Mining Plan for the Sevier Playa Potash Project

BLM Case File Number UTU-88387

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Abbreviations

°C	Degree(s) Celsius
°F	Degree(s) Fahrenheit
µg/m^3	Microgram(s) per Cubic Meter
3D	Three-dimensional
ac-ft/yr	Acre-feet per Year
amsl	Above Mean Sea Level
AWAL	American West Analytical Laboratories
bcy	Bank Cubic Yards
bgs	Below Ground Surface
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
BMU	Brine Mining Unit
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
Company	Crystal Peak Minerals Inc.
CPM	Crystal Peak Minerals Inc.
CPMC	Crystal Peak Minerals Corporation
CPT	Cone Penetration Tests
cy	Cubic Yards
DEM	Digital Elevation Model
EA	Environmental Assessment
ECIP	Environmental Compliance and Inspection Plan
EIS	Environmental Impact Statement
Emerald Peak	Emerald Peak Minerals LLC
EPA	U.S. Environmental Protection Agency
EPM	EPM Mining Ventures Inc.
FCZ	Fat Clay Zone
FLPMA	Federal Land Policy and Management Act
FONSI	Finding of No Significant Impact
FS	Feasibility Study
ft/day	Feet per Day

ft^2/day	Feet Squared per Day
gpm	Gallon(s) per Minute
gpd	Gallon(s) per Day
gram/L	Gram(s) per Liter
Graymont Lime	Graymont Western US Inc.
GSM	Gridded Seam Model
Hazen	Hazen Research
HDPE	High-density Polyethylene
lb/in^2	Pound(s) per Square Inch
IGES	Intermountain GeoEnvironmental Services, Inc.
lcy	Loose Cubic Yards
LUMA	LUMA Minerals LLC
m	Meter(s)
m^3	Cubic Meter(s)
m tons/yr	Million U.S. Customary Tons per Year
mg/L	Milligram(s) per Liter
MCZ	Marl Clay Zone
MFSF	MODFLOW SURFACT
Mining Plan	Mining Plan for the Sevier Playa Potash Project
MOP	Muriate of Potash
Mt	Million Metric Tonnes
mph	Miles per Hour
Mton	Million Ton(s)
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
Novopro	Novopro Projects Inc.
NRCS	Natural Resources Conservation Service
O&M	Operations and Maintenance
PFS	Preliminary Feasibility Study
PM_{10}	Particulate matter smaller than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter smaller than 2.5 microns in aerodynamic diameter
ppm	Parts per Million
PRISM	Parameter-elevation Regressions on Independent Slopes Model

POD	Plan of Development
Project	Sevier Playa Potash Project
RCRA	Resource Conservation and Recovery Act
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-way
SCS	Soil Conservation Service
SCZ	Siliceous Clay Zone
SG	Specific Gravity
SITLA	School and Institutional Trust Lands Administration
SOP	Sulfate of Potash
SPCC	Spill Prevention, Control, and Countermeasures
SR 257	Utah State Route 257
SWPPP	Stormwater Pollution Prevention Plan
TDS	Total Dissolved Solids
ton	U.S. Customary Ton
tons/yr	U.S. Customary Tons per Year
tonne or t	Metric Tonne(s)
USC	United States Code
UAC	Utah Administrative Code
UCA	Utah Code Annotated
UDAQ	Utah Division of Air Quality
UDOGM	Utah Division of Oil Gas and Mining
UDOT	Utah Department of Transportation
UDWQ	Utah Division of Water Quality
UDWR	Utah Division of Wildlife Resources
UDWRi	Utah Division of Water Rights
UPDES	Utah Pollutant Discharge Elimination System
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
WOUS	Waters of the United States

WSRA RMP	*Warm Springs Resource Area, The Resource Management Plan, Record of Decision Rangeland Program Summary*
Wt%	Weight Percent

Minerals, Formulas, Alternative Formulas, and Alternative Names

Mineral	Formula	Alternative Formula	Alternate Name
Anhydrite	$CaSO_4$		Anhydrous calcium sulfate
Astrakanite	$Na_2SO_4 \cdot MgSO_4 \cdot 4H_2O$		Bloedite
Bitterns	$MgCl_2$ or $MgSO_4$		
Calcium	Ca^{2+}		
Carbonate	CO_3^{2-}		
Carnallite	$KMgCl_3 \cdot 6H_2O$		
Chloride	Cl^-		
Cranswickite	$MgSO_4 \cdot 4H_2O$		Starkeyite
Epsomite	$MgSO_4 \cdot 7H_2O$		
Glauberite	$Na_2SO_4 \cdot CaSO_4$	$Na_2Ca(SO_4)_2$	
Gypsum	$CaSO_4 \cdot 2H_2O$		
Halite	NaCl		Sodium chloride, common salt
Hexahydrite	$MgSO_4 \cdot 6H_2O$		
Kainite	$MgSO_4 \cdot KCl \cdot 3H_2O$	$KMgSO_4Cl \cdot 3H_2O$	
Korshunovskite	$Mg_2Cl(OH)_3 \cdot 4(H_2O)$		
Leonite	$K_2SO_4 \cdot MgSO_4 \cdot 4H_2O$	$K_2Mg(SO_4)_2 \cdot 4H_2O$	
Lithium	Li^+		
Magnesium	Mg^{2+}		
Magnesium chloride	$MgCl_2$		
Magnesium sulfate	$MgSO_4$		
Pentahydrite	$MgSO_4 \bullet 5H_2O$		
Picromerite	$K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$	$K_2Mg(SO_4)_2 \cdot 6H_2O$	Schoenite
Polyhalite	$K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$		Hydrated potassium calcium magnesium sulfate
Potassium	K^+		
Potassium sulfate	K_2SO_4		
Potassium magnesium sulfate	$K_2SO_4 \cdot Mg_2(SO_4)_2$	$K_2Mg_2[SO_4]_3$	Sulfate of potassium magnesium (SOPM)
Sodium	Na^+		
Sulfate	SO_4^{2-}		
Sylvite (potassium chloride)	KCl		
Thenardite	Na_2SO_4		Salt cake, sodium sulfate
Water	H_2O		

1 Introduction

1.1 Project Overview

Crystal Peak Minerals Inc. (CPM), formerly known as EPM Mining Ventures Inc. (EPM), is a Canadian development-stage, pre-revenue potash company domiciled in Whitehorse, Yukon Territory, Canada, with domestic headquarters in Salt Lake City, Utah, United States. Peak Minerals Inc. (Peak, or the Company), a direct, wholly-owned subsidiary of CPM, owns as lessee, or through agreement has the right to develop and operate, potassium mineral leases on approximately 118,000 acres of land administered by the U.S. Bureau of Land Management (BLM) as well as potash mineral leases on an additional approximately 6,400 acres of state lands managed by the State of Utah School and Institutional Trust Lands Administration (SITLA) on the Sevier Playa property in Millard County, Utah (**Figure 1-1**), for a total of approximately 124,400 acres.

CPM, through Peak, is proposing to construct and operate the Sevier Playa Potash Project (Sevier Playa Project, or Project) that would be designed to produce average annual production over the 30-year life of the Project of approximately 328,500 tons/yr, with peak production of approximately 372,000tons/yr declining to approximately 246,000 tons/yr, of potash in the form of sulfate of potash (SOP, or potassium sulfate), as well as other associated mineral products. Brines extracted from Sevier Playa sediments would be concentrated by solar evaporation. The potassium-rich salts, precipitated in production ponds, would be harvested and processed in a modern crystallization plant, referred to as the Processing Facility, to produce a saleable SOP product, as well as other associated minerals. Refer to Sections 6.6, 7.9 and 8 for a discussion on associated minerals. SOP is a soluble mineral containing potassium that is used primarily as fertilizer.

The Project would feature recharge and extraction canals at the surface of the mineral extraction area as a method of recovery of the potassium-rich brines. Also, shallow extraction wells would be used to extract brine from within the playa. Recharge waters would be collected from natural precipitation and from the Sevier River. Evaporation ponds would be used for recovery of the crude salts. The salts would be harvested using mobile equipment and sent to the Processing Facility for beneficiation producing SOP.

Potassium is defined by regulation as a solid leasable mineral under Title 43 of the Code of Federal Regulations (CFR) Part 3500 (43 CFR 3500) and the Mineral Leasing Act of 1920 (30 United States Code [USC] 181 et seq.). The federal lands leased for the Project are public lands, administered by the BLM.

Potash leases on state lands were issued to EPM. Potash is classified and defined in Utah Administrative Code R850-25-100(1)(b) (collectively “leased substances”). The state lands leased for the Project are school trust lands administered by SITLA.

Potassium and potash leases, collectively referred to as potash leases, grant the lessee the exclusive right and privilege to explore for, drill for, mine, extract, remove, beneficiate, concentrate, or otherwise process and dispose of the potassium deposits and other associated minerals. The extraction and development of the leased deposits are only allowed in accordance with the lease and associated stipulations and under an approved mining plan, as well as being subject to other required state and federal approvals.

The leases within the Project are held by three entities:

- Peak
- LUMA Minerals LLC (LUMA)
- Emerald Peak Minerals LLC (Emerald Peak)

1.2 History of Mineral Exploration and Development on the Sevier Playa

As early as the late 1800s, various topographic surveys were conducted in the Sevier Playa region. In 1869, the U.S. Army Corps of Engineers (USACE) determined the true position of the playa (Gwynn 2006). Between 1869 and 1977, most mapping work in the region focused on improving topographical and surface geology information, with scientific studies undertaken in the 1960s to assess the Sevier Playa mineralogy and brine chemistry. These studies served as the basis for more detailed exploration and bulk sampling by Crystal Peak Minerals Corporation (CPMC), starting in 1977. (There is no relationship between the historical CPMC company and the current CPM company.)

In 1987, the BLM completed an Environmental Assessment (EA) of the leaseholds under the National Environmental Policy Act (NEPA). The CPMC development and operations plans were reviewed, and the leasehold area was surveyed for environmental concerns, including wildlife habitat, threatened and endangered species, cultural and archaeological resources, and impacts to recreational opportunities. The BLM issued a "Finding of No Significant Impact" (FONSI) in October 1987.

In 1997, Salada Minerals LLC (Salada) assembled approximately 15,360 acres of federal sodium leases covering the south end of the playa. Salada also held approximately 1,280 acres of potash leases in five separate sections from the State of Utah. Salada's leases went through the EA process, culminating in a FONSI decision by the BLM in June 1997 and a right-of-way (ROW) grant in February 1998.

More recently, two additional EAs have been developed by the BLM for the area. In February 2011, the BLM published an EA (DOI-BLM-UT-W020-2010-014-EA) (Leasing EA), disclosing and analyzing the environmental consequences of its Sevier Lake Competitive Potash Leasing Proposal (BLM 2011a). The Leasing EA was not limited to the assessment of leasing and included analysis of the effects of reasonable scenarios for potash extraction based on known available processes and technology.

The BLM's Decision Record and FONSI for the Leasing EA allowed a competitive Sevier Playa potassium lease sale to move forward. The BLM published the Sevier Lake Potash Lease Sale notice for the lands under consideration on March 2, 2011. Peak was the high bidder and, on June 1, 2011, was awarded leases totaling 95,801.76 acres.

As a follow-up to the Leasing EA, the BLM completed a second EA (DOI-BLM-UT-W020-2011-015-EA) (Exploration EA) to assess the impacts of CPM's proposed exploration on Sevier Playa (BLM 2011b). The BLM issued a Decision Record and FONSI for the Exploration EA in August 2011. After the Decision Record was signed, the first phase of the exploration program was successfully initiated and completed in 2012. A second phase of exploration was successfully initiated and completed in 2013. A third exploration phase was initiated in 2015 and completed in 2017.

1.3 Mining Plan Document Overview

This *Mining Plan for the Sevier Playa Potash Project* (Mining Plan) was developed with the intent of meeting the regulatory requirements of the BLM and the Utah Division of Oil, Gas and Mining (UDOGM).

This Mining Plan was prepared based on the current understanding of the Project and the Company's Feasibility Study (FS), as documented in the National Instrument 43-101 (NI 43-101) Technical Report (CPM 2018a).

Modifications to this plan may be required as new data are acquired or as operational plans and/or processes are revised, based on new survey information, hydrologic data, and information from various third parties.

Tables and figures in this Mining Plan are sequentially numbered by the section number in which they are first referenced. Tables are located in the section in which they are referenced. Most figures are located at the end of the document with the exception of a few figures that are located within the body of the report. Figures are provided at a reduced scale (8.5 × 11–inch or 11 × 17–inch format) in the text section for reader reference.

Peak's federal lease, Special Stipulation 6 states the following:

> As Built Drawings: The Lessee will submit to the Deputy State Director, Lands and Mineral Resources, BLM Utah State Office, and the FFO, a scaled map showing the construction and the survey coordinates (State Plane or metes and bounds description) of each of the mine features, buildings, ditches, pumps etc., within 90 days after construction is complete. The surveyor that conducts the survey will be licensed and shall stamp the drawing. Land features will be shown on the drawing. These will include but are not limited to section corners, roads, and section lines. An updated map will be sent to BLM within 90 days after construction is completed on any new sites. (BLM 2011c)

Due to the extended time required to construct the Project, it was determined that as-built drawings would be provided to the BLM annually opposed to within 90 days after construction is completed per the lease stipulation. These drawings would be provided annually by April 1 showing the construction that occurred the previous year.

The mine design incorporates several types of computer modeling. Discussions of the various types of modeling are presented in their applicable sections in this Mining Plan.

