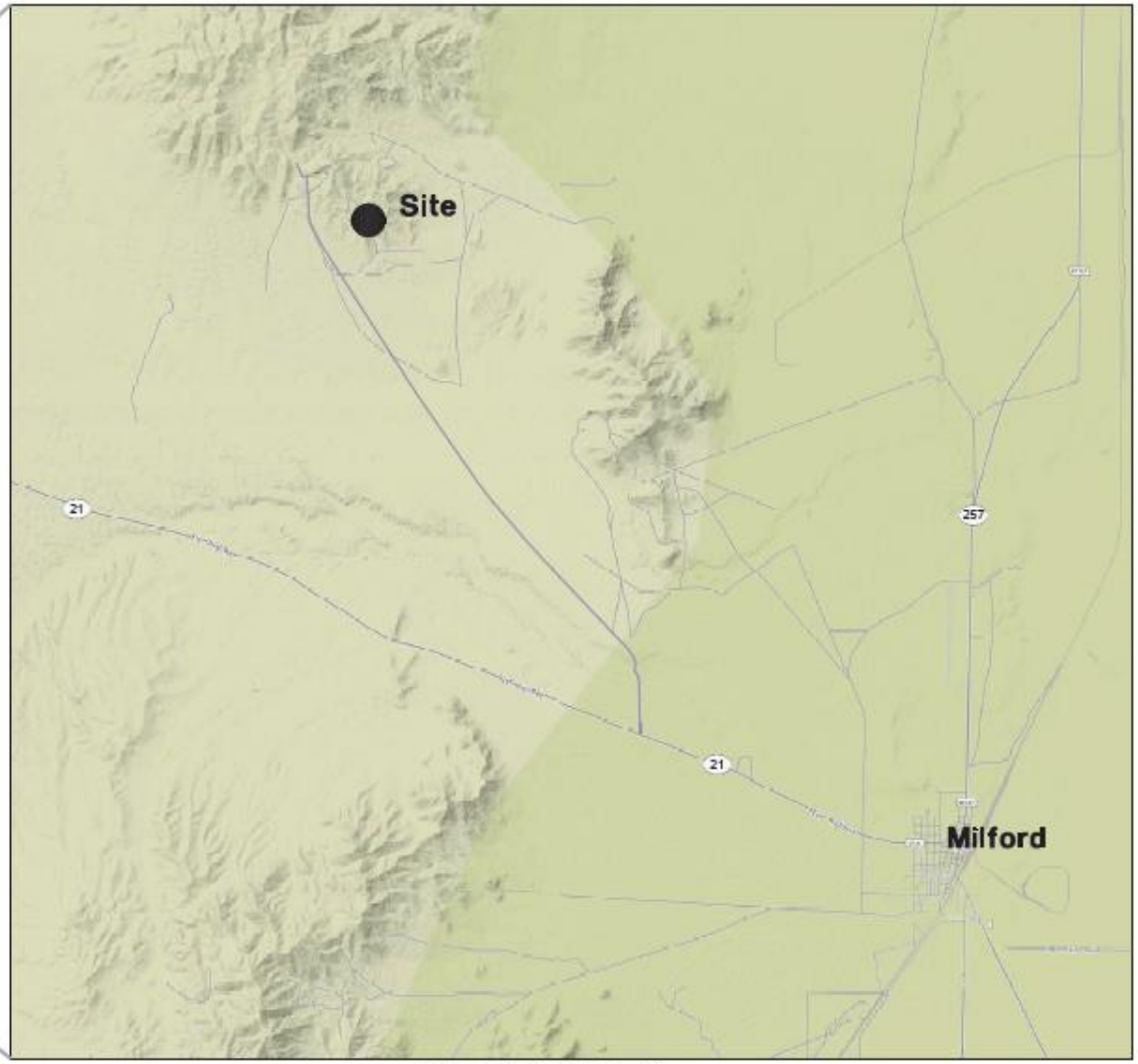
MILFORD MINING COMPANY UTAH, LLC.
GENERAL SITE LOCATION



SITE LOCATION

0 25 50 100 150

SCALE IN MILES



SITE VICINITY

0 1 2 4 6

SCALE IN MILES

Figure 2 Mine Site Map



Figure 2a: Facilities Map
Storm Water Management Plan
Milford Mining Company Utah, LLC.
March 2024

0 310 620 1,240 1,860 2,480 Feet

MILFORD MINING COMPANY
UTAH



Figure 2b: Mine Map
Storm Water Management Plan
Milford Mining Company Utah, LLC.
March2024

0 800 1,600 3,200 4,800 6,400
Feet

MILFORD MINING COMPANY
UTAH



Figure 2c: Truck Shop Map
Storm Water Management Plan
Milford Mining Company Utah, LLC.
March 2024

0 105 210 420 630 840
Feet

MILFORD MINING COMPANY
UTAH

Figure 3 Storm water Controls – Facilities



Figure 3: Storm Water Controls - Facilities Area

Storm Water Management Plan
Milford Mining Company Utah, LLC.
March 2024

MILFORD MINING COMPANY
UTAH

Figure 4 Storm water Controls – Mining Area



Figure 4: Storm Water Controls - Mine Area

Storm Water Management Plan
Milford Mining Company Utah, LLC.
March 2024

0 800 1,600 3,200 4,800 6,400 Feet

MILFORD MINING COMPANY
UTAH

Appendix C

Blank Monthly Visual Inspection For

MILFORD MINING COMPANY
UTAH

Stormwater Pollution Prevention Plan (SWPPP)
Environmental Site Inspection & Compliance
Monthly - Visual

Definition of Symbols:

✔	Good condition or only minor work needed.
✕	Work needed (when budget and time allow. Needs to be done, but not crucial)
✕	Work needed (sooner rather than later)
✕	Crucial work needed (fix immediately)

Truck Shop and PNT1		Notes / Description	Assigned To:	Date Completed:
Fuel Containment				
No signs of deterioration on shell				
No damage or deterioration on supports, foundation, and anchor bolts				
No deterioration or leakage at pipe connections to container				
No signs of leakage on container, foundation, or supports				
Drain valves on tanks are closed and secured				
Pressure relief devices, emergency vents, or relief vents are clean and free of obstructions				
Mobile or portable containers are provided with secondary containment				
Totes, barrels, or buckets containing hydrocarbons are stored within secondary containment or on pallets				
No signs of leakage or spills within the containment				
Containment walls and floors are intact and are not cracked				
Drainage systems for containment maintained and free of obstruction				
No visible oil sheen on water in containment areas				
No standing water in containment areas				
NOTES:				

Working Area				
No signs of ruts or unusual drainage patterns around quick fill station				
No signs of ruts or unusual drainage patterns around working area				
Spill kits contain proper equipment				
Oil absorbant material is available				
No oil sheen or runoff around oil-containing equipment				
Obsolete equipment stored in an orderly manner				
Litter Picked up				
Trash recepticals not overflowing				
Totes for storage of contaminated soil are readily available				
Unpaved roads and parking areas in good condition				
NOTES:				

Greater Plant Area		Notes / Description	Assigned To:	Date Completed:
Boneyard				
No oil sheen or runoff from around oil-containing equipment				
Obsolete equipment stored in an orderly manner				
Litter is picked up				
Totes for storage of contaminated soil are readily available				
Totes, barrels, or buckets containing hydrocarbons are stored within secondary containment or on pallets				
NOTES:				
Float Mill Area				
Obsolete equipment stored in an orderly manner				
Empty totes stored in an orderly manner				
Obsolete totes containing liquids stored in areas that will not impact water sources				
Empty grinding ball drums stored covered or upside down on pallets				
Grinding ball drums containing grinding balls stored covered on pallets				

No signs of ruts or unusual drainage patterns around working area				
Storm water diversion systems in place and properly maintained				
No oil sheen or runoff around oil-containing equipment				
Litter is picked up				
Trash receptacles not overflowing				
Tailings pipelines not showing signs of leakage				
Mill topsoil stockpiles bermed and maintained				
Unpaved roads and parking areas in good condition				
All disturbance is contained within the bonded disturbance boundary				
NOTES:				
Fuel Containment & Filter Cake Tote Storage				
No signs of deterioration on shells				
Totes, barrels, or buckets containing hydrocarbons are stored within secondary containment or on pallets				
No signs of leakage or spills within the containment				
Containment liner showing no signs of being punctured or ripped				

Containment berms are properly lined and maintained				
No visible oil sheen on water in containment areas				
No standing water in containment areas				
Spill kits contain proper equipment				
Oil absorbant material is available				
Totes for storage of contaminated soil are readily available				
NOTES:				
Leach Plant Area				
Obsolete equipment stored in an orderly manner				
Empty barrels and totes stored in an orderly manner				
Obsolete barrels and totes containing liquids stored in areas that will not impact water sources				
Liner for secondary containment of acid tanks and CCD tanks showing no signs of being punctured or ripped				
Acid unloading area clear of spills				
No signs of ruts or unusual drainage patterns around working area				
Storm water diversion systems in place and properly maintained				

No oil sheen or runoff around oil-containing equipment				
Litter is picked up				
Trash recepticals not overflowing				
Process ponds showing no signs of seepage				
Process pond berms maintained for 24" of freeboard with no signs of erosion				
Process pond liner showing no signs of being punctured or ripped				
Tailings pipelines not showing signs of leakage				
Phase II topsoil stockpile bermed and maintained				
Unpaved roads and parking areas in good condition				
All disturbance is contained within the bonded disturbance boundary				
NOTES:				
ITDF				
ITDF Topsoil stockpile bermed and maintained				
Unpaved roads and parking areas in good condition				

Litter is picked up				
Storm water diversion systems in place and properly maintained				
ITDF pond liner showing no signs of being punctured or ripped				
Tailings and return water pipelines not showing signs of leakage				
Emergency turnout maintained in good condition				
Fencing around ITDF in good condition				
All disturbance is contained within the bonded disturbance boundary				
Opacity for the eight-week monitoring period is within requested limits				
NOTES:				

Mine		Notes / Description	Assigned To:	Date Completed:
Berms maintained with no signs of erosion				
No evidence of erosion on dump slopes				
No evidence of cracking on dump tops				
No evidence of erosion on topsoil stockpiles				
Topsoil stockpiles bermed and maintained				
Unpaved roads and parking areas in good condition				
Equipment Staging area showing no signs of spills or leaks				
No oil sheen or runoff around oil-containing equipment				
Spill kits contain proper equipment				
Oil absorbant material is available				
Totes for storage of contaminated soil are readily available				
Totes, barrels, or buckets containing hydrocarbons are stored within secondary containment or on pallets				
Trash receptical at PNT2 not overflowing				
No signs of ruts or unusual drainage patterns around working areas				
Litter is picked up				
Storm water diversion systems in place and properly maintained				
Blasting Contractor area in good condition with no signs of ANFO or fuel spillage				

All disturbance is contained within the bonded disturbance boundary				
NOTES:				

Exploration Drilling		Notes / Description	Assigned To:	Date Completed:
Exploration Equipment stored in an orderly manner				
Mobile or portable containers are provided with secondary containment				
Totes for storage of contaminated soil are readily available				
Totes, barrels, or buckets containing hydrocarbons are stored within secondary containment or on pallets				
Holes are plugged at a frequency compliant with the respective Exploration Permit				
Unused roads and pads have been reclaimed				
No oil sheen or runoff around oil-containing equipment				
No signs of ruts or unusual drainage patterns around working areas				
Litter is picked up				
Storm water diversion systems in place and properly maintained				
All disturbance is contained within the bonded disturbance boundary				
NOTES:				

Appendix D

Completed Monthly Visual Inspections Forms

Appendix E

Blank Quarterly Visual Monitoring Forms

Milford Mining Company Utah

Quarterly Visual Monitoring Report Form

Milford Mining Company Utah, LLC.
1208 South 200 West
Milford, Utah 84751

INSPECTORS NAME:	INSPECTION DATE:	INSPECTION TIME:

MONITORING PERIOD: FROM: MONTH_____ DAY_____ YEAR_____ TO: MONTH_____ DAY_____ YEAR_____

DURATION OF STORM EVENT:_____ HOURS **RAIN FALL MEASUREMENT:**_____INCHES

TIME ELAPSED BETWEEN RECORDED AND PREVIOUS STORM EVENT:_____DAYS

TYPE OF EVENT: _____ STORM WATER RUNOFF _____ SNOWMELT

IF NO SAMPLE WAS TAKEN DURING THIS MONITORING PERIOD, CHECK THE APPROPRIATE BOX:

☐ NO DISCHARGE OR RUNOFF DUE TO INSUFFICIENT RAINFALL OR SNOWMELT

☐ ADVERSE WEATHER CONDITION, LIST CONDITION:

_____

PART 1: Sample and Data Collection

1. Collect one or more storm water runoff samples during a storm event that is greater than 0.1 inches and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event or when runoff from snowmelt occurs.
2. Collect samples within the first 30 minutes (or as soon thereafter as practical, but not more than 1 hour) of when the runoff or snowmelt begins discharging.
3. Examine the sample in a well-lit area and fill in each column for each sample taken.

   NOTE: No laboratory tests are required to be performed on the samples.

SAMPLE #	SAMPLE LOCATION	COLOR & INTENSITY	CLARITY	ODOR	SOLIDS	OTHER POLLUTANT INDICATORS	COMMENTS and PROBABLE SOURCES of CONTAMINANTS

COLOR:	COLOR INTENSITY:	CLARITY:	ODOR:	SOLIDS:	OTHER POLLUTANT INDICATORS:
DG = Dark Gray BL =Black LG = Light Gray G =Green LB = Light Brown T = Tan MB = Medium Brown Y=Yellow DCB = Dark Chocolate Brown Other = Write in color	VI = Very Intense P = Prominent MP = Moderately Perceptible HP = Hardly Perceptible	TO = Totally Opaque (cannot see through) ST = Slightly translucent NT = Nearly translucent TL = Translucent TP = Transparent	D = Diesel G = Gasoline P = Petroleum SO = Solvent M = Musty SE = Sewage NO = No odor NX=Noxious SU = Sulfur (Rotten Egg) Other = write in odor and explain in Comments column	NS = No solids FS = Floating solids SS = Suspended and settled solids Provide description of solids in Comments column	F = Foam OS = Oil sheen Other = write in any other indicators and explain in the Comments column

PART 2: Site Walk-through and SWP3 Review

1. Perform a walk-through of the facility during the storm water or snowmelt runoff event.
2. Check YES or NO for each item.
3. Record any corrective action or maintenance that is needed.
4. Review the SWP3 and complete Section 2.
5. Describe the corrective actions that were taken in Section 3.