Technical references cited in this Mining Plan are included in Appendix B, *Confidential Technical References*, and Appendix C, *Publicly Available Technical References*. Appendix B contains documents that the Company considers confidential and proprietary while Appendix C contains public documents.

1.3.1 Federal Mining Plan Requirements

This Mining Plan has been prepared in compliance with the requirements specified in the 43 CFR 3590, Solid Minerals (Other than Coal) Exploration and Mining Operations, through 43 CFR 3596, as applicable to the brine extraction and processing methods. To facilitate review, a cross-reference table is provided in **Table 1-1,** *43 CFR Subpart 3592 and Mining Plan Cross Reference*, to link the required sections of CFR Title 43 to the contents of this Mining Plan.

Table 1-1. 43 CFR Subpart 3592 and Mining Plan Cross Reference

CFR Title 43 Subpart		Mining Plan Location	
Designation	**Description**	**Section(s)**	**Tables and Figures**
3592.1c (1)	Operator name (point of contact if corporate), address, telephone number.	2.0	–

CFR Title 43 Subpart		Mining Plan Location	
Designation	**Description**	**Section(s)**	**Tables and Figures**
3592.1c (1)	Names and address of lessees.	2.1	–
3592.1c (1)	Federal lease serial numbers.	2.1	Tables 2-2 through 2-4; Figure 2-1
3592.1c (2)	A general description of geologic conditions, with appropriate maps, within the area where mining is to be conducted.	3.2	Figures 3-1 through 3-4
3592.1c (2)	A general description of mineral resources, with appropriate maps, within the area where mining is to be conducted.	5.0	Figures 5-1 through 5-16
3592.1c (3)	A copy of a suitable map or aerial photograph showing the topography, the area covered by the lease(s), the name and location of major topographic and cultural features, and the drainage plan away from the affected area.	3.1	Figure 1-2
3592.1c (4)	A statement of proposed methods of operating, including a description of the surface or underground mining methods, the proposed roads, the size and location of structures and facilities to be built, mining sequence, production rate, estimated recovery factors, and stripping ratios.	6.0	Figures 6-1 through 6-38
3592.1c (4)	Number of acres in the federal or American Indian lease(s), license(s), or permit(s) to be affected.	1.2, 2.1	–
3592.1c (5)	An estimate of the quantity and quality of the mineral resources, proposed cutoff grade and, if applicable, proposed blending procedures for all leases covered by the Mining Plan.	2.0, 5.0	Figures 5-1 through 5-16; Tables 5-1 through 5-14
3592.1c (6)	An explanation of how ultimate maximum recovery of the resource will be achieved for the federal or American Indian lease(s). If a mineral deposit, or portion thereof, is not to be mined or is to be rendered not minable by the operation, the operator/lessee shall submit appropriate justification to the authorized officer for approval.	8.0	–
3592.1c (7)	Appropriate maps and cross sections showing:		
3592.1c (7) (i)	Federal or American Indian lease boundaries and serial numbers.	2.0	Figure 2-1
3592.1c (7) (ii)	Surface ownership and boundaries.	2.0	Figure 2-1
3592.1c (7) (iii)	Locations of existing and abandoned mines.	6.3.1	Figure 6-29
3592.1c (7) (iv)	Typical structure cross sections.	6.0	Included as part of Section 6.0 figures
3592.1c (7) (v)	Location of shafts or mining entries, strip pits, waste dumps, and surface facilities.	6.0	Figure 6-2
3592.1c (7) (vi)	Typical mining sequence, with appropriate timeframes.	6.4, 6.5	Table 6-20
3592.1c (8)	A narrative which addresses the environmental aspects associated with the proposed mine which includes, at a minimum, the following:		
3592.1c (8) (i)	An estimate of the quantity of water to be used and pollutants that may enter any receiving waters.	9.1.1, 9.1.2, 9.1.3	–

CFR Title 43 Subpart		Mining Plan Location	
Designation	**Description**	**Section(s)**	**Tables and Figures**
3592.1c (8) (ii)	A design for the necessary impoundment, treatment, or control of all runoff water and drainage from workings to reduce soil erosion and sedimentation and to prevent the pollution of receiving waters.	9.3 and *Stormwater Pollution Prevention Plan* (CPM 2018b)	–
3592.1c (8) (iii)	A description of measures to be taken to prevent or control fire, soil erosion, subsidence, pollution of surface and ground water, pollution of air, damage to fish or wildlife or other natural resources and hazards to public health and safety.	9.0 and supplemental plans listed in Section 9.0	–
3592.1c (9)	A reclamation schedule and the measures to be taken for surface reclamation of the federal or American Indian lease(s), license(s), or permit(s) that will ensure compliance with the established requirements. In those instances, in which the lease requires the revegetation of an area affected by operations, the Mining Plan shall show:		
3592.1c (9) (i)	Proposed methods of preparation and fertilizing the soil prior to replanting.	*Reclamation Plan* (CPM 2018c)	–
3592.1c (9) (ii)	Types and mixtures of shrubs, trees or tree seedlings, grasses, or legumes to be planted; and	*Reclamation Plan* (CPM 2018c)	–
3592.1c (9) (iii)	Types and methods of planting, including the amount of grasses or legumes per acre, or the number and spacing of trees or tree seedlings, or combinations of grasses and trees.	*Reclamation Plan* (CPM 2018c)	–
3592.1c (10)	The method of abandonment of operations on federal or American Indian lease(s), license(s), and permit(s) proposed to protect the unmined recoverable reserves and other resources, including the method proposed to fill in, fence, or close all surface openings that are a hazard to people or animals.	*Reclamation Plan* (CPM 2018c)	–
3592.1c (11)	Any additional information that the authorized officer deems necessary for approval of the plan.	–	–

– = not applicable

This Mining Plan has been prepared in compliance with the requirements specified in Peak's Potassium Lease, UTU-88387 (BLM 2011c). To facilitate review, a cross-reference table is provided in **Table 1-2,** *BLM Lease Special Stipulation Cross Reference*, to link the Special Stipulations included in the Potassium Lease to the contents of this Mining Plan.

Table 1-2. BLM Lease Special Stipulation Cross Reference

Stipulation No.	Brief Description	Mining Plan Location	
		Section(s)	**Tables and Figures**
1	Ditches, berms, drillholes, and other excavations	10.0	–
2	Mining unit	2.3	–
3	Waste certification	6.12.3	–
4	Noxious weeds	3.6	–
5	Survey monuments	10.0	–

Stipulation No.	Brief Description	Mining Plan Location	
		Section(s)	Tables and Figures
6	As-built drawings	1.3 and Appendix A	–
7	Reclamation	10.0	–
8	Water replacement	9.4.3	–
9	Wildlife and plant species	3.6, 9.4.6	–
10	Cultural resources	9.4.7	–
11	Corps of Engineers	9.4.6.5	–
12	Drilling results	Provided in Exploration Reports	–
13	Hydrogeological analysis	9.4.3 Additional information provided in Water Resource Report (Whetstone Associates, Inc. 2017) and the *Groundwater Discharge Permit Application* (CPM 2018d)	–
14	Lands and realty	10.0 and *National Environmental Policy Act Plan of Development for Off-Lease Facilities for the Sevier Playa Potash Project* (CPM 2018e)	–
15	Dust control plan	9.4.4 and *Fugitive Dust Control Plan* (CPM 2018f)	–
16	Riparian and wetland inventory	9.4.6.5 and 9.4.6.6	–
17	Lighting	6.12	–
18	Royalty value of unmined potassium and related products	2.3	–
19	Diligence requirements	N/A – Diligence requirements apply to the BLM's cancellation of leases at end of lease term should potassium or related products not be produced in paying quantities	–

– = not applicable

Per 43 CFR 3592.1 (11) (d)(1), an approved mining plan may be modified at any time to adjust to changed conditions or to correct an oversight. To obtain approval of a mining plan modification, the operator/lessee shall submit a written statement of the proposed modification and the justification for such modification. Any proposed mining plan modification(s) shall not be implemented unless previously approved by the authorized officer.

The lead lease file for this Mining Plan has been assigned BLM case file number UTU-88387. All correspondence with the BLM concerning this operation should reference the assigned case file number.

1.3.2 State of Utah Mining Plan Requirements

The State of Utah requires the submission of a Notice of Intention to Commence Large Mining Operations, as mandated by the Utah Minerals Regulatory Program Rule R647, as stated in Utah Code Annotated (UCA) Title 40 Chapter 8, Utah Mined Land Reclamation Act, as approved by the Board of Oil, Gas and Mining. To facilitate review, a cross-reference table is provided in **Table 1-3**, *Utah Division of Oil, Gas and Mining Cross-Reference*, to link the required sections of Utah Administrative Code (UAC) R647-4 to the contents of this Mining Plan.

Table 1-3. Utah Division of Oil, Gas and Mining Cross Reference

(Table 1-3 Utah Division of Oil, Gas and Mining Cross-Reference to be added at a later date.)

Pursuant to UAC R647-4-118 and R647-4-119, revisions or amendments to an approved notice of intention shall be filed on the Notice of Intention to Revise Large Mining Operations (FORM MR-REV). The operator would be authorized and bound by requirements of the existing approved notice until the revision is acted upon and any revised surety requirements are satisfied. However, R647-4-102 indicates that UDOGM may review the permit and require updated information and modifications when warranted.

1.4 Project Objective

The purpose of the Project is to the support economic recovery of potash resources from federal and state lands by commercial production. Such development has the potential to supplement the global supply of potash, a desirable and necessary potassium fertilizer, and to contribute to local, regional, and state economies.

An Environmental Impact Statement (EIS) is being prepared in compliance with NEPA to analyze and disclose potential impacts on the environment that could result from the Project. The BLM is serving as the lead agency responsible for preparing the EIS. Siting of the potash extraction and processing facilities on leased federal lands would not require a BLM ROW grant; however, multiple BLM ROW grants would be required for any ancillary facilities located on non-leased federal lands. The BLM has a responsibility under the Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.) (FLPMA), as amended, and the Mineral Leasing Act of 1920, as amended, to respond to a request for a ROW grant, while avoiding or minimizing adverse impacts to other resource values and to allow for ROW uses in conformance with existing land use plans.

The Mineral Leasing Act of 1920, as amended, promotes the mining of potassium on public domain lands. (Potash is a soluble salt containing potassium). In addition, the BLM is mandated to establish multiple uses of federal lands in providing for present and future generations. Authorization of this minerals extraction Project would be consistent with Section 102(a)(912) of FLPMA, which states that “it is the policy of the United States that the public lands be managed in a manner which recognizes the nation‘s need for domestic sources of minerals.” The BLM Fillmore Field Office is responsible for management of the Sevier Playa for multiple uses, including minerals extraction.

1.5 Property Location and Access

The Project property is located in southwestern Utah’s Millard County and is defined by the geographical boundaries of the Sevier Playa, centered approximately at latitude 38°56'50.213" N and longitude -113°08'25.747" W, Universal Transverse Mercator (UTM) World Geodetic System 1984 (WGS84) Zone 12 coordinates 4313105 Northing (N), 314505 Easting (E), or UTM North American Datum (NAD) 83 Zone 12 4313104.3N, 314506.0E. The playa covers an area of approximately 130,000 acres, is approximately 26 miles long by an average of 8 miles wide, and has an elevation of approximately 4,514 feet above mean sea level (amsl).

The Project property is situated about 140 miles southwest of Salt Lake City, Utah, generally between the towns of Delta, about 30 miles to the northeast, and Milford, about 25 miles to the south-southeast, as illustrated in **Figure 1-1**. From Delta, the northern margin of the playa is accessed by traveling approximately 11 miles southwest along U.S. Routes 6 and 50. The southern end of the Project can be accessed from Milford by traveling approximately 23 miles north on Utah State Route (SR) 257 to the historic town of Black Rock and then traveling the remaining about 13 miles west on Crystal Peak

Road, a secondary improved gravel road, and Crystal Peak Spur Road, a Class B county maintained road, which leads to the south end of the playa, as shown in **Figure 1-2**.

Two secondary north-south-trending roads run along the west and east sides of the property. On the west, the Steamboat Pass Road is a graded native surface (dirt) road, which is a Class B county maintained road. On the east of the playa, a rough two-track road runs from SR 257 Cutoff Road to Crystal Peak Road. Numerous unimproved roads and trails, suitable for four-wheel drive vehicles, lead from these north-south-trending routes to the edge of the playa.

The ability to travel on the playa varies seasonally, depending on the amount of moisture on the saltpan. The margins of the playa can support a pickup truck in places, but use of normal vehicles is risky due to their ground pressure and the likelihood of becoming mired in the relatively soft playa sediments. Playa travel is best approached with all-terrain or tracked vehicles. This has been creatively addressed by the use of snow cats with extra-wide treads. Recent exploration activities, performed during a period of unusually wet playa conditions, have used marsh buggies commonly employed in the bayous of the southern United States as rig platforms, as well as air-propelled boats for personnel and equipment transport.

1.5.1 Authorizations, Permits, Reviews, and Approvals

The *Warm Springs Resource Area, The Resource Management Plan, Record of Decision Rangeland Program Summary* (WSRA RMP) (BLM 1987) designates the Sevier Playa area as suitable for mineral extraction operations. As a component of the Sevier Lake Competitive Potash Leasing Program, the proposed mining activities are also consistent with the WSRA RMP.

The Leasing EA determined that the leasing action, including future exploration and development as described in the Leasing EA, was consistent with other plans, programs, and policies of affiliated Tribes, other federal agencies, and state and local governments, including the following:

- FLPMA of 1976, as amended (43 USC 1701 et seq.)
- Mineral Leasing Act of 1920, as amended (30 USC 181 et seq.)
- Clean Air Act (42 USC 1857 et seq.), as amended and recodified (42 USC 7401 et seq.)
- Clean Water Act (33 USC 1251 et seq.)
- Rangeland Health Standards, as developed by the Secretary of the Interior on February 22, 1995
- Endangered Species Act of 1973 (16 USC 1531 et seq.)
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations
- Migratory Bird Treaty Act of 1918 (16 USC 703 et seq.)
- Sevier Lake Competitive Potash Leasing Proposal, February 2011
- National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.)
- Protection of Historic Properties (36 CFR 800)
- Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001 et seq.)

- American Indian Religious Freedom Act of 1978 (42 USC 1996)
- Native American Trust Resource Policy standards presented in the Department of the Interior Comprehensive Trust Management Plan, dated March 28, 2003
- U.S. Fish and Wildlife Service Bald and Golden Eagle Protection Act, as amended (16 USC 668 et seq.)

1.5.2 State of Utah Compliance

- Utah Division of Air Quality (UDAQ)
- Utah Division of Oil Gas and Mining (UDOGM)
- Utah Division of Water Quality (UDWQ)

1.5.3 Utah Division of Water Rights Local Compliance

- *Millard County General Plan* (Millard County 2013)
- Millard County Zoning Ordinance

1.5.4 Potential Authorization, Permits, and Approvals

Table 1-4, *Potential Authorizations, Permits, Reviews, and Approvals*, identifies the authorizations, permits, reviews, and approvals that are anticipated to be required for the Project.

Table 1-4. Potential Authorizations, Permits, Reviews, and Approvals

Action Requiring Permit, Approval, or Review	Permit/Approval	Agency Authority	Statutory Reference
Federal			
Official survey	Review and approval	BLM, Utah State Office Cadastral Survey	43 CFR 3503.33
NEPA compliance	Project EIS ROD	BLM	40 CFR 1500–1508
Off-lease activity	Approval of ROW grants	BLM	43 CFR 2800 and 2880
Mining Plan	Requirements for mine development, operations and reclamation	BLM	43 CFR 3590
Aggregate materials sourced from BLM-administered lands	Mineral materials negotiated sale	BLM	43 CFR 3601–3603
Handling of migratory birds	Special Purpose Utility Permit	USFWS	50 CFR 21.27

Action Requiring Permit, Approval, or Review	Permit/Approval	Agency Authority	Statutory Reference
State of Utah			
Dike (berm) construction	Water impoundment permit; water right approval	Utah Division of Water Rights (UDWRi)	UAC R655.11
Water usage/well drilling	Water right approval; approval to install wells	UDWRi	UAC R655.4, UCA Title 73, Chapter 3
Processing Facility and ponds	Groundwater Discharge Permit	UDWQ	UAC R317-6
Stormwater management	Utah Pollutant Discharge Elimination System; storm water permits for construction activities and operational activities	UDWQ	UAC R317-8
Mining and reclamation activities	Notice of Intent to Conduct Large Mining Operations (more than 10 acres)	UDOGM	UAC R647-4
Construction and operations activities	Minor Source Air Permit	UDAQ	UAC R307
Materials movement; surface disturbance	Fugitive Dust Control Plan	UDAQ	UAC R307–309
Sevier River diversion berm and canal	State Stream Alteration Permit	UDWRi	Utah Code 73-3-29; UAC R655-13
Handling of wildlife	Certificate of Registration	UDWR	UAC R657-3
Local			
Facility construction	Construction permit	Millard County	Millard County General Plan
ROWs	Conditional use permit	Millard County	Millard County Zoning Ordinance
Federal lands—proposed actions in Millard County	Review	Millard County	Millard County General Plan
Road use and maintenance agreement	Permit and Agreement	Millard County	Millard County General Plan
Processing Facility holding ponds, leach field, and septic system	Waste water system permit	Central Utah Public Health Department	UAC R317-4
Others			
Road maintenance agreement	Agreement	Rocky Mountain Power	
Road maintenance agreement	Agreement	University of Utah	

– = not applicable

1.6 Standard Mitigation Measures / Best Management Practices

CPM is committed to minimizing the Project's potential negative environmental impacts through use of standard best management practices (BMP) and mitigation measures. These BMPs and mitigation measures may be refined, based on input from the BLM or other agencies, for all permitted activities. BMPs are designed to provide good stewardship of the lands involved. **Appendix E** lists these measures.

2 Operator Information

CPM is responsible for operations to be conducted under the approved Mining Plan. Notices and orders are to be delivered to CPM.

Contact: Dean Pekeski, Vice President, Project Development
Crystal Peak Minerals Inc.
2180 South 1300 East, Suite 200
Salt Lake City, UT 84106
Telephone: (801) 485-0223
Cell Phone: (778) 828-9724
Fax: (801) 467-2521
email: dean@crystalpeakminerals.com

2.1 Leased Lands

The following three entities hold the leases for the Project:

- Peak, through its 2011 federal potassium leases

  Contact: Woods Silleroy
  Crystal Peak Minerals Inc.
  2180 South 1300 East, Suite 200
  Salt Lake City, UT 84106
  Telephone: (801) 485-0225
  email: woods@crystalpeakminerals.com

- LUMA, through its 2011 federal potassium leases

  Contact: Denise Dragoo
  Snell & Wilmer L.L.P.
  15 West South Temple, Suite 1200
  Salt Lake City, UT 84101
  Telephone: (801) 257-1998
  email: ddragoo@swlaw.com

- Emerald Peak, through its 2008 state potash leases

  Contact: Lance D'Ambrosio
  Emerald Peak Minerals, LLC
  8857 Parleys Lane
  Park City, UT 84098
  Telephone: (801) 580-0188
  email: lance5657@gmail.com

Table 2-1, *Summary and General Description of the Sevier Playa Leases*, summarizes the relationship of entities controlling the potash leases included in the Project.

Table 2-1. Summary and General Description of the Sevier Playa Leases

Leaseholder	Peak Minerals Inc.	LUMA Minerals LLC	Emerald Peak Minerals LLC
Relationship to CPM	Direct wholly-owned subsidiary	Contractual agreement with Peak	Peak holds a 40% membership interest
Contractual agreement with CPM	100% owned by CPM	Cooperative Development Agreement with Peak for Leasehold Operations	40% membership interest owned by Peak with Commercial Services Agreement for leasehold operations
Acres held	95,801.76	22,011.79	6,409.48
Effective date of leases	June 1, 2011	June 1, 2011	September 1, 2008
Lease descriptions	See Table 2-2	See Table 2-3	See Table 2-4

The federal potassium mineral leases held by Peak and LUMA are summarized in **Table 2-2**, *Summary of Federal Potassium Mineral Leases Held by Peak Minerals Inc.*, and **Table 2-3**, *Summary of Federal Potassium Mineral Leases Held by LUMA Minerals LLC*, respectively, and the state potash mineral leases held by Emerald Peak are summarized in **Table 2-4**, *Summary of State Potash Mineral Leases Held by Emerald Peak Minerals LLC*. **Figure 2-1** presents the land surface ownership, leaseholder's lease boundaries, and lease numbers overlaying the Sevier Playa boundary. Leases of federal lands are indicated with light yellow shading while leases of state lands are indicated with blue shading. The Project may occupy private lands for the Rail Spur but would not rely on split-estate or Indian lands for any Project feature.

The Project does not involve any leases of Indian lands.

Table 2-2. Summary of Federal Potassium Mineral Leases Held by Peak Minerals Inc.

UTU Number	Location*	Acreage	UTU Number	Location*	Acreage
88387	T24S, R12W, S3–5	1,929.01	88412	T22S, R12W, S1–2 T22S, R11W, S6	1,798.33
88388	T24S, R12W, S9–11	1,920.00	88413	T22S, R11W, S7–10	2,421.09
88389	T24S, R12W, S14–15	1,280.00	88414	T21S, R12W, S34–36 T21S, R11W, S31	2,400.77
88390	T23S, R12W, S26–27	1,280.00	88415	T22S, R11W, S3–5	1,982.65
88391	T24S, R12W, S7-8, S17–18	2,487.76	88416	T21S, R11W, S32–34	1,933.20
88392	T23S, R12W, S33–35	1,920.00	88417	T21S, R12W, S25–27 T21S, R11W, S30	2,396.57
88393	T24S, R12W, S1, S12	1,283.38	88418	T21S, R11W, S27–29	1,920.00
88394	T23S, R12W, S14–15, S22–23	2,560.00	88419	T21S, R12W, S22–24 T21S, R11W, S19	2,395.65
88395	T23S, R12W, S25 T23S, R11W, S30–31	2,032.74	88420	T21S, R12W, S13–15 T21S, R11W, S18	2,394.72
88396	T23S, R12W, S21, S28	1,280.00	88421	T21S, R11W, S20–22	1,920.00

UTU Number	Location*	Acreage	UTU Number	Location*	Acreage
88397	T23S, R12W, S12–13	1,280.00	88422	T21S, R12W, S1–2, S11–12	2,406.53
88398	T23S, R12W, S24 T23S, R11W, S19	1,335.32	88423	T21S, R11W, S7–8, S16–17	2,393.82
88399	T23S, R12W, S3, S9–10	1,921.63	88424	T21S, R11W, S4–6, S9	1,869.64
88401	T23S, R12W, S4–5 T22S, R12W, S33	1,922.86	88425	T21S, R11W, S3, S10, S15	1,728.85
88402	T22S, R12W, S21, S28–29	1,920.00	88426	T20S, R12W, S25–26, S35–36	2,560.00
88403	T23S, R12W, S1 T23S, R11W, S6	1,366.56	88427	T20S, R11W, S31–34	2,559.21
88404	T23S, R12W, S2, S11	1,281.88	88428	T20S, R11W, S25–26, S35–36	2,560.00
88405	T22S, R12W, S34–36	1,919.40	88429	T20S, R11W, S27–30	2,557.64
88406	T22S, R12W, S25–27	1,918.55	88430	T20S, R11W, S19–22	2,556.07
88407	T22S, R12W, S22–24	1,917.81	88443	T20S, R11W, S23–24	1,280.00
88408	T22S, R12W, S13–15	1,917.09	88457	T20S, R12W, S28, S33–34	1,886.40
88409	T22S, R12W, S9–12	1,918.37	88461	T21S, R12W, S3–4, S9–10	2,393.45
88410	T22S, R11W, S18–19, S29–31	2,510.11	88462	T21S, R12W, S16–17, S20–21	2,548.83
88411	T22S, R11W, S17, S20–21	1,924.48	88463	T21S, R12W, S28–29, S33	1,911.39
Total					**95,801.76**

*Township, Range, Section (Salt Lake Base Meridian)

Table 2-3. Summary of Federal Potassium Mineral Leases Held by LUMA Minerals LLC

UTU Number	Location*	Acreage
88444	T20S, R11W, S15–18	2,554.50
88445	T20S, R11W, S11–14	2,557.18
88446	T20S, R11W, S3, S10	1,358.44
88448	T20S, R10W, S7–8, S17	2,012.41
88449	T20S, R10W, S18–20	2,115.47
88450	T20S, R10W, S29–31	2,129.20
88451	T20S, R11W, S4–5, S9	2,048.40
88452	T20S, R11W, S6–8	1,953.40
88453	T20S, R12W, S12–13, S24	1,799.62
88455	T20S, R12W, S11, S14–15	1563.17
88456	T20S, R12W, S22–23, S27	1,920.00
Total		**22,011.79**

*Township, Range, Section (Salt Lake Base Meridian)

Table 2-4. Summary of State Potash Mineral Leases Held by Emerald Peak Minerals LLC

Lease Number	Location*	Acreage
ML 51479	T21S, R12W, S32	640.00
ML 51480	T22S, R11W, S2 T22S, R11W, S16	1,286.24
ML 51481	T22S, R12W, S16 T22S, R12W, S32	1,280.00
ML 51482	T23S, R12W, S16 T23S, R12W, S32 T23S, R12W, S36	1,920.00
ML 51483	T24S, R12W, S2 T24S, R12W, S16	1,283.24
Total		**6,409.48**

*Township, Range, Section (Salt Lake Base Meridian)

2.2 Off-Lease Lands

CPM submitted Department of Interior Standard Form 299 to apply for ROWs on and across certain off-lease federal lands within and immediately bordering the Sevier Playa for the purposes of construction and operational access to the leased lands, as well as for facilities supporting the Project. The ROWs would provide for the construction and use of power and communication lines, propane and natural gas supply, water supply facilities, communication towers, rail facility and new spur track, new access roads, including portions of the playa perimeter road (Perimeter Road) and portions of preconcentration ponds (including the Heel Brine Pond), segments of the recharge canal and recharge collectors, and segments of the brine transfer canal that extend outside the leased area, as detailed in the *National Environmental Policy Act Plan of Development for Off-Lease Facilities for the Sevier Playa Potash Project* (POD, or Plan of Development) (CPM 2018e). CPM is not required to apply for ROWs on the on-lease lands because the governing regulations for federal and state leases grant the lessee and, when unitized, the unit operator, the right to such on-lease ROWs as is necessary and convenient in the exercise of the rights and privileges granted under those leases. Additional ROWs and approvals would be required from SITLA for project related infrastructure on SITLA lands and from private landowners for project related infrastructure on private lands, as discussed in Section 6.3, *Infrastructure*.