1. General	YES	NO	Corrective Actions/Maintenance Required
• Any evidence of erosion on slopes or berm on east side?			
• Is runoff leaving the property anywhere?			
• Any erosion or ruts along unpaved roads and parking areas?			
• Any oil sheen or foam on rainwater or snowmelt that are in puddles?			
• Any new problem areas or potential pollutant sources?			

2. SWP3 Review

If deficiencies were noted above, are changes to the SWP3 required? YES NO

If yes, describe the revisions that were made: _____

3. Corrective Actions Taken

For the Corrective Actions/Maintenance Required that were identified above, enter the action that was taken and the date:

Appendix F

Completed Visual Monitoring Forms

Appendix G

Blank Annual Site Compliance Evaluations

Annual Site Compliance Evaluation Report

INSPECTORS NAME:	
INSPECTION DATE:	INSPECTION TIME:

Milford Mining Company Utah, LLC.

1208 South 200 West

Milford, Utah 84751

MILFORD MINING COMPANY
UTAH

1. Perform a walk-through of the facility. Inspect the following areas and answer the questions.

_____	Ore storage piles	_____	Oil storage drums
_____	Diesel storage tanks	_____	Secondary containment areas for drums and tanks
_____	Process equipment (power plant, sand de-watering equipment, retorts, crushers, hoppers, screens, etc.)	_____	Unpaved roads and parking areas
		_____	Water truck fill station
_____	Mobile equipment	_____	Berm along east side
_____	Obsolete equipment	_____	Spill response equipment

• Were any substantial erosion problems on the roads or berm on east side identified during the walk-through? If yes, explain:_____	**YES**	**NO**
• Any new storm water contaminants or pollutant sources identified during the walk-through? If yes, explain:_____	**YES**	**NO**
• Secondary containment areas for tanks and oil drums in good condition? If no, explain:_____	**YES**	**NO**
• Additional measures required to reduce pollutant loadings? If yes, explain:_____	**YES**	**NO**
• Spill response equipment in place? If no explain:_____	**YES**	**NO**

2. Review the SWP3 and the Storm Water Permit.

• Have the BMPs in the SWP3 been effective at minimizing storm water runoff and contamination? If no, explain:_____	**YES**	**NO**
• Were any deficiencies in the SWP3 identified? If yes, explain:_____	**YES**	**NO**

• Any components of the SWP3 no longer apply or are incorrect? If yes, explain:_____	**YES**	**NO**
• Are the descriptions of the potential pollutant sources accurate (Section 4.2)? If no, explain:_____	**YES**	**NO**
• Does the facility comply with the requirements in the Storm Water Permit? If no, explain:_____	**YES**	**NO**

3. Actions Required:

If an explanation is required for any of the above questions, is reporting to a regulatory agency required or revisions to the SWP3 needed?	**YES**	**NO**

If yes, describe the actions taken:

* A responsible corporate officer is the president, secretary, treasurer, or vice-president of the corporation or a person who is a duly authorized representative of that person.

4. Certification:

If the evaluation does not identify any incidents of noncompliance, a responsible corporate officer* must sign the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_____

Signature Printed Name

_____

Title Date

Appendix H

Completed Annual Site Compliance Evaluations

Appendix I

Blank Quarterly Analytical Monitoring Report Forms

STORM WATER DISCHARGE MONITORING REPORT (SWDMR)

(For additional forms copy this form or contact the DWQ)

IDENTIFICATION & LOCATION

Name _____ Permit No. UTR _____

Mailing Address:

_____
_____
_____
_____

Location *(if different)*

_____
_____
_____
_____

Monitoring Period:

From: Month _____ Day _____Year _____ To: Month _____ Day _____ Year _____

Total Storm Water Discharge Points_____ Number assigned to this Discharge Point _____

INDUSTRY SECTOR(S)

Industrial Activities or Industry Sector(s) Drained by this Discharge:

- ☐ A. Timber Products Facilities
- ☐ B. Paper and Allied Products Manufacturing Facilities.
- ☐ C. Chemical and Allied Products Manufacturing Facilities.
- ☐ D. Asphalt Paving, Roofing Materials, and Lubricant Manufacturing Facilities.
- ☐ E. Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing Facilities.
- ☐ F. Primary Metals Facilities.
- ☐ G. Metal Mines (Ore Mining and Dressing).
- ☐ H. Coal Mines and Coal Mine-Related Facilities.
- ☐ I. Oil or Gas Extraction Facilities.
- ☐ J. Mineral Mining and Processing Facilities.
- ☐ K. Hazardous Waste Treatment Storage or Disposal Facilities.
- ☐ L. Landfills and Land Application Sites.
- ☐ M. Automobile Salvage Yards.
- ☐ N. Scrap Recycling and Waste Recycling Facilities.
- ☐ O. Steam Electric Power Generating Facilities.
- ☐ P. Motor Freight Transportation Facilities, Passenger Transportation Facilities, Petroleum Bulk Oil Stations and Terminals, the United States Postal Service, or Railroad Transportation Facilities.
- ☐ Q. Vehicle Maintenance Areas and Equipment Cleaning Areas of Water Transportation Facilities.
- ☐ R. Ship or Boat Building and Repair Yards.
- ☐ S. Vehicle Maintenance Areas, Equipment Cleaning Areas or Airport Deicing Operations located at Air Transportation Facilities.
- ☐ T. Wastewater Treatment Works.
- ☐ U. Food and Kindred Products Facilities.
- ☐ V. Textile Mills, Apparel and other Fabric Product Manufacturing Facilities.
- ☐ W. Furniture and Fixture Manufacturing Facilities.
- ☐ X. Printing and Publishing Facilities.
- ☐ Y. Rubber and Miscellaneous Plastic Product Manufacturing Facilities.
- ☐ Z. Leather Tanning and Finishing Facilities.
- ☐ AA. Facilities That Manufacture Metal Products including Jewelry, Silverware and Plated Ware.
- ☐ AB. Facilities That Manufacture Transportation Equipment, Industrial or Commercial Machinery.
- ☐ AC. Facilities That Manufacture Electronic and Electrical Equipment and Components, Photographic and Optical Goods.
- ☐ AD. Non-Classified Facilities.

ANALYTICAL MONITORING DATA *(For sectors where it is required)*

Storm Event: All samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. This data must be submitted to the Division of Water Quality.

Date of Storm Event	Month Day Year
Duration of Storm Event	Hours
Rain Fall Measurement	Inches
Time Elapsed Between Recorded & Previous Storm Event	Days
Estimated Total Volume of Discharge *(Include units; gal., ft^3, etc.)*	

Please check if there has been no discharge of Storm Water during this reporting period. (If none please explain in comment section)	□ No Discharge

Sample Type: Data shall be reported for a grab sample taken during the first thirty minutes of the discharge. If the collection of a grab sample during the first thirty minutes is impracticable, a grab sample can be taken during the first hour of the discharge, and the discharger shall submit with the monitoring report a description of why a grab sample during the first thirty minutes was impracticable.

Parameter	Effluent Limit (*If Applicable*)	*Concentration* *(Concentration quantity, for example - 14.2)*	*Units* *(Example - mg/L)*

SIGNATURE

Name/Title Principle Executive Officer

(Typed or Printed)

_____

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 U.S.C. 1001 and 33 U.S.C. 1319. (penalties under these statues may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)

_____

Signature of Principle Executive Officer or Authorized Agent *Date*

Comments:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

INFORMATION

Adverse Weather Waiver. *When a discharger is unable to collect samples within a specified sampling period due to adverse climatic conditions, the discharger shall collect a substitute sample from a separate qualifying event in the next period and submit the data along with data for the routine sample in that period. Adverse weather conditions that may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricanes, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).*

Exemption to Monitoring Requirements. *(Does not apply to sector S or any Visual Monitoring Requirements.) As an alternative to monitoring an outfall, an annual certification may be made that material handling equipment or activities; raw or waste materials; intermediate, final, or by-products; industrial machinery or operations; and significant materials from past industrial activity that are located in areas of the facility within the drainage area of the outfall are not presently exposed to storm water and will not be exposed to storm water for the certification period. Such certification must be retained in the storm water pollution prevention plan, and submitted to the DWQ in accordance with Part V.B of the permit. In the case of certifying that a pollutant is not present, the permittee must submit the certification along with the monitoring reports required under reporting requirements in the sector. If the permittee cannot certify for an entire period, they must submit the date exposure was eliminated and any monitoring required up until that date. This certification option is not applicable to compliance monitoring requirements associated with effluent limitations.*

When to Monitor and Report. *Samples must be collected and analyzed at least once during each three month monitoring period. Monitoring results must be submitted annually. See Reporting for dates.*

More Frequent Monitoring. *If sampling is conducted more frequently than semi-annually, all sampling results must be submitted. A separate SWDMR is required for each storm event sampled.*

How to Report. *A separate SWDMR form is required for each storm event and for each outfall sampled. SWDMRs must be signed and mailed to the Division of Water Quality, and must be postmarked by the date specified under Monitoring Periods and Reporting Deadlines. The permittee should retain a copy. The address and phone number for questions or to mail the SWDMR is:*

Department of Environmental Quality

Division of Water Quality

Attention Storm Water Coordinator

PO Box 144870

Salt Lake City, UT 84114-4870

(801) 538-6146

Substantially Identical Discharges. *If there is reason to believe that the discharges from two or more outfalls are substantially identical, one of the outfalls may be monitored and that data submitted for all substantially identical outfalls. A description of the location of the outfalls, an explanation of why the outfalls have substantially identical discharges, and the size of the drainage area and runoff coefficient must be submitted as an attachment to the SWDMR.*

VISUAL MONITORING REQUIREMENTS

Sample and Data Collection: *Examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed one hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable the same individual will carry out the collection and examination of discharges for the life of the permit.*

COLOR (Circle the ones that apply):

1. Identification of Color.

Black Dark Grey Medium Grey Light Grey Dark Chocolate Brown Medium Brown

Light Brown Tan Yellow Green Other

2. Intensity of Color. Very intense Prominent Moderately Perceptible Hardly Perceptible

Comments: _____

_____

_____

CLARITY (Circle the right one):

Totally Opague Slightly Translucent Translucent Nearly Transparent Transparent

ODOR (Circle the ones that apply):

Diesel Gasoline Petroleum Solvent Musty Sewage Chlorine

Rotten Egg Sulfur No Odor Noxious Other

Comments: _____

_____

SOLIDS

Floating Solids: (Description) _____

*Suspended and Settled Solids: (Description*_____

FOAM, OIL SHEEN, OR OTHER OBVIOUS INDICATORS OF POLLUTION

Appendix J

Copy of Completed Quarterly Analytical Monitoring Reports

Appendix K

Completed Storm Water Discharge Monitoring Reports

Appendix L

Spill and Spill Cleanup Reports and Summaries

Appendix M

Spill and Spill Cleanup Reports and Summaries (Non-Hydrocarbon Spills)

There is no pre-written form for this report

Appendix N

Soil, Overburden, and Ore Pile Chemical Analysis Data

USU ANALYTICAL LABORATORIES

Soil Test Report
and
Fertilizer Recommendation

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)
www.usual.usu.edu

Date Received: 10/20/2014
Date Completed: 11/3/2014

PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2268
Identification: 1 SUNRISE ALLUVIAL
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		7.8	Normal	
Salinity - ECe	dS/m	5.62		
Phosphorus - P	mg/kg	7.2		
Potassium - K	mg/kg	182		
Nitrate-Nitrogen - N	mg/kg	17.7		
Zinc - Zn	mg/kg	0.17		
Iron - Fe	mg/kg	1.97	Very Low	
Copper - Cu	mg/kg	2.83	Adequate	
Manganese - Mn	mg/kg	2.40	Adequate	
Sulfate-Sulfur - S	mg/kg	84.2	Adequate	
Organic Matter	%	<1.0		
SAR				

Notes
FOR INTERPRETATIONS / RECOMMENDATIONS, PLEASE CONTACT THE LAB WITH INFORMATION ON WHAT YOU WILL BE GROWING (NOT INDICATED ON INFORMATION SHEET RECEIVED), OR CONSULT TABLES IN "UNDERSTANDING YOUR SOIL TEST RESULTS" (FOUND ON OUR WEBSITE "AFTER RESULTS")

For further assistance, please see your County Agent -- Mark Nelson - 438-6451
For further information and publications of interest, see the
USU Analytical Lab webpage or Utah State University Extension

Methods Used by USUAL: pH + EC (salinity) + SAR by saturated paste; P + K by Olsen sodium bicarbonate extract – K by AA, P by ascorbic acid/molybdate blue colorimetric; NO3-N by CaOH extract + cadmium reduction; Zn, Fe, Cu, Mn by DTPA + ICP; SO4-S by CaHPO4 + ICP; OM by Walkley-Black
Results only reflect the sample received and may not be indicative of actual field conditions.