2.3 Royalty Allocation and Unit Agreement and Operating Agreement

Brines extracted from the various leases would, by necessity, be combined and the resources would be blended. Special Stipulation 2 to the federal potassium leases held by Peak and LUMA provides that

> prior to production, a Unit Agreement (royalty allocation agreement) shall be approved which establishes the fee, Federal and State lands as a unit for production royalty purposes. Along with this, the mining unit shall count production from anywhere on the fee, Federal, or State lands as production on any of the lands. (BLM 2011c)

Special Stipulation 18 states the following:

> Royalty Value of Un-Mined Potassium and Related Products: The Lessee shall be required to pay the value of the royalty due on any salable potassium or related products which would have been produced under an approved mining plan, which is otherwise lost or left economically inaccessible by mining practices, unless approval for leaving the potassium or related products has been granted in writing by the authorized officer. (BLM 2011c)

The Royalty Allocation and Unit Agreement addresses allocation of production among lessees and royalty owners. Accordingly, Peak, LUMA, Emerald Peak, the BLM, and SITLA would enter into the Royalty Allocation and Unit Agreement in the form attached hereto as Appendix D, as may be amended, for combined operations on the Project lands and leases.

The Royalty Allocation and Unit Agreement would complement the Mining Plan, allow for operations on the leases as a single unit (Sevier Playa Unit), and consider the potassium, potash, and associated minerals thereunder as unitized substances. Peak would be designated operator of the Sevier Playa Unit and would be responsible for all unit operations. The unitized substances produced from the Sevier Playa Unit would be deemed to be produced equally on an acreage-percent basis from all unitized lands. Each lease shall have allocated to it the percentage of production as the number of acres in such lease bears to the total acres of the Sevier Playa Unit.

In addition, the lessees would enter into a second agreement, an Operating Agreement, detailing the relative rights and responsibilities of the lessees in the Sevier Playa Unit.

3 Characterization of the Environment

3.1 Physiography

Sevier Playa occupies the terminal playa of the Sevier River internal drainage basin.[1] There is no drainage out of the affected area. The playa covers an area of approximately 130,000 acres. Average elevation on the playa is approximately 4,514 feet amsl with very little relief seen across the site. The playa is located in western Utah's Sevier Desert, in a broad valley that is 10 to 15 miles wide. **Figure 1-2** presents the Project map showing the Sevier Playa area local topography with the names and locations of major topographic and cultural features, the lease boundaries, and the access routes from paved roads. The playa is bound on the east by the Cricket Mountains and on the west by the Black Hills portion of the House Range, each reaching an elevation of approximately 8,000 feet amsl. South and southwest of Sevier Playa, lie the San Francisco and Wah Wah Mountains, respectively, which together flank the Wah Wah Valley. The dry Wah Wah playa, which is located within the Wah Wah Valley, exhibits physiographic conditions similar to those of Sevier Playa. North of Sevier Playa is the gently south-sloping surface of the Sevier Desert.

The Sevier River is the main source of water that flows into the Sevier Playa. The U.S. Geological Survey (USGS) maps the river as being perennial for a 6-mile reach, directly above Crafts Lake. The remaining reaches of the river below Gunnison Bend Reservoir are mapped as intermittent. Inflow from the Sevier River is unpredictable during most years because of reservoir storage and the heavy demand for irrigation water upstream. Satellite imagery acquired from August 1999 through August 2002 (Gwynn 2006) indicates water to be on the surface of Sevier Playa, typically from November through April, though likely amounting to only several inches in depth and the result of local precipitation. During the remainder of the year (May through October), the majority of the playa's surface appears to be dry.

Gilbert (1890) described the playa and surrounding areas as being part of Lake Bonneville which covered much of the central Utah area. Following the drop of Lake Bonneville below the Provo shoreline, the Sevier River continued to maintain a lake in the area. This lake is referred to as Lake Gunnison. This lake overflowed northward into the Great Salt Lake Basin (Gwynn 2006). As the climate continued to change, the level of the lake in the Project area continued to reduce to the extent found in 1872. At that time, Hoxie conducted a hydrographic survey of the lake referred to by the locals as Sevier Lake (Gilbert 1890). This was prior to considerable settlement and water use within the drainage. The survey indicated that Sevier Lake was about 28 miles in length and had a water surface area of 188 square miles. Based on the hydrographic survey, an estimated maximum depth of 15 feet was determined, the northern portion being deeper than the southern end. Gilbert (1890) reported that by 1879, the lake was completely dry and local residents and researchers were able to walk across the area that had been the deepest on a salt crust. Local residents described how the lake level had decreased in the preceding one to two seasons. Further, he reported that the desiccation of the lake was attributed to human agency via diversion of the stream flows for irrigation. As the Sevier River was the sole source of considerable water to the lake, water use within the upper Sevier River drainage had increased to the point where water flow within the lower reaches of the river occurred only during abnormally wet or considerable snowmelt periods.

According to Gwynn (2006), water of abnormal depth was probably present on the playa from 1913 through 1915 and from 1922 through 1923. Additionally, during the period from 1983 through 1985,

[1] An internal drainage basin is a closed drainage basin that retains water and allows no outflow to other external bodies of water, such as rivers or oceans, Instead, surface flows converge into permanent or seasonal lakes. In an internal basin, precipitation that falls within it may only leave the drainage system by evaporation or seepage. The bottom of such a basin is typically occupied by a salt lake or salt pan.

Sevier Playa filled with water due to the above average inflow from the Sevier River. At its peak, during the 1983 through 1985 period, the water surface was nearly 13 feet above the playa low point, as reported by Larry Sower of CPMC (Gwynn 2006). From 1986 through 1988, inflow to the playa was reduced considerably and the depth of the water declined.

Considerable snowfall and precipitation through the winter and spring of 2011 caused unusually high-water levels in the numerous reservoirs along the course of the Sevier River. Consequently, water management authorities found it necessary to release retained water during the fall and early winter of 2011 rather than in the spring when it is used for irrigation and consumed before reaching the playa. The exploration activities conducted for the Project from November 2011 to April 2012 had to contend with surface water ranging from 1 to 2 feet in depth.

3.2 Geology

The Sevier Playa is located within the Basin and Range physiographic province. The Basin and Range physiographic province covers more than 10% of the continental United States, including all of Nevada and portions of Idaho, eastern Oregon, Utah, Arizona, and southeastern California. Formation of the Basin and Range province began during the Miocene, approximately 24 to 25 million years ago, during regional uplift of a sizeable portion of the western United States. In this formative period, the east-west extension of the continental crust resulted in uplifted north-south-trending mountains (horsts) and intervening, down-dropped valley platforms (grabens), bounded by normal faults. Subsequent erosion of the mountains led to sediment-filled valleys of the grabens. It is in one of these north-south-trending sediment-filled valleys where the Sevier Lake terminal playa was formed.

3.2.1 Sedimentation and Associated Mineralization

The Pleistocene period was characterized by the deposition of lacustrine shore deposits from Lake Bonneville along the high-lying areas surrounding what is now the Sevier Playa. As Lake Bonneville receded from its maximum extent, from southern Idaho to southwestern Utah, a fresh water lake (Lake Gunnison) remained in the Sevier Desert Basin. Lake Gunnison emptied into the Great Salt Lake to the north through the Old River Bed (Rasmussen 1997), north of the Sevier River. Further decline in Lake Gunnison water levels ended with the present-day isolation of the Great Salt Lake in the north and Sevier Playa in the south (**Figure 1-1**). The Sevier Playa is a terminal hydrologic system, meaning that all surface water within the Sevier Playa watersheds terminates at the playa, and there is no exterior drainage from it. Over recent (Quaternary) geologic time to present, the accumulation of minerals eroded from the drainage area supplying the lake, coupled with persistent desert conditions, has altered the chemistry of the groundwater in the unconsolidated lacustrine and alluvial sediments below the playa surface to that of a mineral-rich brine.

Figure 3-1 shows that the north-south-trending mountains that surround the Sevier Playa, the Cricket Mountains, and the Black Hills/House Range Mountains, expose Paleozoic basement rocks as a result of uplift during the Basin and Range orogeny. The Cricket Mountains in the east expose Cambrian-age quartzites and limestones. The Black Hills/House Range Mountains in the west are composed of Upper Cambrian- to Lower Ordovician age dolomites, limestone, and quartzite. On the lower-lying margins of the surrounding mountains, a layered series of sedimentary deposits and erosional features of Pleistocene and Quaternary age have been surface mapped and observed from drill cuttings. These largely unconsolidated sediments are composed of a mix of sand, marl (carbonate-rich, silt-sized sediments), and clay. The coarser-grained sandy and marly layers contain saturated and semi-saturated levels of brine and water that have accumulated in the subsurface over the dry Quaternary period.

As suggested by Case and Cook (1979), the depth to bedrock within the Sevier Playa may be as much as 4,500 feet. Four wells drilled by CPMC on the margins of the playa show the basin sediment to be a minimum of 975 feet deep, given that no Paleozoic bedrock was encountered in these holes. The Company drilled a hole in lake sediments to 497 feet in depth. The lithologic log for this hole illustrated mainly fine-grained, gray-green to brown clays, with minor amounts of gypsum, sand, silt, salt, and carbonaceous and vegetal material from surface to total depth.

3.2.2 Geologic Structure

A detailed structural study of the region was undertaken by Case and Cook (1979) after completing a gravity survey in the area. Their interpretation of the Sevier Playa structure is illustrated in **Figure 3-2**. **Figure 3-3** illustrates the playa basin's location within an asymmetrical graben. A major north-south-trending normal fault zone, designated as the East Sevier Lake Fault Zone, exists between the playa and the Cricket Mountains to the east. There is an estimated vertical displacement of more than 4,000 feet, with down-throw on the west. This fault zone forms the east margin of the east-tilted Sevier Lake graben and the west margin of the east-tilted Cricket Mountains horst. The Sevier Lake graben is bordered on the west by the West Sevier Lake Fault Zone (**Figure 3-3**). The graben that underlies Sevier Playa is interpreted as consisting of two separate fault blocks, designated as the northern and southern blocks. These two blocks have been displaced differentially with respect to each other and with respect to the adjacent mountain blocks, as interpreted from the gravity data (Case and Cook 1979).

The Case and Cook (1979) survey shows that the western margin of the graben is bounded by several normal faults of minor displacements that collectively uplift lower Paleozoic strata to form the Black Hills. The limited displacements shown by the Case and Cook survey make the Sevier Playa graben appear asymmetrical. However, the gravity survey's western margin shows only the initial faults of this uplift that occur in the Black Hills; Norwest interprets the faulting to increase in upward displacement in successive faults approaching the House Range, where the Paleozoic strata are uplifted to more considerable elevations. Surface mapping of faults is difficult in the western areas due to abundant volcanics, primarily deposited as thick tuffs covering the Paleozoic strata.

3.2.3 Mineralization

Composition of the crust covering the playa consists of evaporite minerals and is up to 18 inches thick, as determined from drill and auger data (Section 5.1.3, *Drillhole Data*). Evaporite minerals forming the crust tend to be zoned on the playa surface, with halite (NaCl) being the dominant mineral in the center of the lakebed, followed by glauberite ($Na_2Ca[SO_4]_2$) and then gypsum ($CaSO_4\,2H_2O$) near the playa shore (Gwynn 2006; Rasmussen 1997).

Soluble salts in the sediment-hosted brine are the target mineralization of current development work. The source of soluble salts is the erosion and leaching of Paleozoic-era bedrock in the Sevier and Bear River drainages when the Basin and Range was inundated by Lake Bonneville. Observation and sampling of playa sediments and brine have identified the following features that characterize the top 100 feet of the deposit:

- Salt crust up to 18 inches thick
- Lateral zonation in crust mineral chemistry
- Variation in brine saturation, both laterally and with depth
- Variation in sediment grain size distribution

- Artesian brine flow in some areas
- Elevated concentrations of sodium (Na^{+}), potassium (K^{+}), magnesium (Mg^{+2}), calcium (Ca^{+2}), chloride (Cl^{-}), and sulfate (SO_4^{-2}) in the brine

These features influence, to varying degrees, the target brine extent (volume) and potential for production of potash, halite, and bitterns (liquor remaining after potash and halite are harvested[2]) from the brine. The focus of the resource estimates presented in this Mining Plan are two shallow (depths less than 100 feet) brine horizons referred to as the Marl Clay Zone (MCZ) and the Siliceous Clay Zone (SCZ), corresponding respectively to the Upper Resource Zone (URZ) and Lower Resource Zone (LRZ) of prior studies and reports.

Figure 3-4 graphically illustrates the major litho-hydrologic units and subunits of the modeled playa aquifer system. The playa surface below the salt crust is composed of a low-hydraulic conductivity (hydraulic conductivity is the ability of soil or strata to pass water) fat clay, designated the Fat Clay Zone (FCZ). The FCZ is of variable thickness, from the playa surface to approximately 11.2 feet below the playa surface. The average thickness of the FCZ is 9.7 feet. The MCZ is composed of an argillic marl aquifer with a crumbly and blocky sedimentary structure, averaging approximately 20.5 feet in thickness. It extends from below the FCZ to an average depth from surface of approximately 31.7 feet, where the voids in the argillic marl decrease rapidly, along with the carbonate content of the clay. The SCZ is hosted in a clay aquifer with permeability developed in intercalated clayey silts, sands, and gravels occurring at various depths and thicknesses throughout the zone. The top of the SCZ occurs at the transition from predominantly carbonate to siliceous sediments at the base of the MCZ, while the aquifer zone, hosting the resource, is taken to be the uppermost occurrence of a coarse-grained permeable material, which varies with location.

The base of the SCZ is rather distinct and is observed as a rapid transition to a reddish-brown, tight clay of very low moisture content and hydraulic conductivity occurring at approximately 75.5 feet in depth below ground surface (bgs). The combined MCZ and SCZ horizons vary from 40 to 100 feet in depth from the surface and are bound at the base by the stiff clay horizon. Drilling to date is insufficient to determine accurately a brine resource potential below these two shallow aquifers, although limited sampling has confirmed the presence of elevated brine concentrations below the bottom of the presently defined SCZ.

Past and present development efforts have focused on using large-scale solar evaporation ponds to extract salt compounds from the brine through concentration and fractional crystallization.

3.3 Hydrogeology

Groundwater in the Sevier Playa Potash Project Baseline Water Resources Analysis Area (**Figure 3-5**) is part of the Great Basin Carbonate and Alluvial Aquifer System (Great Basin Aquifer System) described by Heilweil and Brooks (2011). The Great Basin Aquifer System covers an area of approximately 110,000 square miles, mostly in eastern Nevada and western Utah, and generally consists of unconsolidated alluvium and volcanic rocks in valleys that are bound by carbonate and clastic sedimentary rocks in the adjacent ranges.

The *Draft Baseline Water Resources Technical Report for the Sevier Playa Potash Project* (Whetstone Associates, Inc. 2017) includes a conceptual model of groundwater flow at the Sevier Playa and was prepared as a composite of information from CH2M (2013a) and data collected during CPM's preparation

[2] Bitterns are the source for several magnesium-based compounds, such as magnesium chloride ($MgCl_2$) and magnesium sulphate ($MgSO_4$), that have some degree of commercial or utilitarian value.

of the NI 43-101 Technical Report (CPM 2018a). The Whetstone Associates, Inc. (2017) and CPM (2018g) reports discuss groundwater flow under, around, and at Sevier Playa. As is standard in groundwater projects of this scale, three interrelated systems, defined by the lengths of their flow paths, are needed to understand the system. These scales include regional scale, intermediate scale, and local scale. The Whetstone Associates, Inc. (2017) report describes the regional scale groundwater system which exist within the playa and bedrock and local scales which exist in the playa and on upper mountain slopes. These local scales were considered minor, so their evaluation does not differentiate between zones in the alluvial/colluvial hillsides or within the playa sediments.

Flow in the regional system is consistent with the conceptualization by Carlton (1985) as well as Harrill and Prudic (1998), and is generally west-to-northwest groundwater movement in bedrock from recharge areas east of the playa toward the House Range and Tule Valley, turning north to discharge at Fish Spring Flat, approximately 55 miles north of the Sevier Playa. Water level measurements and water quality data from boreholes and wells are consistent with the west-northwest flow direction in the regional system. Unconsolidated deposits along the edges of the playa and in valley floors may participate in the regional flow system where they intersect the regional potentiometric surface.

It is likely that the playa is a minor intermediate discharge point within the regional system, as indicated by evapo-concentrated total dissolved solids (TDS) levels and upward hydraulic gradients observed in wells completed in shallow and deep basin fill sediments. Regional groundwater flow in bedrock from the east beneath the Cricket Mountains toward Sevier Playa flows through the deeper basin-fill sediments (underlying the SCZ) to discharge to the west with some of evaporative discharge from upward flow through the shallow basin-fill sediments (FCZ, MCZ, and SCZ zones). Review of borehole and pumping test data for unconsolidated deposits near the playa indicate that groundwater occurs under confined and unconfined conditions. Pumping tests in these sediments returned transmissivity and hydraulic conductivity values ranging from 16 to 3,010 square feet per day (ft^2/day) and less than 0.06 to 51 feet per day, respectively.

Flow in the local-scale system(s) occurs around the margins of the playa, where meteoric water infiltrates on the upper slopes of the basin and flows toward the playa, following topography, to discharge at ephemeral springs and streams on the lower slopes or percolate downward to the regional water level. Inflows in the local-scale system(s) are episodic and may be perched at various locations, depending on the presence of low-permeability strata, such as clay layers.

Due to the density of the brines within the playa sediments, the heads from the various wells needed to be corrected for variations in fluid density. This correction allowed the brine and non-brine water heads to be compared equally. This correction is described in the Whetstone Associates Inc. (2017) report. The corrected head values are referred to as equivalent fresh water heads. Evaluation of the equivalent fresh water heads from playa wells shows a resultant pattern in the hydraulic gradient that is consistent with a playa groundwater system that generally gains groundwater flow from alluvial/colluvial sediments in the east and outflows groundwater to the adjacent alluvial/colluvial aquifer in the west. Within the playa aquifer system, the horizontal hydraulic gradient is small, with groundwater generally flowing from east to west across the playa. In addition, upward hydraulic gradients exist within the playa aquifer. Upward flow from deep within the playa aquifer, combined with the 12-foot-thick layer of FCZ at the surface, results in a confined brine aquifer. The corrected fresh water heads are typically near or above the surface elevation of the playa.

Review of borehole and pumping test data from playa aquifer wells indicates that, starting at relatively shallow depths below the playa surface, groundwater is confined. The groundwater flow and transport model developed for mine planning and reserves determination uses CPM (2018g) hydraulic conductivity values of 5.9×10^{-4} ft/day for the FCZ, 1.2 to 120 ft/day for the MCZ, and 0.08 to 26 ft/day for

the SCZ. These results are consistent with the expected values for the playa, given both the clayey-silt nature of the fine-grained sediments and the gravel layers.

3.4 Climate

The climate of the Sevier Playa area is semi-arid, with reported values of average annual precipitation at or near the site varying from approximately 7.86 inches (Milford) to 7.89 inches (Delta) (CH2M 2013b; March Consulting Associates Inc. 2012; Western Regional Climate Center 2013) to approximately 8.03 inches (Gwynn 2006). An independent assessment of average annual precipitation at the site was calculated using the Parameter-elevation Regressions on Independent Slopes Model (PRISM), developed by the PRISM Climate Group (Oregon State University 2012). PRISM is an analytical model that uses point data and an underlying grid, such as a digital elevation model (DEM) or a 30-year climatological average (e.g., 1971–2000 average) to generate gridded estimates of monthly and annual precipitation and temperature, as well as other climatic parameters. By entering the location of the site (latitude and longitude), the PRISM model calculated an annual precipitation of 8.22 inches for Sevier Lake. The range in the annual precipitation values, 7.86 from the Milford Station to 8.22 from PRISM model, is to be expected and can be explained by consideration of several factors, including how the data (daily or monthly) are averaged and annualized, differing periods of record, and location of where the data were collected. Based on this range for annual precipitation, it is recommended that 8 inches be used for the annual precipitation at the site for engineering design purposes.

Regional climate statistics from nearby towns and weather stations show an average maximum temperature of 66.4 degrees Fahrenheit (°F), ranging between a high of 93°F in July and a low of 40.2°F in January. Minimum temperatures average 33.5°F, ranging from a high in July of 55.9°F to a low in January of -13.8°F. Extreme temperatures range from a record low of -34°F to a record high of 105°F (Gwynn 2006).

The climate of the Sevier Playa is important in that proposed harvesting of the brine minerals is through the use of large-scale, shallow solar evaporation ponds. The ideal conditions for this type of process occurs in areas that is arid, relatively hot, and windy. The early developers of the Project established two weather stations that recorded climatic conditions at the playa for a period during the late 1970s. Data from late June through early September 1979 (Gwynn 2006) show daytime temperatures averaged about 86°F and nighttime temperatures averaged approximately 54°F. Wind speeds, recorded during spring through fall, averaged 15 to 20 miles per hour.

Exploration activities have been conducted year-round. Potential mining operations would likely face climatic challenges related to decreased solar evaporation during winter months. However, it is envisioned that management of multiple pond systems at varying stages of development would provide sufficient feed stockpiles to maintain operations throughout the year.

3.5 Soils

The Project occurs within areas for which the soil resource has previously been mapped at a Third-Order survey level (e.g., scales in the range of 1:63,360 to 1:190,080). An assessment of soil conditions for the Project was performed, based upon a review of published, unpublished, and web resource data from the Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service [SCS]) (CH2M 2013c) and is included in Appendix C. The NRCS data includes the *Soil Survey of Delta Area, Utah – Part of Millard County* (SCS 1971), the *Soil Survey of the Beaver-Cove Fort Area, Utah – Part of Beaver and Millard Counties* (SCS 1970), the *Soil Survey of West Millard/Juab Area, Utah – Parts of Millard and Juab Counties* (NRCS 2013), and the Web Soil Survey (NRCS 2018). These resources were utilized to generate

technical descriptions of the soil resource and background information within the context of the study area. The report, *Soil Assessment for the Sevier Playa Project* (CH2M 2013c), includes a description of the soils present in the study area and a preliminary evaluation of growth medium that could be salvaged for use in reclamation activities.

The mining facilities on the playa are located in soil areas mapped as Playas (NRCS 2018). The playa soil geography is described as a miscellaneous land type consisting of level depressions of mixed alluvial sediment found at elevations between 4,500 and 4,800 feet amsl. Playa soil textures are generally silty clay loam or silty clay. The content of salt is generally so high that no vegetation grows. Playa soils are unsuitable for use as a growth medium and have no value for farming (CH2M 2013c).

The Processing Facility (location shown on Figure 6-2) is located in soil areas mapped on the Dera-Dera Sandy Loam Families Association (NRCS 2018). The soils surrounding the playa include the Dera-Dera Sandy Loam Families Association, Lynndyl-Uvada Families-Duneland Association, Uvada-Skumpah Families Association, and Dune Land (CH2M 2013c). The Dera-Dera Sandy Loam Families Association soils are excessively drained, consisting mostly of gravels occurring on dissected alluvial fans. The Lynndyl-Uvada Families-Duneland Association consists of moderately low to excessively drained soils occurring within slightly to strongly saline lake plains, lake terraces, and alluvial fans. The Uvada-Skumpah Families Association has a moderately low water capacity and occurs on lake plains with a slight to strong salinity. Growth medium potential for these soils was included as part of the *Soil Assessment for the Sevier Playa Project* (CH2M 2013c). These soils were determined to have fair growth medium suitability and are slightly saline (CH2M 2013c). Dune Land soils are not suitable for growth medium and are limited to a small area north of the playa (CH2M 2013c).

3.6 Vegetation

The extreme physical and chemical characteristics of the Sevier Playa area are, in general, not conducive to the establishment and growth of vegetation. Area surveys conducted in 2011 identified the following five vegetation zones (in order of increasing elevation and distance from Sevier Playa): salt flats, salt desert scrub, sagebrush-grassland, desert woodland, and montane forest. Only salt flats and salt desert scrub occur in the immediate vicinity of the Project. Sagebrush-grasslands could also be traversed by Project access roads.

The playa surface itself is devoid of vegetation due to periodic flooding and the resulting formation of a salt crust on the surface from the evaporation of the mineral brine. Along the margins of the Sevier Playa, vegetation consists of low brush and sage.

No federally listed or candidate plant species are known to occur in the Project area, which includes the Project footprint plus a 0.25-mile buffer around off-playa Project components. The area does not contain habitat suitable for any federally protected plant species, based on a review of the Utah Conservation Data Center database performed by the Utah Division of Wildlife Resources (UDWR) and field surveys conducted for the Project in 2013 and 2014 to collect data for the NEPA analysis (CH2M 2014). The *General and Special-Status Wildlife and Plant Species Survey Report*, prepared for the Project, determined that no special-status plant species were identified in the Project survey area during a UDWR search of the Utah Native Plant Society database (CH2M 2014).

Vegetation surveys documented the presence of several noxious and invasive species in the survey area. Saltcedar (*Tamarix ramosissima*), was found in riparian areas along the Sevier River and moist areas surrounding Sevier Playa. Medusahead (*Taeniatherum caput-medusae*) was found along the western edge of the Cricket Mountains. African mustard (*Malcolmia africana*) was found throughout the survey area and, in some areas, was the dominant plant cover (CH2M 2014).

Peak's federal lease, Special Stipulation 4 states the following:

> Noxious Weeds: Equipment will be cleaned prior to entering the proposed project area to minimize the introduction of noxious/invasive weeds in other areas. The lessee/operator shall annually inspect active and inactive operational areas on each lease for noxious weeds (that are listed for control by the State of Utah, the Utah BLM and Millard County). If any of the listed weeds are found, control must be initiated by the lessee. The lessee shall contact the Weed Control official at the FFO in advance to discuss the planned control method (lessees are required to obtain a permit prior to the control through the application of approved herbicides). The lessee shall chemically treat annual invasive weeds (such as cheatgrass) in areas of high activity so as to prevent the potential of fire on the site and buildup of fire potential. Active and inactive operational areas on leases shall be inspected annually on each lease for noxious weeds. A plan shall be submitted and approved by the AO prior to the initiation of any control of weeds. (BLM 2011c)

Noxious weeds would be managed to facilitate long-term, self-sustaining, plant communities. In accordance with this special stipulation and the *Noxious Weed Management Plan* (CPM 2018h), weed species, locations, and populations would be identified within the Project by an initial field inventory and inspected annually. Immediate, aggressive weed control measures would be implemented to reduce weed populations within the Project footprint in off-playa areas, as approved by the BLM authorized officer. A combination of physical, biological, and cultural methods for controlling noxious weeds and other invasive species may be used. To minimize the introduction of noxious and invasive weeds, equipment would be cleaned prior to entering off-playa areas from non-project areas. Successful revegetation of off-playa disturbed areas would establish permanent, beneficial plant communities within the mine area to reduce the opportunity of establishment of noxious or invasive species.