11/3

USU ANALYTICAL LABORATORIES

Soil Test Report and Fertilizer Recommendation

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Date Received: 10/20/2014
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PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2269
Identification: 2 ALLUVIAL UNDER HT TOP
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		8.0	Normal	
Salinity - ECe	dS/m	1.48		
Phosphorus - P	mg/kg	5.8		
Potassium - K	mg/kg	139		
Nitrate-Nitrogen - N	mg/kg	2.45		
Zinc - Zn	mg/kg	0.10		
Iron - Fe	mg/kg	1.22	Very Low	
Copper - Cu	mg/kg	1.44	Adequate	
Manganese - Mn	mg/kg	1.56	Adequate	
Sulfate-Sulfur - S	mg/kg	63.7	Adequate	
Organic Matter	%	<1.0		
SAR				

Notes
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Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2270
Identification: 3 MARIA ALLUVIUM
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		8.7	Very High	
Salinity - ECe	dS/m	1.25		
Phosphorus - P	mg/kg	6.3		
Potassium - K	mg/kg	179		
Nitrate-Nitrogen - N	mg/kg	2.03		
Zinc - Zn	mg/kg	0.15		
Iron - Fe	mg/kg	1.71	Very Low	
Copper - Cu	mg/kg	7.20	Adequate	
Manganese - Mn	mg/kg	1.13	Adequate	
Sulfate-Sulfur - S	mg/kg	21.1	Adequate	
Organic Matter	%	<1.0		
SAR				

Notes
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Date Received: 10/20/2014
Date Completed: 11/3/2014

PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2271
Identification: 4 HIDDEN TREASURE TOP
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		7.6	Normal	
Salinity - ECe	dS/m	3.80		
Phosphorus - P	mg/kg	11.3		
Potassium - K	mg/kg	268		
Nitrate-Nitrogen - N	mg/kg	9.88		
Zinc - Zn	mg/kg	0.44		
Iron - Fe	mg/kg	1.65	Very Low	
Copper - Cu	mg/kg	11.3	Adequate	
Manganese - Mn	mg/kg	5.36	Adequate	
Sulfate-Sulfur - S	mg/kg	34.2	Adequate	
Organic Matter	%	1.4		
SAR				

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USU ANALYTICAL LABORATORIES

Soil Test Report and Fertilizer Recommendation

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Logan, Utah 84322-9400
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Date Received: 10/20/2014
Date Completed: 11/3/2014

PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2272
Identification: 5 "PRE-ACT" SOIL STOCKPI
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Loamy Sand		
pH		8.2	Normal	
Salinity - ECe	dS/m	1.27		
Phosphorus - P	mg/kg	12.0		
Potassium - K	mg/kg	532		
Nitrate-Nitrogen - N	mg/kg	15.7		
Zinc - Zn	mg/kg	0.23		
Iron - Fe	mg/kg	1.37	Very Low	
Copper - Cu	mg/kg	7.22	Adequate	
Manganese - Mn	mg/kg	2.54	Adequate	
Sulfate-Sulfur - S	mg/kg	6.2	Low	
Organic Matter	%	<1.0		
SAR				

Notes

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Date Received: 10/20/2014
Date Completed: 11/3/2014

PAP-Accredited NAPT 2014

Name: CS MINING LLC
Address: 1208 S 200 W

MILFORD UT 84751

Phone: 435-387-5053
County: BEAVER

Lab Number: 1401-2273
Identification: HIDDEN TREASURE ALLUVI
Crop to be Grown:

Grower's Comments:

Acres in Field:

Soil Test Results			Interpretations	Recommendations
Texture		Loamy Sand		
pH		7.7	Normal	
Salinity - ECe	dS/m	5.34		
Phosphorus - P	mg/kg	5.5		
Potassium - K	mg/kg	99.3		
Nitrate-Nitrogen - N	mg/kg	3.97		
Zinc - Zn	mg/kg	0.11		
Iron - Fe	mg/kg	1.68	Very Low	
Copper - Cu	mg/kg	1.55	Adequate	
Manganese - Mn	mg/kg	2.29	Adequate	
Sulfate-Sulfur - S	mg/kg	6.2	Low	
Organic Matter	%	<1.0		
SAR				

Notes

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Results only reflect the sample received and may not be indicative of actual field conditions

UtahStateUniversity
USU ANALYTICAL LABORATORIES

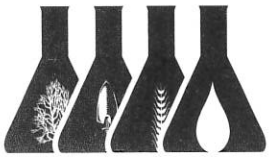
Physical Address: 1541 North 800 East, North Logan
Mailing Address: 9400 Old Main Hill, Logan, UT 84322 – 9400
Phone: (435) 797– 2217 • Fax: (435) 797 – 2117
Web: usual.usu.edu

10/5/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg					%
2320	SR_soil	1	1	Sandy Loam	8.1	0.72	7.5	478	1.94	0.37	2.78	5.58	4.20	3.3	1.1
2321	SR_soil	1	2	Sandy Clay Loam	8.0	3.06	5.1	425	1.46	0.20	2.82	2.59	4.55	11.1	<1.0
2322	SR_soil	2	1	Sandy Loam	7.7	0.37	5.1	190	1.39	0.33	2.50	2.84	3.18	2.0	1.0
2323	SR_soil	2	2	Sandy Clay Loam	7.7	0.32	2.2	176	1.25	0.15	2.61	1.82	3.49	1.0	<1.0
2324	SR_soil	2	3	Sandy Clay Loam	7.6	0.31	2.5	173	0.77	0.12	2.51	1.47	3.95	1.0	<1.0
2325	SR_soil	3	1	Sandy Loam	7.4	0.30	5.5	252	1.05	0.48	3.39	5.26	4.50	0.8	1.0
2326	SR_soil	3	2	Sandy Loam	7.7	0.33	3.0	251	0.71	0.19	2.90	2.03	4.16	1.1	<1.0
2327	SR_soil	3	3	Sandy Clay Loam	7.7	0.36	2.8	203	0.74	0.22	2.86	2.62	4.52	1.3	<1.0
2328	SR_soil	4	1	Sandy Loam	8.0	0.52	6.7	456	1.58	0.29	2.61	3.78	3.65	2.9	1.3
2329	SR_soil	4	2	Sandy Clay Loam	8.1	1.86	3.0	305	1.06	0.15	2.80	1.48	4.24	3.9	<1.0
2330	SR_soil	5	1	Sandy Loam	7.6	0.39	6.9	377	1.26	0.57	3.34	9.32	4.78	1.2	1.0
2331	SR_soil	5	2	Sandy Clay Loam	7.8	0.56	3.7	378	0.75	0.35	3.39	5.58	4.47	1.3	<1.0
2332	SR_soil	5	3	Sandy Clay Loam	7.9	1.21	3.8	317	1.71	0.43	3.59	6.77	4.98	2.3	<1.0
2333	SR_soil	6	1	Sandy Loam	7.8	0.37	4.5	281	1.34	0.37	3.14	3.96	4.04	1.7	<1.0
2334	SR_soil	6	2	Sandy Clay Loam	7.8	0.37	3.0	293	0.81	0.17	3.33	1.76	3.46	1.9	<1.0
2335	SR_soil	7	1	Sandy Loam	8.0	0.45	6.6	316	1.32	0.56	2.75	8.09	3.20	1.9	1.0
2336	SR_soil	7	2	Sandy Clay Loam	8.1	1.01	4.8	287	0.73	0.34	3.32	4.80	4.70	2.1	<1.0
2337	SR_soil	8	1	Sandy Clay Loam	7.8	0.38	7.0	327	1.13	0.48	2.55	8.49	3.37	2.4	1.2
2338	SR_soil	8	2	Sandy Clay Loam	7.8	0.38	3.1	346	0.85	0.15	2.65	2.62	4.27	2.4	1.0
2339	SR_soil	8	3	Sandy Clay Loam	7.6	0.41	4.2	315	0.78	0.16	2.50	2.21	3.62	5.4	<1.0
2340	SR_soil	9	1	Sandy Loam	7.9	0.48	5.5	410	0.79	0.43	2.67	6.05	4.51	2.7	1.3
2341	SR_soil	9	2	Sandy Clay Loam	8.1	0.70	2.4	370	0.73	0.20	2.98	2.42	3.71	1.9	<1.0
2342	SR_soil	10	1	Sandy Loam	7.9	0.45	12.4	250	2.10	1.00	2.68	16.9	4.35	2.9	1.4
2343	SR_soil	10	2	Loam	7.8	0.43	5.1	303	1.08	0.24	2.51	2.93	3.87	1.8	<1.0
2344	SR_soil	10	3	Sandy Clay Loam	7.8	0.39	7.2	346	1.32	0.33	2.93	6.04	4.73	1.8	<1.0
2345	SR_soil	11	1	Sandy Clay Loam	7.7	0.41	4.9	132	0.75	0.31	3.09	3.79	3.42	2.3	1.0
2346	SR_soil	11	2	Sandy Clay Loam	7.7	0.35	2.5	125	0.76	0.16	2.98	1.64	4.51	1.6	1.0
2347	SR_soil	11	3	Sandy Clay Loam	7.7	0.42	1.8	122	0.73	0.15	3.48	1.86	4.80	1.8	1.0
2348	SR_soil	11	4	Sandy Clay Loam	7.8	0.33	1.1	107	0.60	0.13	3.75	2.44	4.70	2.5	<1.0
2349	SR_soil	12	1	Sandy Clay Loam	7.8	0.43	6.3	180	1.19	0.42	2.96	5.38	4.04	1.9	1.2
2350	SR_soil	12	2	Sandy Clay Loam	7.7	0.41	3.0	171	0.80	0.25	3.02	3.04	4.78	1.9	1.0
2351	SR_soil	12	3	Sandy Clay Loam	7.7	0.44	2.7	194	1.05	0.17	3.21	2.75	4.07	2.3	<1.0
2352	SR_soil	12	4	Sandy Clay Loam	7.8	0.40	1.5	148	1.38	0.17	3.60	2.52	4.07	2.2	<1.0



Plant Analysis Lab
Soil Testing Lab
Feed Anaysis Lab
Irrigation Water Analysis Lab
Manure Analysis Lab

UtahStateUniversity
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Web: usual.usu.edu