4 Mineral Processing and Metallurgical Testing

CPM intends to convert Sevier Playa brine into SOP using standard unit processes common to the potash and soda ash industries. Process test work completed to progress the understanding of the metallurgical properties of the Project and predict the overall grade and recovery involved the following:

- Identification of major, minor, and deleterious species
- Pond crystallization modeling and evaporation tests
- Generation of feed stock for vendor testing
- Conversion tests
- Flotation tests
- Crystallization tests

Results of the test work were used to update and refine the process designs. Flotation tests were performed to evaluate possible reagents and recovery. Tests were also performed to assist with predicting the potential purity of the final SOP product, as well as to estimate recoveries.

Table 4-1, *Mineral Processing and Metallurgical Test Summary*, summarizes the test work performed, the laboratories used, the test objectives, and the test results. All tests were completed using industry standard methods, where applicable.

Table 4-1. Mineral Processing and Metallurgical Test Summary

Test	Laboratory*	Objective	Dates of Testing	Status	Results
Identification of major, minor, and deleterious species	AWAL, Hazen	Data were used in process models and to refine flow sheets; quantified potential variability of salts in solar evaporation ponds.	August 2011–August 2013	Testing completed; additional testing recommended	Testing showed considerable variations in species and ion balance, with the exception of potassium (K) and magnesium (Mg).
Preliminary pond crystallization modeling and mass balance	Novopro	Determined evaporation characteristics of brine and suitability of pond designs and process unit operation design.	October 2016	Modeling completed	Model showed primary potassium bearing minerals would be schoenite ($K_2Mg(SO_4)_2 \cdot 6H_2O$), sylvite (KCl), and carnalite ($KMgCl_3 \cdot 6H_2O$). These pond solids were acceptable for processing to potassium sulfate (K_2SO_4).

Test	Laboratory*	Objective	Dates of Testing	Status	Results
Flotation tests	Hazen	Used synthetic mineral blend to determine flotation reagent and reagent dosages, required flotation time, and establish relationship between grade and recovery.	October 2016	Testing completed	Rougher flotation produced 90% recovery of schoenite and was implemented into the mass balance
Conversion tests	Hazen	Used synthetic mineral blend to determine reaction kinetics and to verify brine equilibrium.	October 2016	Testing completed	A 30-minute reaction time was confirmed and the chemical equilibrium used in modeling was confirmed.
Potassium sulfate crystallization tests	Hazen	Used synthetic mineral blend to determine reaction kinetics, crystallizer recovery, and to verify brine equilibrium.	March 2017	Testing completed	Crystallization test containing potassium chloride (KCl) produced a crystallizer potassium recovery of near 50%. The brine equilibrium was verified and implemented into the mass balance models.

*American West Analytical Laboratories (AWAL), Hazen Research (Hazen), Novopro Projects Inc. (Novopro)

4.1 Identification of Major, Minor, and Deleterious Species

Analytical results from over 800 samples of brine were reviewed to provide information on the expected variation of salts in the solar evaporation ponds. There was considerable variation in the American West Analytical Laboratories (AWAL) analyses for the individual species due to laboratory dilutions of concentrated brine associated with the analytical method used. A subsequent analysis by Hazen Research (Hazen) using an alternative method (barium precipitation and gravimetric analysis), yielded more accurate results for sulfate, a key anion, and produced a set of analyses that were ionically balanced.

The concentrations of positive and negative ions were checked to help determine the accuracy of the analyses. Balanced charges are an indication that major ions have been identified and are accurate for the purposes of the study. When the AWAL analyses were checked in this way, the resulting ion balance was found to have an average error of 17% and a standard deviation of 26%. The AWAL analyses matched information found in the literature for other evaluations of Sevier Playa brine, but those analyses were found to have similar ion balance errors. As mentioned, these errors are likely a result of the analytical method and the required dilutions.

A subsequent analysis by Hazen resulted in a more accurate charge balance. The Hazen analytical results yielded a charge balance with 94% agreement and, because they were the best available data, were used for preliminary process modelling work. The Hazen results are provided in **Table 4-2**, *Results of Hazen Analysis: Concentration of Ions*, to provide an example of the balance calculations.

Table 4-2. Results of Hazen Analysis: Concentration of Ions

ION	Concentration (grams/L)	Concentration (moles/L)	Ion Concentration (equivalents/L)
Na^{+}	73.9	3.2	3.213
Mg^{+2}	4.15	0.17	0.341
Ca^{+2}	0.69	0.017	0.034
K^{+}	3.28	0.084	0.084
Total Positive	–	–	3.672
SO_4^{-2}	23.8	0.25	0.496
Cl^{-}	121.3	3.5	3.421
Total Negative	–	–	3.917
ION balance, percent	–	–	93.7

– = not applicable

Table 4-2 shows the ion balance calculation for the composite brine. The concentration of each ion (Column 2) was divided by the atomic or molecular weight to get the concentration of the ion in moles/L (Column 3). That value was multiplied by the charge of the ion (indicated in Column 1) to get the charge equivalent of the ions (Column 4). When the sum of the positive ions (3.672 equivalents/L) is divided by the sum of the negative ions (3.917 equivalents/L) the result is a 93.7% ion balance. While this value represents a lower than expected ion balance, it was not investigated further due to the fact that all analytes of interest were covered in the analysis. Additionally, small errors in the sodium or chloride analysis could easily shift the ion balance by approximately 6% so further investigation was deemed unnecessary.

Additional samples were collected from the Sevier Playa and submitted to Hazen for duplicate, confirming analyses. In addition, a synthetic brine sample was compounded from reagents to be submitted as a blind check of the analytical techniques. The synthetic brine was included as a blind sample, with the Sevier Playa brine samples taken in the May 2013 sampling event. Analytical results were consistent and generally within 5% of the known concentrations of ions in the synthetic brine. The Hazen analysis of the "average playa brine" used in modelling work and the average analytical values from the 2013 samples analyzed by AWAL are shown in **Table 4-3**, *Summary of Analytical Values Used in Modeling.*

Table 4-3. Summary of Analytical Values Used in Modeling

ION	Concentration (gram/L)		
	Hazen Analysis of Composite Sevier Playa Brine	Average of 20 Samples (2013)	
		Hazen	AWAL
Na^{+}	73.9	74.1	67.7
Mg^{+2}	4.15	3.92	3.64
Ca^{+2}	0.69	0.64	–
K^{+}	3.28	3.05	2.92

ION	Concentration (gram/L)		
	Hazen Analysis of Composite Sevier Playa Brine	Average of 20 Samples (2013)	
		Hazen	AWAL
$SO4^{-2}$	23.8	20.7	24.5
$HCO3^{-}$	–	0.54	–
Cl^{-}	121.3	115	100

– = not applicable

The average analysis performed by Hazen of the 20 samples collected in 2013 supports the composition of the composite sample that had been used for thermodynamic modeling. Previous analyses of samples from the same locations had been analyzed by AWAL and showed appreciably different concentrations. An average HCO3 concentration is listed in **Table 4-3**; however, HCO3 was not reported in Hazen's brine analysis. Therefore, HC03 was not included in **Table 4-2**.

4.2 Pond Crystallization Modeling

Minerals produced in the solar ponds drive the operation of the Processing Facility and also influence the optimal plant design. A simulation of the ponds was calculated using PHREEQC software, provided by the USGS (see Section 4.2.1, *Numerical Modeling*).

4.2.1 Numerical Modeling

The numerical modeling was performed using PHREEQC interactive software Version 3.3.8-11728, provided by the USGS, and brine analyses, provided by Hazen. The software used an internal database that feeds Pitzer equations that calculate equilibrium constants. The program can determine equilibrium brine concentrations, equilibrium solids concentration, and temperature effects. The numerical model did not include information on reaction kinetics. The information from the numerical model was used to predict all minerals expected to crystallize in the harvest ponds, information that is critical to the process design.

The model predicted the crystallization of a variety of salts as water was removed by evaporation. The first minerals to crystallize in the preconcentration ponds would be halite, polyhalite ($K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$) and gypsum. There is the potential for bloedite ($Na_2SO_4 \cdot MgSO_4 \cdot 4H_2O$) to crystallize in the preconcentration ponds but the extent to which bloedite supersaturates in the brine is not well understood. As potassium-bearing minerals become saturated, the brine is moved to the production ponds where potassium crystallizes as schoenite ($K_2Mg(SO_4)_2 \cdot 6H_2O$); sylvite (KCl); and carnallite ($KMgCl_3 \cdot 6H_2O$). Additionally, halite, epsomite ($MgSO_4 \cdot 7H_2O$) and hexahydrite ($MgSO_4 \cdot 6H_2O$) crystallize in the production ponds. **Table 4-4**, *Minerals Crystallized in the Preconcentration Ponds*, and **Table 4-5**, *Minerals Crystallized in Production Ponds*, summarize the minerals crystallized in each pond. **Table 4-6**, *Pond Brine Specific Gravity*, describes the brine specific gravity in each pond.

Table 4-4. Minerals Crystallized in the Preconcentration Ponds

Preconcentration Ponds	Salts Deposited (tons/yr)			
	Halite	Gypsum	Polyhalite	Bloedite
P-1	–	–	–	–
P-2	–	53,059	–	–
P-3	830,434	59,225	–	–
P-4	4,678,322	18,702	–	–
P-5	426,502	–	5,294	–
P-6	475,292	–	3,314	106,822
P-7	426,099	–	1,947	253,196
P-8	388,059	–	1,548	247,817
P-9	349,449	–	1,055	218,836
P-10	385,509	–	777	228,228
Total	**7,959,666**	**130,985**	**13,933**	**1,054,900**

– = not applicable

Table 4-5. Minerals Crystallized in Production Ponds

Production Ponds	Salts Deposited (tons/yr)					
	Halite	Schoenite	Carnallite	Epsomite	Hexahydrite	Sylvite
Pond H1 (cells: H1-A, H1-B, H1-C & H1-D)	1,004,208	814,448	–	1,233,435	–	–
Pond H2 (cells: H2-A, H2-B, H2-C & H2-D)	130,928	–	–	264,271	–	71,092
Pond H3 (cells: H3-A, H3-B, H3-C & H3-D)	63,497	–	255,009	–	141,710	–
Pond H4 (cells: H4-A, H4-B, H4-C & H4-D)	7,556	–	27,762	–	22,853	–
Total	**1,206,189**	**814,448**	**282,771**	**1,497,706**	**164,563**	**71,092**

– = not applicable

Table 4-6. Pond Brine Specific Gravity

Preconcentration Ponds	Specific Gravity
P-1	1.221
P-2	1.221
P-3	1.222
P-4	1.225
P-5	1.236

Preconcentration Ponds	Specific Gravity
P-6	1.236
P-7	1.236
P-8	1.236
P-9	1.236
P-10	1.236
H1	1.240
H2	1.300
H3	1.310
H4	1.320

4.3 Preliminary Conversion Tests

Based on the results of numerical pond crystallization modeling performed using the PHREEQC software, an estimate of the Processing Facility feed solids was completed. Using this estimate, Hazen generated synthetic salts to match the feed concentration predicted in the models. These salts were placed in a 4-liter kettle, where the experiment took place. The solids were mixed with crystallizer mother liquor at two different temperatures: 25 degrees Celsius (°C) and 30°C. The temperature of the reaction kettle was controlled using a water bath connected to a heating/cooling element.

Results indicated the formation of schoenite from the mixed potassium salts, as well as the presence of halite and epsomite. Kinetic samples were pulled throughout the test and the reaction was determined to be complete after 30 minutes. Hazen performed analytical analysis on the brines and the results were compared to the PHREEQC outputs for this unit operation. The numerical models were validated and equilibrium constants adjusted as needed so that the PHREEQC models more closely reflected actual data.

4.4 Flotation Tests

The objective of the screening campaign was to identify a collector and associated additives (frothers and extender oils) that would effectively float schoenite from a mixture of salts (specifically halite and epsomite) and meet the target design parameters. The collector screening campaign was carried out at Hazen in Golden, Colorado. Four rounds of testing were needed to identify and refine the performance of reagents. Selection of flotation reagents was based on recommendations from industry experts, manufacturers, and literature reviews of schoenite collectors.

Feed solids composition of the flotation test was designed to reflect the most stringent operating conditions for the Processing Facility. The composition of feed solids was different in Round 1 than the composition used in the other tests. In Round 1, schoenite made up 40% of the feed, while halite, epsomite, and bloedite each made up 20%. This composition, however, proved to be thermodynamically unstable and, therefore, represented an unrealistic stressed state. For the subsequent rounds of tests (Rounds 2, 3, and 4), schoenite made up 50% of the feed, while halite and epsomite represented 25% each of the feed. Hence, bloedite was removed from the feed material. Particle size distribution coming out of the crushing circuit is expected to have a top size of 1 millimeter (mm). Hence, the feed solids were screened to ensure that particles larger than 1 mm would not be used in flotation tests.

Brine was made to simulate recirculating brine, similar to that expected in the mineral processing area of the Processing Facility. Brine was synthesized for flotation testing using laboratory reagents at concentrations consistent with the numerical model's predicted concentrations for the final production pond. Brine concentrations used in flotation testing are shown in **Table 4-7**, *Synthetic Brine Concentrations Used in Flotation Testing.*

Table 4-7. Synthetic Brine Concentrations Used in Flotation Testing

Compound	Percent by Mass
Water (H_20)	66.82
Halite (NaCl)	9.68
Magnesium sulfate ($MgSO_4$)	11.87
Magnesium chloride ($MgCl_2$)	7.63
Potassium chloride (sylvite) (KCl)	4.00

In Round 1 of flotation testing, collectors and frothers were chosen based on Hazen and Novopro Projects Inc. (Novopro) recommendations and literature. Four collectors were tested at dosage of 100 grams of collector per ton of solids. In Round 2, new collectors were tested based on manufacturer recommendations. Concentrations of all collectors were increased to 227 grams per ton.

Temperature variations during testing of Rounds 1 and 2 made interpretations of results difficult. As such, stringent temperature control methods were applied in Rounds 3 and 4, and the issue was resolved.

After mostly unsuccessful previous rounds of testing, Novopro conducted a more extensive literature review and considerably modified testing conditions. Most notably slurry conditioning time and reagent concentration were increased. New reagents were also tested, based on manufacturer recommendations and data encountered in literature.

Round 3 was used mostly for reagent screening. The dosages were made to replicate test procedures in literature or manufacturer recommendations. Kerosene extender oil was also added to improve collector attachment.

A recovery of 89.36% and grade of 91.6% were achieved in 12 minutes of rougher flotation. The additional 10 minutes of scavenger floatation took recovery to 97.8% and grade to 88.6%. These data confirmed mass balance modeling.

A detailed summary of the flotation testing can be found in the *Flotation Reagents Screening & Performance Testing Campaign – Summary of Results* report by Novopro (2016), included in Appendix B.

4.5 Crystallization Tests

The crystallization tests were planned to verify the kinetic dissolution of schoenite in a semi-continuous process, as well as the brine composition of the SOP crystallizer once KCl is added. The tests were conducted in 3.5 cycles, each made up of two sequential batch stages for a total of seven consecutive batches.

Test 1.A. – In the first batch stage of the first cycle (1.A.), a fixed mass of schoenite and synthetic dilute mother liquor were added to a continuously stirred kettle. The mixture was stirred at a constant temperature for 3 hours. The solids were then allowed to settle for 2 to 3 minutes by turning off the agitator. A portion of the clear, clarified mother liquor was removed from the kettle for analysis. Brine samples were taken at 1-hour intervals, and a solid sample was taken at the end of the stage.

Test 1.B. – In the second batch stage of the first cycle (1.B.), the remaining mother liquor and solids were stirred continuously at the reaction temperature. Potassium chloride brine was prepared by dissolving solid KCl in hot water. The KCl brine was added to the slurry in the kettle. The mixture was stirred continuously for 3 hours. The slurry was filtered to separate the dilute mother liquor from the solids. Cooling on filtration was prevented. Brine samples were taken at 1-hour intervals, and a solid sample of the bulk solids was taken at the end of the stage.

Test 2.A. – In the first batch stage of the second cycle (2.A.), a fixed mass of schoenite and the dilute mother liquor from the second batch stage of the first cycle (i.e., the filtrate of cycle 1.B.) were added to the continuously stirred kettle. The mixture was allowed to react at a constant temperature for 3 hours. The solids were then allowed to settle for 2 to 3 minutes by turning off the agitator. A portion of the clarified mother liquor was removed from the kettle for analysis.

Test 2.B. – In the second batch stage of the second cycle (2.B.), the remaining mother liquor and solids were stirred continuously at the reaction temperature. Potassium chloride brine was prepared by dissolving solid KCl in hot water. The KCl brine was added to the slurry in the kettle. The mixture was stirred continuously for 3 hours. The slurry was filtered to separate the dilute mother liquor from the solids. Cooling on filtration was prevented. Brine samples were taken at 1-hour intervals, and a solid sample of the bulk solids was taken at the end of the stage.

Test 3.A. – In the first batch stage of the third cycle (3.A.), a fixed mass of schoenite and the dilute mother liquor from the second batch stage of the first cycle (i.e., the filtrate of Cycle 2.B.) were added to the continuously stirred kettle. The mixture was allowed to react at a constant temperature for 3 hours. The solids were then allowed to settle for 2 to 3 minutes by turning off the agitator. A portion of the clarified mother liquor was removed from the kettle for analysis.

Test 3.B. – In the second batch stage of the third cycle (3.B.), the remaining mother liquor and solids were stirred continuously at the reaction temperature. Potassium chloride brine was prepared by dissolving solid KCl in hot water. The KCl brine was added to the slurry in the kettle. The mixture was stirred continuously for 3 hours. The slurry was filtered to separate the dilute mother liquor from the solids. Cooling on filtration was prevented. Brine samples were taken at 1-hour intervals, and a solid sample of the bulk solids was taken at the end of the stage.

Test 4.A. – In the only stage of the fourth cycle (4.A.), a fixed mass of schoenite and the dilute mother liquor from the second batch stage of the third cycle (i.e., the filtrate of cycle 3.B.) were added to a continuously stirred kettle. The mixture was stirred at a constant temperature for 12 hours. Brine samples were taken after 6 hours and 12 hours of continuous stirring. A solid sample was taken at the end of this stage.

The results from the crystallization experiment were implemented into the METSIM Version 2014.04 mass balance. The potassium recovery in the crystallizer was determined to be 50%.

4.6 Summary of Throughput Calculations

Approximately 372,000 tons/yr of SOP would be produced during the highest production years assuming average continuous brine inflow of about 30,000 gallons per minute (gpm) to the preconcentration ponds. Recoverable losses include the following:

- Brine leakage through the bottom of the ponds that would re-enter the brine aquifer
- Entrainment brine (brine that is present as moisture in pond solids) that would be pumped back to the production ponds

A total of 30,000 gpm of brine is pumped into the evaporation ponds. Approximately 3.86 Mtons/yr of pond salts are harvested as feed material and processed to yield approximately 372,000 tons/yr of SOP during peak production. Of the total maximum quantity of 167,660 tons/yr of potassium that enters the evaporation ponds, 83.7% is harvested as feed material. Loss to bitterns (solution drained from the final pond) would be 1%. The remaining 15.3% loss is due to leakage and entrainment and is not considered recoverable. From the conversion feed material, 86% is processed into saleable SOP product (this includes the addition of potassium from Muriate of Potash [MOP]). The remaining 14% of the conversion feed material is transported to the waste product storage area. This information is provided in the NI 43-101 Technical Report (CPM 2018a).

4.7 Deleterious Elements

Over 800 samples were analyzed for a variety of ions (i.e., magnesium, sodium, chloride, calcium, sulfur, potassium, and bicarbonate). There were no deleterious materials present in concentrations that cannot be accommodated by the process design.

4.8 Summary of Estimated Recovery

The various recoveries are laid out below in **Table 4-8**, *Project Recoveries*. The Playa based recovery is the recovery of potassium from the moment it enters the harvest ponds, to the time it leaves as SOP product. The overall process recovery (see **Table 4-8**) describes the recovery of the Processing Facility and the harvest ponds. The preconcentration pond recovery was discussed previously in Section 4.6, *Summary of Throughput Calculations*, so it would not be addressed again here.

The primary loss of potassium in the flotation/leach circuit is brine entrained within the solids that are sent to tailings. Although not all of the schoenite would be successfully floated, the adjacent halite leach operation would leach the schoenite from the halite and epsomite, allowing it to be sent back to the production ponds and become recoverable (see **Figure 7-1**). The entrained brine in the tailings solids (Filter Cake Tailings) would contain 2.4% of the potassium that enters this unit of the operation.

Both the conversion and crystallization operations are described as having 100% recovery. This is not to say that 100% of the potassium would be recovered in the first pass, but potassium that is not recovered would be soluble and the amount determined by equilibrium phase chemistry. The soluble potassium would be sent back to the production ponds in the process recycle brine and recovered in the pond system. Since no potassium leaves the total system from these unit operations, they are described as having 100% recovery.

The 0.2% loss in recovery during drying and handling is caused by the elutriation of fine particles through the dust collection system.

Table 4-8. Project Recoveries

Item*	Loss (%K)	Potassium Recovery	Units	Notes
Overall process recovery	13.8	86.2	%	Average over a year (includes MOP)
Playa-based recovery	20.21	79.79	%	Average over a year (excludes MOP)

* The single pass process recovery is 58%.

5 Mineral Resource and Reserve Estimates

The brine resource estimate was developed by Norwest Corporation using MineSight® grid modeling software (Version 12.0-6) and Carlson Software's Geology Module© (Version 150609) horizon surface gridding, graphics, and presentation of modeling results. The MineSight® grid model, from which the brine resources are reported, is based on the analyses and descriptions of brine and aquifer sediment samples taken at regular depth intervals from vertically orientated drillholes collared on the playa surface. The mineral resource estimates define the quantity of brine in the aquifer and concentration of major ions in the brine available for extraction and delivery to the solar evaporation ponds via trenches and extraction wells. The recovery of the available brine from trenches and extraction wells is defined under the mineral reserves estimates. Mineral processing and metallurgical recovery includes the solar pond evaporation and downstream processing test results after delivery of the brine to the solar evaporation ponds.

The effective date of these estimated brine resources is June 30, 2017, as stated in the NI 43-101 Technical Report (CPM 2018a). Mineral reserve estimates have been excerpted from the NI 43-101 Technical Report.

5.1 Model Database

The geologic model database comprises three components: topography, surface mapping, and drillhole data. Each component is described separately in the following sections.

5.1.1 Topography

The playa surface represents the top surface limit of the brine aquifer. To the unaided eye, the playa surface appears flat with little or no obvious changes in elevation. To obtain an accurate measure of the elevation of the playa surface, a detailed LiDAR (light detecting and ranging) topographic and imaging survey was conducted in 2015 by Aero-Graphics Inc. (Aero-Graphics) over the entire playa. Data acquisition averaged 1.7 points per square meter with 50% overlap and the non-vegetated Vertical Accuracy results for the LiDAR survey were estimated by Aero-Graphics to be 0.141 m at the 95% confidence level. Additional off-playa DEM data was also combined with the LiDAR survey data. The 10m grid resolution DEM data was sourced from the public domain (Utah Automated Geographic Reference Center 2012). The additional DEM survey data has no material impact on the resource because it is located outside of the brine resource limits defined by the playa boundary.

5.1.2 Surface Mapping

There was no geological mapping of the playa surface because of the generally uniform nature of the playa surface geology. Surface mapping was limited to the surveying of the playa surface and boundary.

5.1.3 Drillhole Data

The following principal brine resource parameters were acquired from drillhole sampling of brine and host sediments:

- Lithologic observations
- Sediment carbonate content

- Penetrometer measurements (pounds per square inch [lb/in^2])
- Gravimetric moisture content in weight percent (Wt%)
- Specific gravity (SG) of brine and host sediments
- Cation in milligrams per liter (mg/L) brine for Mg^{+2}, Na^{+}, and K^{+}
- Anion in mg/L brine for Cl^{-} and SO_4^{-2}

Additional ancillary brine geochemical parameters were analyzed, including lithium, barium, bromide, and TDS. Each of the above principal brine resource parameters is discussed as follows.

5.1.3.1 Lithology

Field observations of drill cores were used to identify three brine-saturated resource horizons or brine aquifers: FCZ, MCZ, and SCZ (presented in order of increasing depth from surface). A detailed description of these resource horizons is provided in Section 3.0, *Characterization of the Environment*, and in **Figure 3-4**. Below these three main horizons is a hard clay that is not included in the geologic model used to define estimate brine resources. The number of partial and complete penetrations of the three brine aquifers and univariate thickness statistics interpreted from drillhole records are outlined in **Table 5-1**, *Brine Aquifer Intercepts and Thickness*.

Table 5-1. Brine Aquifer Intercepts and Thickness

Aquifer	Partial Intercepts	Complete Intercepts	Minimum*		Maximum*		Mean*	
			meters	feet	meters	feet	meters	feet
FCZ	2	428	2.40	7.87	5.09	16.70	3.83	12.57
MCZ	139	289	0.74	2.43	7.46	24.48	5.08	16.67
SCZ	237	52	2.09	6.86	27.33	89.67	13.00	42.65

* Depths vary across the playa.

5.1.3.2 Carbonate Content

The carbonate content of the sediment samples, expressed as a percentage of sample, has been tested for 222 sediment core samples. The considerable decrease in carbonate content from approximately 45% in the FCZ and MCZ to approximately 30% for the SCZ is consistent with changes in drill core lithology from marl-like clays to siliceous clay at approximately 30 feet from surface. The carbonate content, though not used directly in the estimation of brine resources, is an important sediment chemistry marker in both validating and identifying the gradational change from a marl clay aquifer to a siliceous clay aquifer.

5.1.3.3 Penetrometer Measurements

The penetrometer results provided an indirect and relative field measure of moisture content. The lower values (0 to 0.666 lb/in^2) generally represented intervals of elevated moisture content of between 50 Wt% and 30 Wt%, while the higher values (greater than 0.66 lb/in^2) generally represented intervals of low moisture content of approximately 30 Wt% or less. Penetrometer results, together with lithologic descriptions, were used for field assessment of relative moisture content and for corroboration of

assayed values prior to modeling. Penetrometer measurements, along with lithologic descriptions and carbonate content, were used to determine the transition from the MCZ to the SCZ and to delineate the bottom of the total brine aquifer.