9/24/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg				mg/kg	%
2208	HT_soil	1	1	Sandy Loam	8.1	0.32	9.5	292	1.32	0.13	2.19	0.83	2.60	1.6	1.2
2209	HT_soil	1	2	Sandy Loam	8.0	0.33	5.8	342	1.36	0.14	2.20	0.71	3.54	1.7	1.2
2210	HT_soil	1	3	Sandy Loam	8.1	0.41	2.9	310	0.94	0.44	1.65	0.48	3.63	2.5	1.0
2211	HT_soil	2	1	Sandy Clay Loam	7.4	0.25	12.0	225	0.75	0.22	4.04	1.31	4.09	1.1	<1.0
2212	HT_soil	2	2	Sandy Clay Loam	7.6	0.25	5.8	139	0.54	0.19	3.95	1.39	5.16	1.2	<1.0
2213	HT_soil	2	3	Sandy Clay Loam	7.9	0.28	3.2	108	0.54	0.13	3.59	1.07	3.54	1.3	<1.0
2214	HT_soil	2	4	Sandy Clay Loam	8.0	0.69	2.7	83.0	0.51	0.07	3.34	0.73	4.33	1.5	<1.0
2215	HT_soil	3	1	Sandy Loam	8.1	0.24	6.3	225	0.64	0.12	2.10	0.67	1.96	1.2	1.0
2216	HT_soil	3	2	Sandy Loam	8.1	0.26	3.5	175	0.92	0.12	2.43	0.77	2.98	1.3	1.0
2217	HT_soil	3	3	Sandy Loam	8.1	0.25	1.7	60.8	0.52	0.08	2.37	0.54	3.98	1.7	<1.0
2218	HT_soil	3	4	Sandy Loam	8.2	0.33	1.1	71.0	0.67	0.04	2.45	0.40	3.60	1.6	<1.0
2219	HT_soil	3	5	Sandy Loam	8.3	0.73	0.9	63.6	<0.5	0.04	2.60	0.41	3.20	1.9	<1.0
2220	HT_soil	3	6	Sandy Clay Loam	8.2	1.51	2.1	89.7	<0.5	0.06	2.48	0.47	2.96	1.6	<1.0
2221	HT_soil	4	1	Sandy Loam	8.0	0.27	6.5	275	<0.5	0.13	2.30	0.84	2.86	1.5	1.0
2222	HT_soil	4	2	Sandy Loam	8.1	0.25	4.4	226	<0.5	0.09	1.98	0.70	3.22	1.4	<1.0
2223	HT_soil	4	3	Sandy Loam	8.0	0.24	2.1	184	<0.5	0.06	1.98	0.53	3.26	1.4	<1.0
2224	HT_soil	4	4	Sandy Loam	8.0	0.25	1.4	179	<0.5	0.05	1.78	0.43	3.02	1.5	<1.0
2225	HT_soil	4	5	Loamy Sand	8.0	0.28	1.3	205	<0.5	0.07	1.63	0.42	3.35	1.7	<1.0
2226	HT_soil	5	1	Sandy Loam	7.8	0.26	8.5	293	<0.5	0.19	3.29	0.98	4.11	1.6	<1.0
2227	HT_soil	5	2	Sandy Loam	7.8	0.32	6.5	246	1.00	0.16	3.14	0.99	3.79	1.7	1.0
2228	HT_soil	5	3	Sandy Loam	7.9	0.34	2.4	149	0.67	0.08	2.06	0.62	3.96	1.5	1.0
2229	HT_soil	5	4	Sandy Loam	7.9	0.32	1.6	153	<0.5	0.05	2.14	0.54	2.90	1.5	<1.0
2230	HT_soil	5	5	Sandy Clay Loam	8.0	0.40	1.4	186	<0.5	0.04	1.99	0.51	3.25	1.5	1.0
2231	HT_soil	5	6	Sandy Clay Loam	8.2	0.43	1.3	217	0.92	0.04	2.03	0.54	2.59	1.4	<1.0
2232	HT_soil	5	7	Sandy Clay Loam	8.4	0.55	1.7	234	<0.5	0.04	2.00	0.53	3.00	1.6	1.0
2233	HT_soil	5	8	Sandy Clay Loam	8.6	0.63	2.1	223	0.58	0.04	2.02	0.54	2.88	2.0	<1.0
2234	HT_soil	5	9	Sandy Clay Loam	8.6	0.92	2.7	245	0.55	0.05	2.16	0.59	2.69	2.7	<1.0
2235	HT_soil	6	1	Sandy Loam	8.1	1.21	5.4	254	0.56	0.12	2.94	0.71	3.61	2.8	1.4
2236	HT_soil	6	2	Sandy Clay Loam	8.0	3.55	4.9	171	0.74	0.11	5.49	0.84	3.04	6.5	1.1
2237	HT_soil	6	3	Sandy Clay Loam	7.8	6.64	4.3	112	0.54	0.15	4.92	0.72	2.62	15.6	1.0
2238	HT_soil	6	4	Sandy Clay Loam	7.8	8.92	6.0	117	<0.5	0.13	5.12	0.85	3.46	37.2	1.2
2239	HT_soil	6	5	Sandy Clay Loam	7.8	10.4	7.6	149	<0.5	0.16	3.61	0.83	4.21	53.0	1.2
2240	HT_soil	7	1	Sandy Clay Loam	7.4	0.28	11.1	374	0.87	0.25	4.90	1.20	5.33	1.4	1.0
2241	HT_soil	7	2	Sandy Clay Loam	7.5	0.33	7.7	305	0.80	0.21	4.95	1.20	5.81	1.4	<1.0
2242	HT_soil	7	3	Sandy Clay Loam	7.8	0.35	5.3	188	0.50	0.11	3.79	0.82	4.10	1.5	1.2
2243	HT_soil	7	4	Sandy Clay Loam	7.8	0.85	2.7	106	<0.5	0.06	2.97	0.55	5.43	2.0	<1.0
2244	HT_soil	8	1	Sandy Clay Loam	7.7	0.34	6.9	187	1.08	0.21	3.62	0.97	3.88	1.8	1.1
2245	HT_soil	8	2	Clay Loam	7.6	0.35	4.4	103	0.52	0.12	3.29	0.82	4.99	2.2	1.6
2246	HT_soil	8	3	Clay Loam	7.5	0.43	4.7	66.5	<0.5	0.11	2.41	0.53	5.42	2.6	1.6
2247	HT_soil	9	1	Clay Loam	8.0	0.36	14.6	409	0.55	0.28	2.52	0.87	3.45	1.7	1.3
2248	HT_soil	9	2	Sandy Clay	7.8	0.36	6.1	309	0.55	0.16	2.39	0.86	2.95	2.0	1.2
2249	HT_soil	9	3	Loamy Sand	7.9	0.35	8.8	224	<0.5	0.14	3.07	0.65	2.93	2.4	<1.0
2250	HT_soil	9	4	Sand	8.0	0.31	6.7	175	1.05	0.12	2.09	0.42	1.68	2.3	<1.0
2251	HT_soil	9	5	Sand	8.0	0.31	5.8	148	1.53	0.11	2.22	0.43	1.84	2.8	<1.0
2252	HT_soil	9	6	Sand	8.0	0.31	5.5	147	1.35	0.12	2.15	0.38	1.90	2.9	<1.0
2253	HT_soil	10	1	Loamy Sand	7.7	0.33	6.0	204	0.56	0.18	3.42	0.76	4.12	1.8	1.1
2254	HT_soil	10	2	Sandy Loam	7.8	0.50	5.0	247	0.84	0.13	3.22	0.74	5.29	1.8	1.2
2255	HT_soil	10	3	Clay Loam	8.1	1.40	3.6	259	0.56	0.10	2.68	0.62	6.57	12.2	1.4
2256	HT_soil	11	1	Loamy Sand	7.2	0.42	9.7	345	2.01	0.28	5.29	1.13	5.45	2.7	1.6
2257	HT_soil	11	2	Sandy Loam	7.6	0.44	9.1	341	1.94	0.27	4.98	1.03	5.55	2.0	1.4
2258	HT_soil	11	3	Sandy Clay Loam	7.8	0.50	6.1	366	1.46	0.19	4.40	0.76	5.39	2.0	1.3
2259	HT_soil	11	4	Sandy Clay Loam	8.0	0.66	4.7	388	1.12	0.14	4.38	0.69	4.21	3.2	1.0
2260	HT_soil	12	1	Sandy Loam	7.9	0.40	9.1	335	3.18	0.25	3.35	1.00	3.68	2.2	1.4
2261	HT_soil	12	2	Loam	7.8	0.37	7.8	295	1.18	0.19	3.67	1.15	4.44	1.5	1.4
2262	HT_soil	12	3	Loam	7.8	0.35	5.0	233	1.12	0.11	2.64	0.98	4.95	1.4	1.1
2263	HT_soil	12	4	Sandy Clay Loam	7.8	0.36	3.3	161	0.84	0.11	2.69	0.84	4.31	1.4	1.0
2264	HT_soil	12	5	Sandy Clay Loam	8.0	0.73	4.8	195	1.33	0.12	2.55	0.77	5.06	1.5	<1.0
2265	HT_soil	12	6	Sandy Clay Loam	7.9	1.69	4.0	223	4.88	0.09	2.92	0.86	4.71	2.0	<1.0
2266	HT_soil	12	7	Sandy Loam	7.9	2.87	4.0	246	5.27	0.10	2.75	0.87	4.49	4.1	<1.0
2267	HT_soil	12	8	Sandy Loam	7.8	5.57	3.2	233	6.44	0.08	2.43	0.81	3.30	23.6	<1.0
2268	HT_soil	13	1	Clay Loam	8.0	0.54	20.4	>900	2.74	0.28	2.38	1.36	5.50	2.6	2.0
2269	HT_soil	13	2	Clay Loam	8.2	0.66	10.0	886	4.54	0.18	1.86	1.06	4.79	3.2	1.9
2270	HT_soil	13	3	Clay Loam	8.0	0.89	10.0	542	9.74	0.16	2.00	0.96	4.40	5.4	1.4
2271	HT_soil	13	4	Clay Loam	8.0	1.28	8.0	161	18.0	0.17	2.31	0.95	4.18	6.5	1.6
2272	HT_soil	13	5	Clay Loam	7.9	2.04	8.0	154	14.0	0.13	1.73	0.85	3.60	6.7	1.3
2273	HT_soil	13	6	Clay Loam	7.9	3.64	4.9	127	13.9	0.12	1.43	0.75	3.21	9.7	1.3

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9/24/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg					%
2274	HT_soil	13	7	Sandy Loam	7.7	6.85	6.8	113	18.5	0.12	1.16	0.63	2.68	22.9	<1.0
2275	HT_soil	13	8	Clay Loam	7.6	11.7	6.9	97.3	31.8	0.09	1.20	0.62	2.47	50.8	1.0
2276	HT_soil	13	9	Sandy Loam	7.5	16.1	7.1	92.4	46.4	0.10	1.15	0.61	1.93	66.4	<1.0
2277	HT_soil	13	10	Sandy Loam	7.7	17.5	8.3	93.5	48.3	0.11	1.28	0.47	1.73	89.2	<1.0
2278	HT_soil	13	11	Sandy Loam	7.6	18.9	9.8	117	59.1	0.15	1.55	0.56	2.86	67.2	<1.0
2279	HT_soil	14	1	Loam	7.9	0.60	25.4	473	1.56	0.39	3.80	1.61	6.55	2.9	2.1
2280	HT_soil	14	2	Sandy Clay Loam	7.9	0.41	7.7	512	1.01	0.15	2.24	1.01	4.67	1.7	1.6
2281	HT_soil	14	3	Sandy Clay Loam	8.0	0.37	3.2	463	0.71	0.09	1.99	0.8	4.50	1.7	1.0
2282	HT_soil	14	4	Sandy Clay Loam	8.0	0.34	4.4	292	1.37	0.08	1.72	0.55	4.53	1.8	<1.0
2283	HT_soil	14	5	Sandy Clay Loam	8.1	0.37	8.5	168	<0.5	0.06	1.43	0.51	3.91	2.6	<1.0
2284	HT_soil	14	6	Sandy Loam	8.2	0.33	5.1	95.5	<0.5	0.05	1.27	0.47	2.37	2.2	<1.0
2285	HT_soil	14	7	Sandy Loam	8.2	0.42	4.7	96.6	0.66	0.05	1.54	0.47	2.87	2.2	<1.0
2286	HT_soil	15	1	Loamy Sand	7.6	0.33	12.2	188	0.91	0.27	4.04	0.63	4.62	1.0	<1.0
2287	HT_soil	15	2	Sandy Loam	7.7	0.35	6.0	188	1.25	0.19	3.77	0.77	4.40	1.2	1.0
2288	HT_soil	15	3	Sandy Clay Loam	7.8	0.36	5.7	151	1.60	0.13	3.04	0.62	4.69	1.3	1.0
2289	HT_soil	15	4	Sandy Clay Loam	8.0	0.34	4.6	107	1.29	0.09	2.42	0.42	3.83	1.2	<1.0
2290	HT_soil	16	1	Loam	7.9	0.88	29.7	>900	2.39	0.35	2.95	1.73	10.4	3.2	2.4
2291	HT_soil	16	2	Sandy Loam	8.1	0.86	11.6	837	1.51	0.15	2.11	1.09	5.26	2.7	1.1
2292	HT_soil	16	3	Sandy Loam	8.1	0.53	5.1	516	1.43	0.09	1.82	0.71	3.75	2.3	<1.0
2293	HT_soil	16	4	Sandy Loam	8.0	0.46	3.4	197	0.99	0.08	1.62	0.49	2.88	1.7	<1.0
2294	HT_soil	16	5	Sandy Loam	8.1	0.56	4.2	76.9	1.04	0.07	1.42	0.52	3.51	3.0	<1.0
2295	HT_soil	16	6	Sandy Clay Loam	8.3	0.65	4.5	48.1	1.10	0.06	1.47	0.58	3.29	3.9	<1.0
2296	HT_soil	16	7	Sandy Clay Loam	8.3	0.76	4.7	55.9	1.19	0.09	1.49	0.61	2.88	4.0	1.0
2297	HT_soil	16	8	Clay Loam	8.4	0.83	5.6	53.7	1.13	0.08	1.55	0.66	2.99	3.8	1.1
2298	HT_soil	16	9	Silty Clay Loam	8.5	0.88	5.9	61.9	0.96	0.10	2.01	0.81	3.22	3.8	1.3
2299	HT_soil	16	10	Silty Clay Loam	8.5	0.99	6.9	60.1	1.05	0.12	1.93	0.79	3.55	4.9	<1.0
2300	HT_soil	16	11	Silty Clay Loam	8.3	1.46	8.5	72.8	1.14	0.11	2.46	1.10	3.62	11.6	1.1
2301	HT_soil	17	1	Sandy Loam	7.9	0.49	13.0	238	2.10	0.20	3.63	0.99	5.04	1.4	1.6
2302	HT_soil	17	2	Sandy Clay Loam	7.9	1.03	6.9	245	1.76	0.18	3.29	0.90	5.50	2.2	1.1
2303	HT_soil	17	3	Clay Loam	7.6	1.50	3.5	240	1.22	0.08	2.11	0.62	7.95	61.1	1.0
2304	HT_soil	18	1	Clay Loam	8.5	1.89	28.1	>900	7.54	0.37	2.17	1.77	8.89	5.9	1.5
2305	HT_soil	18	2	Silt Loam	8.1	6.78	10.1	>900	6.68	0.15	1.71	1.18	5.05	6.4	1.3
2306	HT_soil	18	3	Silt Loam	8.0	1.66	8.0	635	3.72	0.16	1.57	0.92	4.43	2.7	1.2
2307	HT_soil	18	4	Silt Loam	8.1	0.96	5.8	218	3.96	0.13	1.48	0.85	4.11	4.5	1.0
2308	HT_soil	18	5	Sandy Clay Loam	8.1	0.84	5.9	59.9	2.82	0.12	1.72	0.79	3.47	6.2	<1.0
2309	HT_soil	18	6	Clay Loam	8.1	0.84	8.5	89.1	3.60	0.13	1.73	0.81	4.28	4.7	<1.0
2310	HT_soil	18	7	Silt Loam	8.1	0.73	8.4	66.5	3.77	0.13	1.89	0.97	3.61	5.5	<1.0
2311	HT_soil	18	8	Silt Loam	7.9	1.02	8.8	86.1	8.07	0.17	1.90	0.95	3.61	4.4	<1.0
2312	HT_soil	18	9	Sandy Clay Loam	7.6	2.95	8.4	99.2	24.9	0.16	1.73	0.74	2.96	12.0	<1.0
2313	HT_soil	18	10	Sandy Clay Loam	7.4	7.56	9.6	98.8	95.8	0.16	1.77	0.78	2.83	57.2	<1.0
2314	HT_soil	19	1	Sandy Loam	7.6	0.45	7.5	260	2.01	0.24	3.52	1.33	5.92	0.8	<1.0
2315	HT_soil	19	2	Sandy Clay	7.7	1.71	3.2	182	1.36	0.16	4.10	0.96	5.05	1.65	<1.0
2316	HT_soil	19	3	Sandy Clay	7.7	6.12	2.2	101	1.11	0.13	3.83	0.71	3.48	16.1	<1.0
2317	HT_soil	19	4	Clay Loam	7.8	8.79	3.1	83.6	1.24	0.11	3.57	0.77	4.19	64.7	<1.0
2318	HT_soil	19	5	Clay Loam	7.9	11.6	8.0	84.6	1.44	0.10	3.16	0.75	3.40	128	<1.0
2319	HT_soil	19	6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
2390	HT_soil	9	7	Not Enough Soil	8.0	0.38	4.4	175	1.73	0.11	2.26	0.36	2.58	3.5	<1.0

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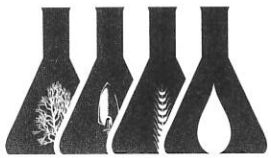
10/7/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg				mg/kg	%
2353	XRDS_soil	1	1	Sandy Clay Loam	7.7	0.35	3.8	134	5.37	0.16	4.05	3.30	3.73	1.9	1.1
2354	XRDS_soil	1	2	Sandy Clay Loam	7.7	0.33	2.8	108	1.47	0.11	5.36	3.55	4.50	1.6	1.0
2355	XRDS_soil	1	3	Sandy Clay Loam	7.7	0.36	1.3	73.2	1.39	0.07	7.10	3.00	3.51	1.6	<1.0
2356	XRDS_soil	1	4	Loamy Sand	8.0	0.59	0.7	67.3	0.80	0.06	5.57	1.93	1.81	2.1	<1.0
2357	XRDS_soil	1	5	Sandy Loam	8.0	1.34	3.0	110	0.91	0.10	5.15	2.97	3.24	9.5	<1.0
2358	XRDS_soil	2	1	Sandy Clay Loam	7.6	0.38	4.6	126	1.48	0.10	2.73	4.91	3.77	1.8	1.4
2359	XRDS_soil	2	2	Sandy Loam	7.8	0.32	6.9	118	1.49	0.22	2.89	3.76	3.32	1.3	1.1
2360	XRDS_soil	2	3	Sandy Loam	7.8	0.32	6.5	124	1.10	0.17	2.85	3.60	2.85	1.5	1.2
2361	XRDS_soil	2	4	Sandy Loam	7.8	0.32	6.6	125	1.31	0.11	2.82	3.16	2.65	1.9	1.3
2362	XRDS_soil	3	1	Loamy Sand	8.0	0.27	4.6	117	1.11	0.17	2.85	8.19	2.92	2.9	<1.0
2363	XRDS_soil	3	2	Sand	7.6	0.47	2.3	108	1.12	0.16	2.90	8.16	4.94	3.0	<1.0
2364	XRDS_soil	3	3	Sand	7.7	0.31	1.4	94.0	0.48	0.09	2.79	4.50	3.27	1.9	<1.0
2365	XRDS_soil	3	4	Sand	7.8	0.27	1.3	90.2	0.54	0.09	2.88	4.38	2.58	2.3	<1.0
2366	XRDS_soil	4	1	Loamy Sand	7.8	0.35	9.0	175	1.05	0.10	2.42	1.49	3.92	1.2	1.1
2367	XRDS_soil	4	2	Sandy Loam	7.7	0.36	5.3	122	0.99	0.08	2.34	1.69	4.52	1.4	1.2
2368	XRDS_soil	4	3	Sandy Clay Loam	7.7	0.33	8.0	146	1.36	0.10	2.63	2.19	5.06	2.1	1.4
2369	XRDS_soil	5	1	Sandy Clay Loam	7.8	0.34	3.7	179	0.69	0.13	2.54	2.36	3.42	1.1	<1.0
2370	XRDS_soil	5	2	Sandy Loam	7.7	0.34	1.6	105	0.58	0.07	2.25	2.50	4.23	0.9	<1.0
2371	XRDS_soil	5	3	Sandy Loam	7.8	0.33	1.3	66.4	0.64	0.06	1.92	2.52	3.63	1.3	<1.0
2372	XRDS_soil	5	4	Sandy Loam	7.8	0.33	1.7	62.4	0.54	0.05	1.96	2.23	3.26	2.5	<1.0
2373	XRDS_soil	5	5	Sandy Loam	7.9	0.36	1.7	58.5	0.58	0.05	1.92	2.07	3.50	2.2	<1.0
2374	XRDS_soil	5	6	Loamy Sand	8.1	1.55	2.0	82.9	0.72	0.06	1.59	1.61	2.59	9.3	<1.0
2375	XRDS_soil	6	1	Sandy Clay Loam	7.7	0.35	4.1	144	1.05	0.11	2.40	4.45	3.06	0.9	1.2
2376	XRDS_soil	6	2	Sandy Loam	7.7	0.36	4.0	136	0.84	0.13	2.82	4.82	4.19	1.0	1.1
2377	XRDS_soil	6	3	Sandy Clay Loam	7.7	0.34	2.4	77.8	0.69	0.05	2.17	4.71	3.53	1.3	<1.0
2378	XRDS_soil	6	4	Sandy Clay Loam	7.8	0.29	1.4	79.3	0.50	0.04	1.85	3.93	2.66	1.4	<1.0
2379	XRDS_soil	6	5	Sandy Clay Loam	7.8	0.36	2.4	90.0	0.62	0.07	1.91	3.82	2.56	1.4	<1.0
2380	XRDS_soil	7	1	Sandy Clay Loam	7.8	0.35	9.4	148	1.21	0.13	3.56	7.09	3.44	1.1	1.3
2381	XRDS_soil	7	2	Sandy Clay Loam	7.7	0.39	5.9	95.7	1.11	0.10	3.47	5.84	3.04	1.5	1.3
2382	XRDS_soil	7	3	Sandy Clay Loam	7.7	0.47	4.4	68.1	0.98	0.09	4.49	8.50	1.81	1.4	1.1
2383	XRDS_soil	7	4	Sandy Clay Loam	7.7	0.44	2.8	64.9	1.06	0.09	4.57	6.17	0.56	1.8	<1.0
2384	XRDS_soil	8	1	Loamy Sand	7.9	0.29	6.3	118	0.95	0.18	2.56	2.40	2.70	1.4	1.0
2385	XRDS_soil	8	2	Sandy Clay Loam	7.8	0.42	6.1	117	1.04	0.12	2.59	3.60	4.02	1.7	1.3



Plant Analysis Lab
Soil Testing Lab
Feed Anaysis Lab
Irrigation Water Analysis Lab
Manure Analysis Lab

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Physical Address: 1541 North 800 East, North Logan
Mailing Address: 9400 Old Main Hill, Logan, UT 84322 – 9400
Phone: (435) 797– 2217 • Fax: (435) 797 – 2117
Web: usual.usu.edu

10/7/2015

CS Mining
1208 South 200 West
Milford, UT 84751

Samples Received: 7/15/2015

USU ID	Identification	Sample Number	Subgroup	Texture	pH	Salinity	Phosphorus	Potassium	Nitrate-Nitrogen	Zinc	Iron	Copper	Manganese	Sulfate-Sulfur	Organic Matter
						dS/m	mg/kg		mg/kg	mg/kg				mg/kg	%
2386	XRDS_soil	8	3	Sandy Clay Loam	7.8	0.38	3.1	83.0	1.09	0.09	2.36	4.46	3.64	1.6	1.6
2387	XRDS_soil	8	4	Sandy Clay Loam	7.7	0.38	2.1	65.9	0.80	0.08	2.37	6.94	4.57	2.0	1.2
2388	XRDS_soil	8	5	Sandy Clay Loam	7.7	0.47	2.3	68.3	0.82	0.10	2.45	6.40	5.82	1.8	1.0
2389	XRDS_soil	8	6	Sandy Clay Loam	7.8	0.38	3.7	94.5	1.07	0.12	2.67	5.17	5.19	1.7	1.3
2391	XRDS_soil	9	1	Loamy Sand	7.8	0.50	4.4	183	1.54	0.12	2.31	2.30	4.95	2.1	1.1
2392	XRDS_soil	9	2	Loamy Sand	7.8	0.44	2.5	125	1.29	0.10	1.86	2.33	4.23	1.9	1.0
2393	XRDS_soil	9	3	Sandy Loam	7.7	0.47	2.5	98.7	1.24	0.11	2.44	4.07	5.42	2.1	1.0
2394	XRDS_soil	9	4	Sandy Loam	7.8	0.38	2.0	68.2	1.06	0.05	2.24	3.93	4.17	2.6	<1.0
2395	XRDS_soil	9	5	Sandy Loam	7.8	0.38	1.8	68.7	1.00	0.02	2.31	3.40	4.10	2.7	<1.0
2396	XRDS_soil	10	1	Sandy Loam	7.7	0.56	4.2	165	1.42	0.16	3.09	2.64	4.76	1.5	1.0
2397	XRDS_soil	10	2	Sandy Loam	7.7	0.37	3.0	111	1.12	0.09	2.76	3.90	5.63	1.6	1.2
2398	XRDS_soil	10	3	Sandy Loam	7.7	0.36	2.8	72.4	1.17	0.05	2.19	3.85	4.58	1.7	1.3
2399	XRDS_soil	10	4	Sandy Loam	7.9	0.36	2.0	46.8	1.13	0.05	1.93	3.04	3.68	3.2	<1.0
2400	XRDS_soil	10	5	Loamy Sand	8.1	0.55	2.4	52.3	0.76	0.03	1.89	2.09	3.32	6.2	<1.0

Appendix P

Employee Training Records

Milford Mining Company
Utah

SWPPP Environmental Training

Trainer: **Date:**

SWPPP Related Safety Events:	
Attendees	
Name	**Signature**

MILFORD MINING COMPANY
UTAH

SWPPP Description & Goals
Stormwater Pollution Prevention Means, Methods, BMP's
Spill Prevention & Response
Contents & Whereabouts of the SWPPP
Notes
Training Type (Circle one): **Annual Refresher** **Initial Training**

Milford Mining Company Utah, LLC

Spill Prevention, Control, and Countermeasure Plan *(SPCC)*

Prepared By:

Milford Mining Company Utah, LLC.
1208 South 200 West
P.O. Box 608
Milford, Utah 84751

March 2024

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FIGURES

Figure 1 Physical Layout of Facility

APPENDICES

Appendix A SPCC Plan Review Form
Appendix B Completed Plan Review Forms
Appendix C Blank Spill Reporting Form
Appendix D Completed Spill Reporting Forms
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Appendix F Secondary Containment Drainage Log
Appendix G Substantial Harm Certification
Appendix H Cross-Reference Table
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1.0 Purpose, General Information, and Management Approval

1.1 Purpose and General Information

This Spill Prevention, Control, and Countermeasure (SPCC) Plan was developed for the Milford Mining Company Utah, LLC (MMCU) facilities located approximately seven miles west of Milford, Utah, in Beaver County. This plan complies with the SPCC requirements defined in 40 CFR Part 112.

The SPCC requirements establish procedures, methods, and equipment to prevent the discharge of oil from onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines or that may affect natural resources. 40 CFR 112 applies to non-transportation related onshore or offshore facilities engaged in drilling, producing, gathering, storing, processing, refining, transferring, or consuming oil and oil products that could reasonably be expected to have such a discharge and meet one of the following conditions:

1. The completely buried storage capacity of the facility is greater than 42,000 gallons of oil.

2. The aboveground storage capacity of the facility is greater than 1,320 gallons of oil. Only containers with a capacity of 55 gallons or more must be included when determining if the threshold has been exceeded.

The MMCU facilities have a total aboveground oil storage capacity that is greater than 1,320 gallons; therefore, a SPCC Plan is required for this operation. This SPCC Plan identifies potential sources of spills, establishes measures of prevention, and defines control, cleanup, and reporting procedures.

1.2 Management Approval [112.7]

The signature below certifies that the management of MMCU fully approves of this SPCC Plan and will commit the necessary resources to fully implement this SPCC Plan as described.

Name	Signature
Title	Date

2.0 SPCC Plan Certification and Amendments

2.1 PROFESSIONAL ENGINEER REVIEW [112.3(D)]

SPCC Plans must be reviewed and certified by a Registered Professional Engineer. The Professional Engineer's stamp below certifies that:

- The Professional Engineer is familiar with the requirements of this part;
- The Professional Engineer or their agent has visited and examined the facility;
- The Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards and with the requirements of 40 CFR 112;
- Procedures for required inspections and testing have been established; and
- The Plan is adequate for the facility.

Stephen Miller, PE

Registration Number

Utah
State

Date

2.2 SPCC PLAN AMENDMENTS [112.5(A)]

Milford Mining Company Utah will update and amend this SPCC Plan whenever the facilities make a change in the design, construction, operation, or maintenance that may affect the potential for an oil discharge. The Plan must be amended within 6 months of the change. The changes must be fully implemented as soon as possible, but no later than 6 months following the completion of the Plan amendments. Examples of changes that require Plan amendments include, but are not limited to:

- Commissioning or decommissioning containers
- Replacement, reconstruction, or movement of containers
- Reconstruction, replacement, or installation of piping systems
- Construction or demolition that might alter secondary containment structures
- Changes of product or service
- Revision of standard operation or maintenance procedures at the facility

2.3 SPCC PLAN REVIEW [112.5(B)]

MMCU must review and evaluate this SPCC Plan **at least** once every five years to ensure its accuracy and to determine if additional or more effective spill prevention and control technology that is applicable to the facility must be added. As a result of this review, the SPCC Plan must be amended within six months as needed. The changes must then be implemented as soon as possible, but no later than six months after amending this Plan.

MMCU must document the completion of the 5-year review and sign a statement as to whether or not the Plan needs to be amended. The form in Appendix A can be used for this purpose. Completed forms will be maintained in Appendix B. This must be completed by November 2022.

2.4 CERTIFICATION OF TECHNICAL AMENDMENTS [112.5(C)]

A Professional Engineer must certify technical amendments to this SPCC Plan. Changes to this Plan that do not affect the facility's potential for a discharge do not require certification by a Professional Engineer. These changes include name and contact information changes.

2.5 SPCC PLAN AVAILABILITY [112.3(E)]

MMCU must maintain a complete copy of this Plan onsite if the facilities area is normally attended at least four hours per day or at the nearest field office if the facilities area is not attended as such. The Plan must be made available to United States Environmental Protection Agency (USEPA) representatives for on-site review during normal working hours.

3.0 Facility Information

3.1 GENERAL [112.7(A)(1) AND (2)]

This SPCC Plan has been prepared in accordance with the requirements in 40 CFR Part 112. The plan does not follow the sequence specified in 40 CFR 112; therefore, a table in Appendix G cross references the requirements in 40 CFR 112 with the sections in this plan.

3.2 FACILITY INFORMATION [112.7(A)(3)]

Facility Name and Address:

Company Name:	Milford Mining Company Utah, LLC
Address:	P.O. Box 827
City, State, Zip Code:	Milford, UT 84751

Facility Owner:

Company Name:	Milford Mining Company Utah, LLC
Address:	P.O. Box 827
City, State, Zip Code:	Milford, UT 84751

Facility Contact:

Name:	Brendan Moseley
Title:	CEO
Phone Number:	(435) 201-4433

Facility Location: The facility is located approximately seven miles west of Milford, in Beaver County, Utah.

Facility Description: There are two facilities that will be included in this SPCC. The first is the Truck Shop, located southeast of the primary operations. This is where general equipment maintenance occurs. The other facility is the milling circuits, located near the eastern flank of the Beaver Lake Mountains. This is where MMCU processes the copper ore that is mined from various pits.

Table 3-1 lists the oil storage containers at the facilities, including oil-filled equipment and the capacity of each.

Table 3-1: Oil Storage Containers

TYPE OF EQUIPMENT	CONTENTS	TOTAL OIL CAPACITY (gallons)
Storage Tank	Used Oil (truck shop)	400
Storage Tank	Equipment Oil (truck shop)	300
Storage Tank	Equipment Oil (truck shop)	300
Storage Tank	Equipment Oil (truck shop)	200
Storage Tank	2 Diesel tanks – 11,000 gal. each (truck shop)	22,000
Storage Tank	2 Diesel tanks – 7,500 gal. each (truck shop)	15,000
Storage Tank	Diesel tank (ore process area)	1,000
Storage Tank	Diesel tank (process plant)	7,000
Storage Tank	Diluent (kerosene) (process plant)	7,000
SX Settlers	4 SX settlers (diluent and aqueous substance) (process plant)	28,000
Organic Holding Tank	2 Organic holding tanks containing diluent and extractant (process plant)	50,000
Mobile Lube Truck	Diesel Various Oils	650 1000
	TOTAL OIL CAPACITY	**132,850**

3.3 PHYSICAL LAYOUT OF THE FACILITIES [112.7(A)(3)]

The MMCU operation produces copper cathode and concentrate from ore mined via open pit mines. This ore is stockpiled at the milling circuits, then crushed and processed to create concentrate. The tails are sent through a leach circuit to create cathode. Large earthmoving equipment are used to mine and move the ore. Haul trucks are used to transport the ore from the mine site to the process facilities.

Operations at MMCU consist of various open pit mines, a maintenance shop, and a processing facility.

4.0 Spill Response, Cleanup, and Disposal Procedures [112.7(a)(5)]

MMCU personnel will use established spill response and cleanup procedures in the event of an oil spill. These procedures are outlined below. However, the procedures will be modified as needed when unforeseen circumstances arise.

4.1 INITIAL SPILL RESPONSE ACTIONS

⇒ The first person on the scene must immediately notify their Foreman or Supervisor if the oil spill is outside of a secondary containment area or is greater than 10 gallons inside a secondary containment area (see the Internal Spill Reporting requirements in Section 5.1).

⇒ Evaluate the health hazards in the area before proceeding.

⇒ Evacuate the area and establish a security zone around the spill, if needed, and control access into the security zone. Personnel not directly involved with the spill need to stay away from the spill area.

⇒ Stop release when it is safe to do so:

- Implement safety-related measures.
- Mobilize fire control equipment, if needed.
- Don appropriate personal protective equipment before entering the spill area.
- Remove all ignition sources from the security zone.

⇒ Contain the spill by isolating and immobilizing the spill. Construct containment ditches and berms or place absorbent material in front of flowing material.

⇒ Estimate the volume of material that was spilled.

⇒ The HSE Manager, Environmental Engineer, or designated Responsible Company Official must determine if authorities or regulatory agencies need to be notified and make the notifications as required.

4.2 SPILL CLEANUP MATERIAL AND EQUIPMENT

Spill clean-up equipment and supplies and their storage locations are listed in Table 4-1.

Table 4-1:Spill Cleanup Equipment and Supplies

QUANTITY	EQUIPMENT OR SUPPLY	STORAGE LOCATION
4 pair	disposable gloves	Truck Shop/Containment area
2 pair	chemical goggles	Truck Shop/Containment area
2	short-handled brooms	Truck Shop/Containment area
1 package	adsorbent rags	Truck Shop/Containment area
15 pounds	oil asorbent material	Truck Shop/Containment area
2	large plastic bags	Truck Shop/Containment area
1 package	adsorbent blankets or booms or "socks"	Truck Shop/Containment area
1	short-handled shovel	Truck Shop/Containment area
1	dustpan	Truck Shop/Containment area

4.3 SPILL CLEANUP PROCEDURES

⇒ If a large spill occurred or the spill reached a waterway, call a cleanup contractor and they will provide additional equipment to clean up the spill. Contact information is located in Table 5-2.

⇒ **DO NOT** use water to clear the spill away! Water will mobilize the spill and require additional cleanup efforts.

⇒ Pick up free liquid that has collected in sumps or containment areas with absorbent material. Place free liquid that has been collected in a tank or drums for temporary storage.

⇒ Clean up liquid that has spread over a non-porous surface with absorbent material such as oil-dry or absorbent socks or booms. Collect oil-soaked cleanup materials (*e.g.,* oil-dry, absorbent socks, or booms) and place them in leak-proof containers.

⇒ For spills on gravel or soil, absorb as much of the liquid as possible with absorbent material and then excavate the oil-contaminated gravel or soil down to visibly clean material. Place the excavated material in piles for temporary storage.

4.4 DISPOSAL PROCEDURES

An oil spill is not considered cleaned up until all waste produced during the cleanup activities are properly disposed. The HSE Manager, Environmental Engineer, or designated Responsible Company Official is responsible for disposing oil-contaminated cleanup materials in accordance with federal, state, and local regulations. General guidelines are listed below; however, the exact means of disposal will depend on the nature and volume of contaminated material and whether the material is contaminated with other substances.

⇒ Liquid oil that has been collected should be recycled at an offsite facility, if possible, or disposed of at a regulated and licensed facility.

⇒ Ship oily soil that has been excavated to a landfill or land farm that is permitted to dispose of or treat oil-contaminated soil.

⇒ Dispose of oil-soaked absorbent material in a landfill permitted for this type of industrial waste.

4.5 FOLLOW-UP RESPONSE ACTIONS

⇒ The HSE Manager, Environmental Engineer, or designated Responsible Company Official is to complete a Spill Report Form as outlined in Section 5.1 (blank forms are in Appendix C). Completed Spill Report Forms will be maintained in Appendix D.

⇒ Conduct an investigation as needed to

- Determine the cause of the spill;
- Review the response actions that were taken to identify any improvements for response to future incidents; and,
- Determine if any measures need to be implemented to prevent another spill.

⇒ Revise this SPCC Plan to reflect any changes at the facility or in operating procedures that result from an evaluation of the spill.

⇒ Replace all spill cleanup equipment that was used during the cleanup of the spill.

5.0 Spill Reporting [112.7(a)(4)]

Proper reporting of spills is very critical and must be done carefully, accurately, and in a timely manner. Table 5-1, at the end of the section, summarizes the spill reporting information outlined in Sections 5.1 through 5.4. A call list with contact names and telephone numbers is located in Table 5-2.

5.1 INTERNAL REPORTING REQUIREMENTS

The person who discovers an oil spill that is outside of a secondary containment area or inside the facility, but has entered or has the potential to enter a floor drain must immediately notify their Supervisor. The Supervisor must then notify the HSE Manager, Environmental Engineer, or designated Responsible Company Official. If the Supervisor is unavailable, the person who discovered the spill must notify the HSE Manager, Environmental Engineer, or designated Responsible Company Official.

For any oil spill or release outside of a secondary containment area, the Supervisor, HSE Manager, Environmental Engineer, or designated Responsible Company Official must complete a Spill Report Form. A written report must also be completed for any spill that is reported to a federal or state agency. A blank form is located in Appendix C. Completed forms will be maintained in Appendix D of this Plan. Records and reports of spills and releases must be maintained for a period of five years and be made available for inspection upon request by the USEPA or state agency personnel.

5.2 FEDERAL REPORTING REQUIREMENTS

The HSE Manager, Environmental Engineer, or designated Responsible Company Official will determine if an oil spill must be reported to federal agencies. If the spill is determined to be reportable, the HSE Manager, Environmental Engineer, or designated Responsible Company Official will complete the required notifications. Federal reporting requirements are outlined in Sections 5.2.1 through 5.2.3.

5.2.1 National Response Center (NRC)

Immediately notify the NRC of any oil spill that enters or has the potential to enter a stream or natural body of water or creates an oil sheen, film, or discoloration on the water or adjoining shoreline. 'Immediate' is defined as 'as soon as possible' after the release. This notification can be a verbal notification. Be prepared to provide the following information:

- Your name, location, organization, and telephone number
- Name and address of the party responsible for the incident
- Date and time of the incident
- Location of the incident
- Source and cause of the release or spill
- Types of material(s) released or spilled

- Quantity of materials released or spilled
- Danger or threat posed by the release or spill
- Number and types of injuries (if any)
- Weather conditions at the incident location
- Any other information that may help emergency personnel respond to the incident

5.2.2 Regional Administrator for EPA Region 8

Submit a written report to the Regional Administrator if the facility spills more than 1,000 gallons of oil in a single spill event or spills more than 42 gallons of oil in each of two spills within any 12-month period. The written report must be submitted within 60 days of the incident and contain the following information:

- Name of the facility;
- Name of the person submitting the report;
- Location of the facility;
- Maximum storage or handling capacity of the facility and normal daily throughput;
- Corrective action and countermeasures taken, including a description of equipment reports and replacements;
- Description of the facility, including maps, flow diagrams, and topographical maps;
- Cause of such discharge;
- Additional preventive measures taken or contemplated to minimize the possibility of recurrence; and,
- Any other information required by the Regional Administrator.

Submit the report to the following USEPA Region 8 address:

USEPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Attn: SPCC Inspector

5.2.3 Bureau of Land Management

Immediately notify the Spill Response Coordinator at the BLM Utah field office if an oil spill impacts, or has the potential to impact, endangered species or waterfowl.

5.3 STATE REPORTING REQUIREMENTS

The HSE Manager, Environmental Engineer, or designated Responsible Company Official will determine if an oil spill must be reported to state agencies. If the spill is determined to be reportable, the HSE Manager, Environmental Engineer, or designated Responsible Company

Official will complete the required notifications. State reporting requirements are outlined in Section 5.3.1 through 5.3.2.

5.3.1 Utah Department of Environmental Quality (UDEQ) – Division of Water Quality (DWQ) Spill Reporting Requirements

Immediately notify the DWQ for oil spills that enter, or have the potential to enter, a body of water or are a potential threat to human health or the environment. The verbal notification must include the substance that was spilled, the actions taken, the cleanup procedures that were or will be implemented, and the facility's plan for disposal of any contaminated cleanup materials.

Immediately notify the DWQ of used oil spills that are greater than 25 gallons or are a potential threat to human health or the environment.

Phone: (801) 536-6146
After hours: (801) 536-4123

5.3.2 Utah Division of Environmental Response and Remediation (UDERR) Spill Reporting Requirements

Immediately make a verbal notification to UDERR of any oil spills that:

- affect or enter, or have the potential to affect or enter, waters of the state
- create a sheen on waters of the state
- are not contained within a secondary containment area or building

For spills that occur within secondary containment areas, UDERR recommends that they be notified as a courtesy. Since the notification is made as a courtesy, the notification can be made within 24 hours of discovery.

24-hour Phone: (801) 536-4123

5.4 LOCAL REPORTING REQUIREMENTS

Table 5-1: Oil Spill Reporting Table

QUANTITY SPILLED	SPILL AREA	WHEN TO REPORT	REPORT TYPE	WHO REPORTS SPILL	REPORT SPILL TO:
Any	Outside of a secondary containment area or building	Immediately	Verbal	Person who discovered the spill	Internal
Any amount that creates a sheen, film, or discoloration	Any location where a spill enters, or has the potential to enter, a stream or natural body of water	Immediately	Verbal	HSE Manager	NRC PH#: 800-424-8802
>42 gallons – twice in any 12-month period	Any water source or outside secondary containment	Within 60 days	Written	HSE Manager	EPA Region 8 PH# 303-312-6202
= or >1,000 gallons	Any water source or outside secondary containment	Within 60 days	Written	HSE Manager	EPA Region 8 PH# 303-312-6202

Table 5-2: Spill Contact Information

CONTACT NAMES	CONTACT INFORMATION
Facility Contacts:	
• Greg Guzzle – Environmental Engineer	• Ph: (801) 755-5539
• Robert Covington – HSE Manager	• Ph: (435) 864-7823
• Rob Clark – Processing Manager	• Ph: (435) 633-3719
• Chris Wright – Maintenance Manager	• Ph: (435) 691-4349
Corporate Contacts: [If applicable for your facility.]	
• Brendan Moseley – CEO	• Ph: (435) 201-4433
Federal Agency Contact Numbers:	
• National Response Center (NRC)	• (800) 424-8802
State Agency Contact Numbers:	
• Utah Division of Water Quality	• (801) 538-6146 • After Hours (801) 536-4123
• Utah Division of Environmental Response and Remediation (24-hour Phone)	• (801) 538-4100
Local Agency Contact Numbers	• **911**
• Utah Division of Water Quality	• (801) 963-3336
Spill Response/Cleanup/Disposal Contractors:	
• N/A	

6.0 Potential for Equipment Failure [112.7(b)]

The Milford Mining Company Utah facilities were inspected to identify each area where a potential for an oil spill exists. The rate of flow of a spill could range from a small drip from a crack in a line or tank to an instantaneous spill caused by the rupture of a tank or container. Table 6-1 lists the sources that have a reasonable potential for equipment failure.

Table 6-1: Potential for Spills

SOURCE NO.	SOURCE	TYPE of SUBSTANSE	MAJOR TYPE of FAILURE	TOTAL QUANTITY (Gallon)	DIRECTION of FLOW	SECONDARY CONTAINMENT
1	Tank	Used oil	1, 2	400	Remain in Secondary Containment	Concrete Containment
2	Tank	Equipment oil	1, 2	300	Remain in Secondary Containment	Concrete Containment
3	Tank	Equipment oil	1, 2	300	Remain in Secondary Containment	Concrete Containment
4	Tank	Equipment oil	1, 2	200	Remain in Secondary Containment	Concrete Containment
5	Tank	Diesel fuel	1, 2	11,000	Remain in Secondary Containment	Concrete Containment
6	Tank	Diesel fuel	1, 2	11,000	Remain in Secondary Containment	Concrete Containment
7	Tank	Diesel fuel	1, 2	7,500	Remain in Secondary Containment	Concrete Containment
8	Tank	Diesel fuel	1, 2	7,500	Remain in Secondary Containment	Concrete Containment
9	Tank	Diesel fuel	1, 2	1,000	Remain in Secondary Containment	Earthen berm with plastic liner
10	Tank	Diesel fuel	1, 2	7,000	Remain in Secondary Containment	Earthen berm with plastic liner
11	Tank	Diluent (kerosene)	1, 2	7,000	Remain in Secondary Containment	Earthen berm with plastic liner
12	SX Settler	Diluent and aqueous substance	1, 2	7,000	Remain in Secondary Containment	Concrete Containment
13	SX Settler	Diluent and aqueous substance	1, 2	7,000	Remain in Secondary Containment	Concrete Containment
14	SX Settler	Diluent and aqueous substance	1, 2	7,000	Remain in Secondary Containment	Concrete Containment
15	SX Settler	Diluent and aqueous substance	1, 2	7,000	Remain in Secondary Containment	Concrete Containment

SOURCE NO.	SOURCE	TYPE of SUBSTANSE	MAJOR TYPE of FAILURE	TOTAL QUANTITY (Gallon)	DIRECTION of FLOW	SECONDARY CONTAINMENT
16	Holding Tank	Diluent and Extractant	1, 2	25,000	Remain in Secondary Containment	Concrete Containment
17	Holding Tank	Diluent and Extractant	1, 2	25,000	Remain in Secondary Containment	Concrete Containment

MAJOR TYPE OF FAILURE: (1) Tank overfill, (2) Leaking container, (3) Leaking piping and/or fittings, and (4) Ruptured piping

7.0 Containment and Diversionary Structures

7.1 Containment and Diversionary Structures [112.7(c)]

Containment and diversionary structures for bulk hydrocarbon storage include lined earthen berms and concrete containments, each designed to contain more 110 % of the tank's capacity.

7.2 Determination of Practicability [112.7(d)]

Facility management has determined that use of the containment and diversionary structures identified above are practical and effective for this facility.

8.0 Inspections, Tests, and Records [112.7(e)]

An SPCC Inspection is conducted monthly at the facility. The inspection includes a visual inspection of all oil containers, oil-containing equipment, piping systems, and secondary containment areas. The blank inspection form located in Appendix E describes the steps to be taken during the inspection and will be used to document the monthly inspections. The inspection form will be signed by the person performing the inspection. The completed inspection forms will be maintained onsite in the official SPCC records for a period of 3 years from the date of the inspection.

Secondary containment pits are inspected for an oil sheen prior to draining any water from them. The inspection is recorded on the Secondary Containment Drainage Log, which is located in Appendix F.

Mechanical integrity testing of bulk oil storage tanks will be conducted as described in Section 14.2.6. Integrity testing records will be maintained while the tank is located at the MMCU facilities.

9.0 Personnel Training

9.1 Initial Training [112.7(f)(1)]

All MMCU personnel who have the potential to handle oil will receive initial SPCC training. New employees or employees whose job functions change will receive the initial SPCC training within one month of beginning their assigned duties. The initial training will consist of classroom and/or hands-on training. The initial training will include the following topics:

- Operation and maintenance of equipment to prevent discharges;
- Spill response, cleanup, and disposal procedures;
- Applicable pollution control laws, rules, and regulations;
- General facility operations; and,
- The contents of this SPCC Plan.

9.2 Designated Person [112.7(f)(2)]

The HSE Manager has been designated as the person who is accountable for spill prevention at the MMCU facilities.

9.3 Annual Briefings [112.7(f)(3)]

Oil-handling personnel will attend an annual briefing. The briefing will ensure that personnel have an adequate understanding of this SPCC Plan. They will be informed of any known discharges that occurred during the prior year. The response and cleanup actions that were taken and the mode of failure of each spill will be discussed. The refresher training will also include a discussion of any recently developed precautionary measures.

9.4 Training Records

All training will be documented. The documentation will include who attended the training and what was included in the training. Training records will be maintained in the Mine office file. Individual training records will be maintained for the length of employment of the employee.

10.0 Site Security

10.1 FENCING [112.7(G)(1)]

There is fencing in only specific areas of site; however access is restricted site-wide by electronic monitoring and an around the clock watchman.

10.2 DRAIN VALVES [112.7(G)(2)]

This paragraph does not apply, since there are no drain valves in the described tanks.

10.3 OIL PUMPS [112.7(G)(3)]

This paragraph does not apply, since there are no oil pumps in the described tanks.

10.4 FACILITY PIPING [112.7(G)(4)]

This paragraph does not apply, since there is no facility piping.

10.5 FACILITY LIGHTING [112.7(G)(5)]

The lighting from the mobile vehicles at the MMCU facilities is adequate to detect spills, inspect secondary containments, and to prevent vandalism during hours of darkness. There is overhead lighting in the Truck shop and milling areas.

11.0 Facility Tank Car and Tank Truck Loading/Unloading Rack

11.1 LOADING/UNLOADING AREA CONTAINMENT SYSTEM [112.7(H)(1)]

The area where truck unloading takes place is graded to a holding pond with sufficient capacity to contain the contents of the delivery truck.

11.2 PREVENTING PREMATURE DEPARTURES [112.7(H)(2)]

Warning Signs and wheel chocks will be utilized in order to prevent premature departures.

11.3 VEHICLE INSPECTION [112.7(H)(3)]

The vendor making deliveries will be responsible for current and appropriate vehicle inspections and ensure that no dripping of hydrocarbons takes place when leaving the site after making deliveries.

12.0 Aboveground Container Repair [112.7(i)]

All field-constructed tanks were built onsite by certified contractors. Certifications of completion and standards of construction are available. Therefore, this section does not apply to the MMCU facilities.

13.0 Additional Federal, State, or Local Requirements [112.7(j)]

No known additional requirements.

14.0 Requirements for On-shore Facilities

In addition to complying with the general requirements of 40 CFR 112.7, owners and operators of onshore facilities, excluding oil production facilities, must meet the requirements of 40 CFR 112.8.

14.1 FACILITY DRAINAGE

14.1.1 Drainage from Diked Areas [112.8(b)(1)]

There is no drainage from the diked areas since liquid in the containment will either evaporate or be manually removed.

14.1.2 Drain Valve on Diked Areas [112.8(b)(2)]

This paragraph does not apply, since there are no drain valves in the diked areas.

14.1.3 Drainage Systems for Undiked Areas [112.8(b)(3)]

The undiked areas at various transfer stations are sloped into a catchment basin or sump.

14.1.4 Final Discharge for Ditches [112.8(b)(4)]

This paragraph does not apply, since there are no ditches in this facility.

14.1.5 Pumps for Drainage Water Treatment Units [112.8(b)(5)]

There is an RO water treatment system onsite. Reject water remains in process circuit. Redundant pumps are in place in order to handle any issues with drainage in the system and in the event of system failure water volume will be easily handled by current onsite installed pumps..

14.2 BULK STORAGE CONTAINERS

14.2.1 Materials of Construction [112.8(c)(1)]

The bulk storage containers located at the MMCU facilities and their material of construction are shown in Table 14-1. All of the bulk storage containers onsite are constructed of materials that are compatible with the material stored in them and the temperature and pressure of storage.

Table 14-1:Bulk Storage Containers

BULK STORAGE CONTAINER	CONTAINER CONTENTS	STORAGE PRESSURE	STORAGE TEMPERATURE	MATERIALS OF CONSTRUCTION
Tank	Used Oil	Atmospheric	Ambient	Steel
Tank	Equipment Oil	Atmospheric	Ambient	Steel
Tank	Equipment oil	Atmospheric	Ambient	Steel
Tank	Equipment oil	Atmospheric	Ambient	Steel
Tank	Diesel fuel	Atmospheric	Ambient	Steel
Tank	Diesel fuel	Atmospheric	Ambient	Steel
Tank	Diesel fuel	Atmospheric	Ambient	Steel
Tank	Diesel fuel	Atmospheric	Ambient	Steel
Tank	Diesel fuel	Atmospheric	Ambient	Steel
Tank	Diesel fuel	Atmospheric	Ambient	Steel
Tank	Diluent (kerosene)	Atmospheric	Ambient	Steel
Tank	Diluent and aqueous substance	Atmospheric	Ambient	Steel
SX Settler	Diluent and aqueous substance	Atmospheric	Ambient	Fiber Glass
SX Settler	Diluent and aqueous substance	Atmospheric	Ambient	Fiber Glass
SX Settler	Diluent and aqueous substance	Atmospheric	Ambient	Fiber Glass
SX Settler	Diluent and aqueous substance	Atmospheric	Ambient	Fiber Glass
Holding Tank	Diluent and Extractant	Atmospheric	Ambient	Steel
Holding Tank	Diluent and Extractant	Atmospheric	Ambient	Steel

14.2.2 Secondary Containment [112.8(c)(2)]

Secondary containment for the bulk storage tanks is listed in Table 6-1 and discussed in Section 7.

14.2.3 Rainwater Discharge [112.8(c)(3)]

The facility does not have a water treatment system that treats rainwater from secondary containment areas. The inspection of rainwater prior to discharge from secondary containment areas is discussed in Section 8.

14.2.4 Completely Buried Metallic Storage Tanks [112.8(c)(4)]

The facility does not have any completely buried storage tanks with the capacity to hold greater than 42,000 gallons of oil. Therefore, this section does not apply to the facility.

14.2.5 Partially Buried of Bunkered Tanks [112.8(c)(5)]

The facility does not use any partially buried or bunkered metallic tanks for the storage of oil. Therefore, this section does not apply to the facility.

14.2.6 Integrity Testing [112.8(c)(6)]

14.2.6.1 Drums

Fifty-five-gallon drums onsite will receive an external visual inspection during the monthly SPCC inspection. The drums are shipped to and from the facility on a regular basis. Since these containers must meet Department of Transportation (DOT) packaging requirements, additional integrity testing will not be performed.

14.2.6.2 External Visual Inspections

The bulk oil storage tanks listed in Table 14-1 receive an external visual inspection during the monthly SPCC inspection.

All storage tanks at the MMCU facilities are shop fabricated and/or certified and contain less than 30,000 gallons. Therefore, the Semi-annual visual inspection as listed in Appendix E satisfies the integrity testing requirement.

14.2.6.3 Shell Testing

All storage tanks at the MMCU facilities are shop fabricated and/or certified and contain less than 30,000 gallons. Therefore, the Semi-annual visual inspection as listed in Appendix E satisfies the shell testing requirement.

14.2.7 Internal Heating Coils [112.8(c)(7)]

The bulk storage containers listed in Table 14-1 are not equipped with internal heating coils. Therefore, this section does not apply to the facility.

14.2.8 Discharge Prevention for Bulk Storage Containers [112.8(c)(8)]

All tanks at this facility have direct-reading level gauges. An MMCU employee or delivery truck driver is present to monitor the level gauges while filling the tanks.

14.2.9 Effluent Treatment Facilities [112.8(c)(9)]

The MMCU facilities do not have an effluent treatment system that treats water discharged from the secondary containment areas for the bulk storage containers listed in Table 14-1 or from the containers themselves. Therefore, this section does not apply to the facility.

14.2.10 Visible Discharges [112.8(c)(10)]

All visible oil leaks will be promptly corrected. Leaks will be cleaned up and reported as outlined in Sections 4 and 5, respectively. Accumulations of oil within secondary containment areas will be promptly cleaned up and reported, if required.

14.2.11 Mobile or Portable Oil Storage Containers [112.8(c)(11)]

Table 14-2 lists the portable or mobile oil storage containers that are located at the facility and the means of secondary containment that are provided for each container. The secondary containment for each container has sufficient capacity to contain the capacity of the largest single compartment or container and sufficient freeboard to contain precipitation when the container is located outside. Portable or mobile oil storage containers are properly located to prevent a discharge of oil to a stream or natural body of water. These containers are continually monitored by the equipment operator when in use and the night watchman during the other shifts.

Table 14-2: Mobile or Portable Oil Storage Containers

STORAGE CONTAINER	CAPACITY	SECONDARY CONTAINMENT	SECONDARY CONTAINMENT CAPACITY
Diesel	650 gallons	N/A	N/A
Various Oils	1000 gallons	N/A	N/A

14.3 FACILITY TRANSFER OPERATIONS

14.3.1 Buried Piping [112.8(d)(1)]

The facility does not have any buried piping used to transfer oil. Therefore, this section does not apply to the facility.

14.3.2 Terminal Connections [112.8(d)(2)]

The facility currently does not have any oil transfer piping that is not in service or is in standby service. Therefore, this section does not apply to the facility.

14.3.3 Pipe Supports [112.8(d)(3)]

The oil transfer lines at the facility are not supported and do not require pipe supports. Therefore, this section does not apply to the facility.

14.3.4 Piping Inspections [112.8(d)(4)]

Aboveground valves, piping, and appurtenances are inspected during the monthly SPCC Inspection.

14.3.5 Vehicle Warning [112.8(d)(5)]

All aboveground oil transfer piping and oil transfer operations at the facility are protected from vehicular traffic by the containment. Therefore, this requirement does not apply to the facility.

If an oil transfer is taking place within the facility, all incoming drivers will be warned of the transfer and instructed to avoid the area of the transfer.

15.0 Substantial Harm Certification [40 CFR 112 Appendix C]

The MMCU facilities in Beaver County, Utah do not meet the substantial harm criteria outlined in 40 CFR 112 Appendix C. In accordance with this section, a certification form has been completed and is maintained in Appendix G of this SPCC Plan.

FIGURES

Figure 1

Physical Layout of Facilities

APPENDICES

Appendix A

SPCC Plan Review Form

SPCC Plan Review Documentation

“I have completed review and evaluation of the SPCC Plan for the Milford Mining Company Utah Facilities in Beaver County, Utah on _____, 20____, and will / will not amend the Plan as a result.”

_____ _____

Signature Date

_____ _____

Printed Name Title

For technical amendments to the Plan, the following certification from a Professional Engineer is required.

“I certify that the Milford Mining Company Utah Facilities in Beaver County, Utah has been examined and being familiar with the provision of 40 CFR 112, attest that this SPCC Plan has been prepared in accordance with good engineering practices and industry standards, the required inspections and testing schedules have been established, and that the plan is adequate for the facility.”

_____

Name of the Professional Engineer

_____

Registration Number

_____

State

_____

Date

Appendix B

Completed Plan Review Forms

Appendix C

Blank Spill Reporting Form

Spill Reporting Form

GENERAL INFORMATION

FACILITY NAME:_____ PHONE NUMBER:
_____

SPILL DISCOVERED BY: _____ TITLE:
_____

PERSON REPORTING SPILL:_____ TITLE:
_____

DATE OF SPILL:_____ TIME:
_____

DATE SPILL WAS DISCOVERED:_____ TIME:
_____

DURATION OF THE INCIDENT:_____ hours

MATERIAL SPILLED:_____
_____

ESTIMATED QUANTITY SPILLED:_____
_____

AMOUNT RECOVERED: AMOUNT UNRECOVERED:

SPILL REPORTING INFORMATION

WHO WAS NOTIFIED OF THE SPILL? _____ Process Manager _____ Env. Engineer

_____ HSE Manager _____ Shift Supervisor _____ Beaver Fire Dept.

WAS A REPORTABLE QUANTITY SPILLED? _____ YES _____ NO

WHICH AGENCIES WERE NOTIFIED OF THE SPILL? (Only the General Manager or his/her designee is authorized to make notifications):

UDEQ – DWQ (801) 536-6146	**UDERR** (801) 536-4123	**Beaver Emergency Mgmt.**
Date:_____	Date:_____	Date:_____
Time:_____	Time:_____	Time:_____
Name:_____	Name:_____	Name:_____
National Response Center (800) 424-8802	**USFWS – Spill Response Coordinator** (801) 975-3330	**Local Fire Department** 911
Date:_____	Date:_____	Date:_____
Time:_____	Time:_____	Time:_____
Name:_____	Name :_____	Name:_____

SPILL INFORMATION

ESTIMATED QUANTITY THAT HAS, OR HAS THE POTENTIAL TO ENTER WATERS OF THE STATE OR UNITED STATES:_____gallons NAME OF WATER BODY:
_____

SPILL WAS RELEASED INTO (land, water, secondary containment, etc.):
_____

WHERE DID THE SPILL GO OR WHICH DIRECTION DID THE SPILL TRAVEL?

ESTIMATED QUANTITY THAT WAS RELEASED OR MIGRATED OFFSITE:

WEATHER CONDITIONS:

EXACT LOCATION OF THE SPILL (include type of terrain, nearest waters or drains, direction the spill is moving as applicable):

SPILL INFORMATION (continued):

SOURCE OF THE SPILL:

CAUSE OF THE SPILL (include equipment or activities involved in the spill):

WAS THE SPILL CONTAINED? _____ YES _____ NO

IF YES, HOW?

HAZARD/DAMAGE INFORMATION

IDENTIFY HEALTH HAZARDS OR CHARACTERISTICS:

PRECAUTIONS THAT HAVE BEEN OR ARE BEING TAKEN:

LIST PERSONAL INJURIES, ENVIRONMENTAL DAMAGE, OR PROPERTY DAMAGE CAUSED BY THE SPILL (environmental damage includes impacts to wildlife, wetlands, or other environmental resources):

EVACUATION NEEDED? _____ YES _____ NO

SPILL CLEANUP INFORMATION

OUTSIDE CONTRACTOR USED FOR SPILL CLEAN UP? _____ YES _____ NO

CONTRACTOR'S NAME, IF USED:

CLEAN UP ACTIONS:

EFFECTIVENESS OF CLEANUP ACTIVITIES:

SPILL FOLLOW-UP

ACTION(S) TO BE IMPLEMENTED TO PREVENT FUTURE OCCURRENCES:

WAS THE SPCC PLAN REVIEWED AFTER THIS SPILL (applies only to oil spills)? _____ YES _____ NO

DOES THE SPCC PLAN REQUIRE MODIFICATION (applies only to oil spills)? _____ YES _____ NO

WAS THE SWPPP REVIEWED AFTER THIS SPILL (applies to spills other than oil)? _____ YES _____ NO

DOES THE SWPPP REQUIRE MODIFICATION (applies to spills other than oil)? _____ YES _____ NO

SIGNATURE: DATE:

Appendix D

Completed Spill Reporting Forms

Appendix E

Monthly SPCC Inspection Form
or
Monthly SPCC Inspection Procedure

MONTHLY SPCC INSPECTION CHECKLIST

DATE:_____

TIME:_____

INSPECTOR:

√ = Satisfactory
N/A = Not Applicable
X = Repair or Adjustment Required (see comments under Problems Found

OIL STORAGE TANKS, DRUMS, and CONTAINERS

_____ Level gauges and alarms operating properly.

_____ No signs of deterioration on shell (*i.e.,* discoloration or flaking of coating, shell distortion, localized corrosion at welds, general corrosion, hairline cracks, or bulging).

_____ No damage or deterioration on supports, foundation, and anchor bolts (*i.e.,* cracking, distortion, buckling of supports or saddle, signs of settlement, corrosion, pitting, vehicle damage, or loose anchor bolts).

_____ No deterioration or leakage at pipe connections to container.

_____ No signs of leakage on container, foundation, or supports.

_____ Drain valves on tanks are closed and secured.

_____ Pressure relief devices, emergency vents, or relief vents are clean and free of obstructions.

_____ Mobile or portable containers are provided with secondary containment or located to prevent a discharge to water.

_____ Internal heating coils are operating properly and do not show signs of leakage.

SECONDARY CONTAINMENT AREAS

_____ No signs of leakage or spills, such as stained surfaces.

_____ Containment walls and floors are intact and are not cracked.

_____ Drainage from diked areas is restrained.

_____ Drain valves on dikes areas are closed.

_____ No visible oil sheen on water in containment areas.

_____ No standing water in containment areas.

FACILITY DRAINAGE/TREATMENT

_____ No oil sheen or runoff around oil-containing equipment.

_____ No ruts or unusual drainage patterns around secondary containment areas.

_____ Effluent treatment system operating properly.

SPILL CLEAN UP EQUIPMENT

_____ Spill kits contain proper equipment.

_____ Oil absorbent material is available.

VALVES/PIPELINES

_____ No signs of corrosion or damage on piping, valves, flanges, etc.

_____ Terminal connection of out-of-service pipes capped or blind-flanged and origin is marked.

_____ No leaks or signs of leakage at valves, flanges, or other fittings.

_____ No signs of abrasion or corrosion at pipe support locations.

_____ Piping, flanges, expansion joints, and pipe supports in good condition.

_____ Starter locked in 'Off' position on oil pumps when not in operation.

OIL-FILLED PROCESS and ELECTRICAL EQUIPMENT

_____ Equipment is operating properly.

_____ No signs of leakage.

_____ No rust, corrosion, or pitting on external surfaces.

_____ Equipment foundation/base in good condition.

_____ No oil sheen or runoff from around oil-containing equipment.

SECURITY

_____ Fence and gates in good condition.

_____ Gates around oil tanks/containers are locked.

_____ Facility lighting is adequate & working properly.

LOADING/UNLOADING AREAS

_____ Loading/unloading connections are capped or blind-flanged when not in service.

_____ A means to prevent premature departure of tank trucks is in place and used.

PROBLEMS FOUND:_____

CORRECTIVE ACTIONS:_____

Monthly SPCC Inspection Procedure

Observe the general condition of the facility and for conformance with the requirements in the facility's SPCC Plan. The following areas must be observed during the inspection. If any problems are observed, make a note on the inspection form.

Oil storage tanks, drums, and containers:

- Drain valves on tanks are closed and secured.
- Inspect for signs of deterioration on containers shell (*i.e.,* discoloration or flaking of coating, shell distortion, localized corrosion at welds, general corrosion, hairline cracks, or bulging).
- Inspect for damage or deterioration on supports, foundation, and anchor bolts (*i.e.,* cracking, distortion, buckling of supports or saddle, signs of settlement, corrosion, pitting, vehicle damage, or loose anchor bolts).
- Inspect for signs of leakage on container, foundation, or supports.
- Pressure relief devices, emergency vents, or relief vents are clean and free of obstructions.
- Level gauges and alarms operating properly.
- Mobile or portable containers are provided with secondary containment or located as to prevent a discharge to water.
- Internal heating coils are operating properly and do not show signs of leakage.

Oil-filled process and electrical equipment:

- Equipment is operating properly.
- Inspect for signs of leakage.
- Inspect for rust, corrosion, or pitting on external surfaces.
- Equipment foundation/base in good condition.
- Inspect for oil sheen or runoff from around oil-containing equipment.

Diked areas or secondary containment areas:

- Containment walls and floors are intact and are not cracked.
- No visible oil sheen on water in containment areas.
- No standing water in containment areas.
- Inspect for signs of leakage or spills, such as stained surfaces.
- Drainage from diked areas is restrained.
- Drain valves on diked areas are closed.

Effluent treatment system: operating properly.

Loading/unloading areas:

- Loading/unloading connections are capped or blind-flanged when not in service.
- A means to prevent premature departure of tank trucks is in place and used.

Monthly SPCC Inspection Procedure *(continued)*

Oil piping systems:

- Oil pump starters are locked in the OFF position when not in operation.
- The terminal connection of out-of-service piping is capped or blind-flanged and origin is marked.
- Inspect for signs of abrasion or corrosion at pipe support locations.
- Inspect for signs of leakage around pipe fittings, flanges, valves, instrumentation, and other fittings.
- Piping, flanges, expansion joints, and pipe supports in good condition (*i.e.,* no corrosion or damage).

Site security measures:

- Fencing and gates are in good condition.
- Gates around oil tanks/containers are locked.
- Facility lighting is adequate for discovering spills and working properly.

Spill Clean-up Equipment:

- Spill kits contain proper equipment.
- Oil absorbent material is available.

Appendix F

Secondary Containment Drainage Log

SECONDARY CONTAINMENT DRAINAGE LOG

Record the following information every time water is drained from a secondary containment area.

DATE	TIME	INSPECTOR	SECONDARY CONTAINMENT AREA[1]	WATER DISCHARGED? (YES/NO)	REASON FOR DISCHARGE[2]	APPEARANCE OF WATER [3]	DESTINATION OF DISCHARGED WATER

NOTES:
(1) Record which secondary containment area is being inspected.
(2) Rain, leak, etc.
(3) Clear, cloudy, dirty, oil sheen, etc. Do not discharge the water if it has an oil sheen or contains oil.

Appendix G

Substantial Harm Certification

Certification of the Applicability of the Substantial Harm Criteria

Facility Name: Milford Mining Company Utah

Facility Address: Beaver County, Utah

1. Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons?

   Yes_____ No X

2. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation within any aboveground oil storage tank area?

   Yes_____ No X

3. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments?

   Yes_____ No X

4. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance such that a discharge from the facility would shut down a public drinking water intake?

   Yes_____ No X

5. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and has the facility experienced a reportable oil discharge in an amount greater than or equal to 10,000 gallons within the last 5 years?

   Yes_____ No X

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

Signature	Name (please type or print)
Title	Date

Appendix H

Cross-Reference Table

Cross Reference Table between 40 CFR 112 Requirements and Sections in SPCC Plan

40 CFR SECTION	PLAN SECTION	TOPIC
112.3(d)	Section 2.1	Professional Engineer's Certification
112.3(e)	Section 2.5	SPCC Plan Availability
112.5(a)	Section 2.2	SPCC Plan Amendments
112.5(b)	Section 2.3	SPCC Plan Review
112.5(c)	Section 2.4	Certification of Technical Amendments
112.7	Section 1.2	Management Approval
112.7(a)(1) and (2)	Section 3.1	General
112.7(a)(3)	Section 3.2 and 3.3	Facility Information and Physical Layout of the Facility
112.7(a)(3)(i)	Section 6, Table 6-1	Contents of each container and its storage capacity
112.7(a)(3)(ii)	Section 7 and 11	Discharge prevention measures and procedures for routine handling of products
112.7(a)(3)(iii)	Section 7 and 11	Discharge or drainage controls
112.7(a)(3)(iv)	Section 4	Countermeasures for discharge discovery, response, and cleanup
112.7(a)(3)(v)	Section 4.4	Methods of disposal of recovered materials
112.7(a)(3)(vi)	Section 5, Table 5-2	Contact list and phone numbers
112.7(a)(4)	Section 5	Spill Reporting
112.7(a)(5)	Section 4	Spill Response and Cleanup Procedures
112.7(b)	Section 6	Potential for Equipment Failure
112.7(c)(1)	Section 7.1	Containment and Diversionary Structures
112.7(d)	Section 7.2	Determination of Practicability
112.7(e)	Section 8	Inspections, Tests, and Records
112.7(f)	Section 9	Training and Annual Briefings
112.7(g)	Section 10	Site Security
112.7(h)	Section 11	Facility Tank Car and Tank Truck Loading/ Unloading Rack
112.7(i)	Section 12	Aboveground Container Repair
112.7(j)	Section 13	Additional Federal, State, or Local Requirements
112.8(b)	Section 14.1	Facility Drainage
112.8(c)	Section 14.2	Bulk Storage Containers
112.8(d)	Section 14.3	Facility Transfer Operations
40 CFR 112 Appendix C	Section 15	Substantial Harm Certification

Appendix I

Blank SPCC Training Logs

Appendix J

Completed SPCC Training Logs