5.1.3.4 Moisture Content

The gravimetric moisture content was measured for all sediment samples and is considered to be an equivalent measure of porosity, given that all lakebed sediment samples were observed to be 100% saturated. The univariate statistics for modeled moisture content is listed in Table 5-2, Sediment Moisture Content Univariate Statistics. The moisture content samples were taken at regular intervals and, in some instances, straddled FCZ, MCZ, and SCZ boundaries. A total of 3,357 moisture sampled intervals were recorded from each brine aquifer out of the 2,651 moisture samples. The number of moisture sample intervals in the FCZ is 689 (26% of total), MCZ is 742 (28% of total) and SCZ is 1,220 (46% of total). The moisture sample coverage is proportional to the overall aquifer volumes, as reported from the geologic model.

Table 5-2. Sediment Moisture Content Univariate Statistics

Parameter	No. Samples	Minimum (Wt%)	Maximum (Wt%)	Mean (Wt%)	Median (Wt%)	Standard Deviation
Gravimetric moisture	2,651	6.02	75.58	43.67	43.20	8.84

5.1.3.5 Specific Gravity

In-situ SG of the brine was measured for all brine samples together with the cation and anion analyses. The dry SG of the host sediments was not determined for all samples and was limited to a representative group randomly distributed across the property. The univariate statistics for brine and sediment SG is listed in Table 5-3, In-Situ Specific Gravity Univariate Statistics.

Table 5-3. In-Situ Specific Gravity Univariate Statistics

Parameter	No. Samples	Minimum	Maximum	Mean	Median	Standard Deviation
Brine specific gravity	861	0.98	1.21	1.1	1.1	0.03
Brine specific gravity (calculated)	861	1.03	1.28	1.12	1.12	0.03
Sediment specific gravity	43	2.67	2.99	2.84	2.83	0.07

The laboratory determined brine SG varies considerably when compared to concentration of major ions, such as sodium, as evidenced from **Figure 5-1**, depicting a scatter plot of brine SG versus sodium content. Furthermore, the reported minimum brine SG from the laboratories, as indicated in **Table 5-3**, is less than 1.0.

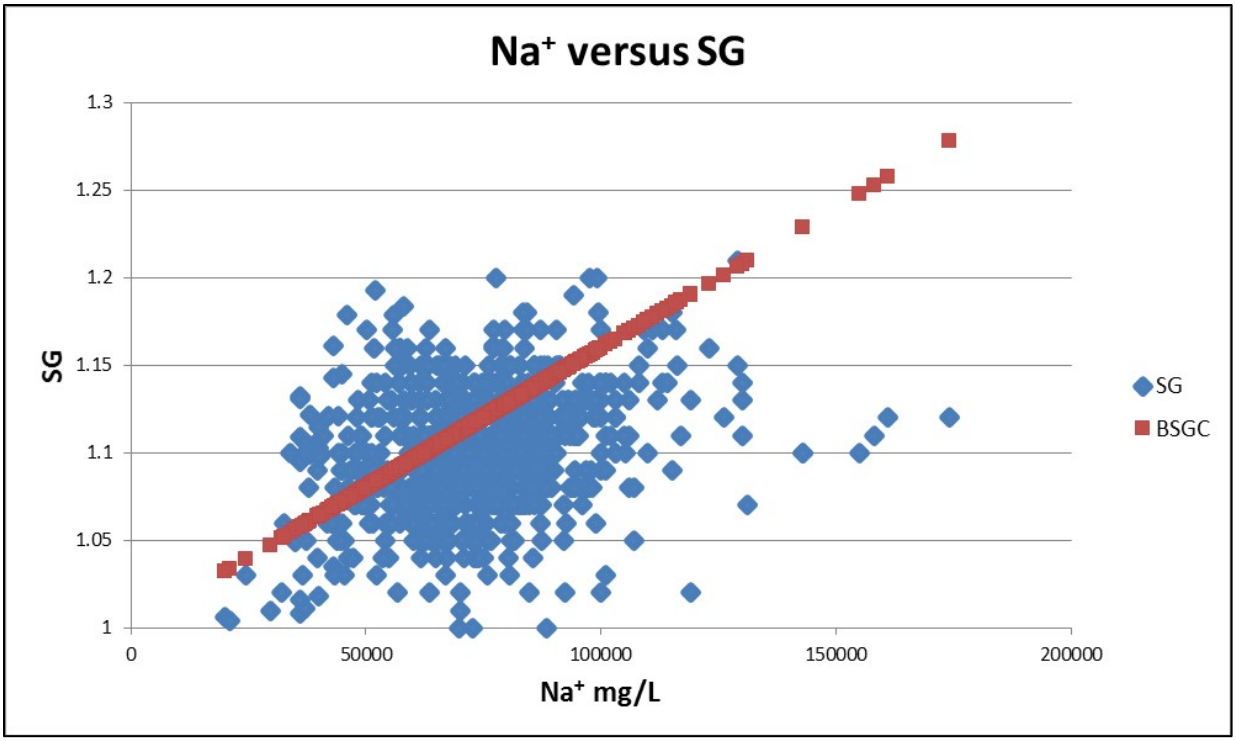


Figure 5-1. Scatter plot of Na^+ versus SG.
Note: BSGC = brine SG calculated

It has been determined that these inaccuracies in measurement of brine SG when compared to major ion distribution is either due to equipment precision limitations in the measurement of SG and/or precipitation of salts between measurement of SG and major ion analyses. To improve the accuracy of the SG estimates and knowing that halite (NaCl) is the primary salt that precipitates out of the brine solution, it was decided to use the concentration of sodium (Na^+) in brine to calculate a theoretical SG. In doing so, the brine SG would increase in linear proportion to the Na^+ concentration of brine. The formula used to calculate SG from sodium is

$$BSGC = ((Na^+ \times 1.6)/1{,}000{,}000) + 1$$

Where:
BSGC = brine SG calculated
Na^+ = sodium concentration in brine in mg/L

The SG formula shown above was derived from salometer (Alkar 2015) reference charts, where measured SG of brine is compared with halite concentration in the brine at 60°F. The univariate statistics to calculate brine SG is listed in **Table 5-3**; it indicates a slight increase in brine SG. The distribution of calculated versus laboratory results is illustrated in **Figure 5-1**, which is a scatter plot of brine SG versus sodium content.

5.1.3.6 Cation and Anion Analyses

The purpose of measuring the most commonly occurring cations and anions in the brine samples is for use in determining the theoretical salt products, including potash (in the form of potassium sulfate or potassium chloride), that could be precipitated from brine in solar evaporation ponds. The major ions used to determine the theoretical salt products from the resource are the cations potassium (K^+), magnesium (Mg^+), and sodium (Na^+); and the anions chloride (Cl^-) and sulfate (SO_4^{-2}). Prior to modeling, some adjustments were made to the anion concentrations to ensure that the cations-anions balance of five major ions is within an acceptable range for accurate downstream modeling of salt productions from the evaporation ponds.

The ratio of total cations to anions, referred to as the ion balance, was identified in many exploration brine samples to be outside of the expected ion balance range for environmental water samples. Industry guidelines suggest that an ion balance ratio (cations-anions) for water samples should be between 0.95 and 1.05 (Lenntech 2017). The average ion balance reported from the exploration samples was 1.23, while the average reported from 19 bulk samples was an acceptable 0.996[3]. The ion imbalance in the exploration samples was identified to be related to the relative concentrations of the anions to cations for the reasons described below.

Anion Testing Methods

The brine bulk samples were tested at Hazen laboratories, which used more accurate but expensive gravimetric methods for testing anions (Cl^- and SO_4^{-2}). Whereas, the exploration brine samples used in the resource model were tested[3] using less accurate but relatively inexpensive ion chromatography (U.S. Environmental Protection Agency [EPA] 300.0/SW 9056) testing methods for anions[4].

A direct comparison between these two testing methods, using duplicate samples, has not been attempted. Furthermore, duplicate and independent analyses[5] of the exploration brine samples, using ion chromatography, did not reveal any consistent error or shift in the results.

Na^+ to Cl^- Ratio

The average ratio of Na^+ to Cl^- reported from the balanced bulk samples was 0.637, which is very close to that of the Na^+ to Cl^- ratio for halite at 0.649. The average Na^+ to Cl^- ratio reported from the exploration samples was 0.803. Halite is the primary precipitant (80%) from the solar ponds and the Na^+ to Cl^- ratio from the brine samples is expected to be close to the ratio for halite (0.649).

Anion Corrections

For estimation and reporting of accurate anion concentrations from the brine aquifers, the following adjustments were made to anion test results prior to modeling:

- For those exploration samples identified as outside the ion balance cutoff, the Cl^- ions were adjusted to match the ratio for that of halite (0.649). The impact of this adjustment brought most of the brine sample ion balances to within an acceptable 0.95 to 1.05 range.

[3] AWAL in 2013 and prior years and ALS Global in 2015–2016.

[4] Cation testing uses inductively coupled plasma-atomic emission spectrometry (ICP-AES) method 6010C, which is understood to be more accurate than anion testing method due to built-in correction factors in the ICP-AES method.

[5] A third, independent laboratory (SGS) was used for duplicate exploration samples.

- Adjustments to the SO_4^{-2} concentration were used to bring the remaining samples with ion balances outside acceptable ranges to 0.95, if less than 0.95, or 1.05, if greater than 1.05. An exact ion balance match was not attempted to account for minor element concentration, such as Ca^{+2} and $HCO3^{-6}$, which are not available in all brine samples.

The purpose of the anion adjustments was to ensure that the brine feed chemistry reported from the geologic model is balanced for accurate feasibility-level downstream evaporation pond modeling. The impact of the anion adjustments has no material impact on the available SOP resource given that available average SO_4^{-2} concentration is considerably higher than K^+ at seven times the average potassium concentration.

Univariate statistics for the modeled and ion balanced cations and anions are listed in **Table 5-4**, *Cation and Anion Univariate Statistics Presented (mg/L).* The aquifers are divided into an upper zone, corresponding to the combined FCZ and MCZ, and a lower zone, corresponding to the SCZ. The combined FCZ and MCZ is required, as they are universally sampled together. The combined aquifer statistics reflect the entire 861-sample dataset.

Table 5-4. Cation and Anion Univariate Statistics Presented (mg/L)

Aquifer	Parameter	Number of Samples	Minimum	Maximum	Mean	Median	Standard Deviation
Upper zone	Magnesium Mg^{+2}	807	816	9,400	3,776	3,597	1,069
	Sodium Na^+	807	24,411	174,048	74,838	73,200	17,618
	Potassium K^+	807	641	7,940	3,051	2,970	774
	Chloride Cl^-	807	37,641	268,378	114,742	112,410	27,364
	Sulfate SO_4^{-2}	807	6,200	65,190	22,618	21,616	7,090
Lower zone	Magnesium Mg^{+2}	54	867	7,450	3,698	3,695	1,167
	Sodium Na^+	54	20,000	174,048	69,958	69,676	20,634
	Potassium K^+	54	782	5,030	2,976	3,104	818
	Chloride Cl^-	54	33,000	268,378	107,606	108,555	31,966
	Sulfate SO_4^{-2}	54	5,000	48,000	18,849	17,800	6,836
Aquifers combined	Magnesium Mg^{+2}	861	816	9,400	3,734	3,570	1,101
	Sodium Na^+	861	20,000	174,048	73,364	72,684	18,600
	Potassium K^+	861	641	7,940	3,017	2,960	795
	Chloride Cl^-	861	33,000	268,378	112,516	110,868	28,802
	Sulfate SO_4^{-2}	861	5,000	65,190	22,084	21,249	7,302

6 Ca^{+2} and HCO_3^- are too low in concentration for a material impact on overall ion balance.

5.2 Database Validation

5.2.1 Brine and Sediment Sample Analyses

Brine sample analyses taken from the Sevier Playa wells from 2011 to 2013 were performed by AWAL at its Salt Lake City facility. Brine sample analyses sampled from the wells in 2015 were performed by Australian Laboratory Services (ALS) at their Salt Lake City facility. AWAL and ALS laboratories are accredited by The NELAC Institute, and all analyses were performed in accordance with NELAC Institute protocols. Lakebed sediment samples were analyzed by Intermountain GeoEnvironmental Services (IGES) for sediment moisture content and bulk density and were used in the brine volumetric calculations. The laboratories were engaged by CPM on a contractual basis and are independent of the Company.

Duplicate brine samples were prepared by CH2M for the 2011–2013 programs for internal check assays, and by Norwest Corporation in the 2015 program, for external laboratory testing at SGS North America (SGS) in Denver. A total of 861 unique brine analyses had been completed as part of the playa exploration and used in the resource model. Of these samples, an additional 85 blind duplicate samples were completed by AWAL and another six blind duplicate samples were completed by ALS and SGS in 2015. This represented a QA/QC procedure of duplicate blind testing of 1 in 10 samples during the 2011–2013 program and approximately 1 in 4 for the 2015 program. These blind duplicate analyses were not used in defining the resource.

Comparison of original 2011–2013 AWAL samples to AWAL blind field duplicates, representing 839 of the 861 total samples, shows a slight but acceptable range of deviation for potassium assays, as illustrated in **Figure 5-2**. The area of greatest difference is in the higher potassium levels, possibly exhibiting a slight "nugget effect" at these higher concentrations. This may be caused by the logistics of obtaining a repeat sample of a liquid material as opposed to a solid. The repeatability, however, is generally good with a coefficient of determination (R^2) of 0.84.

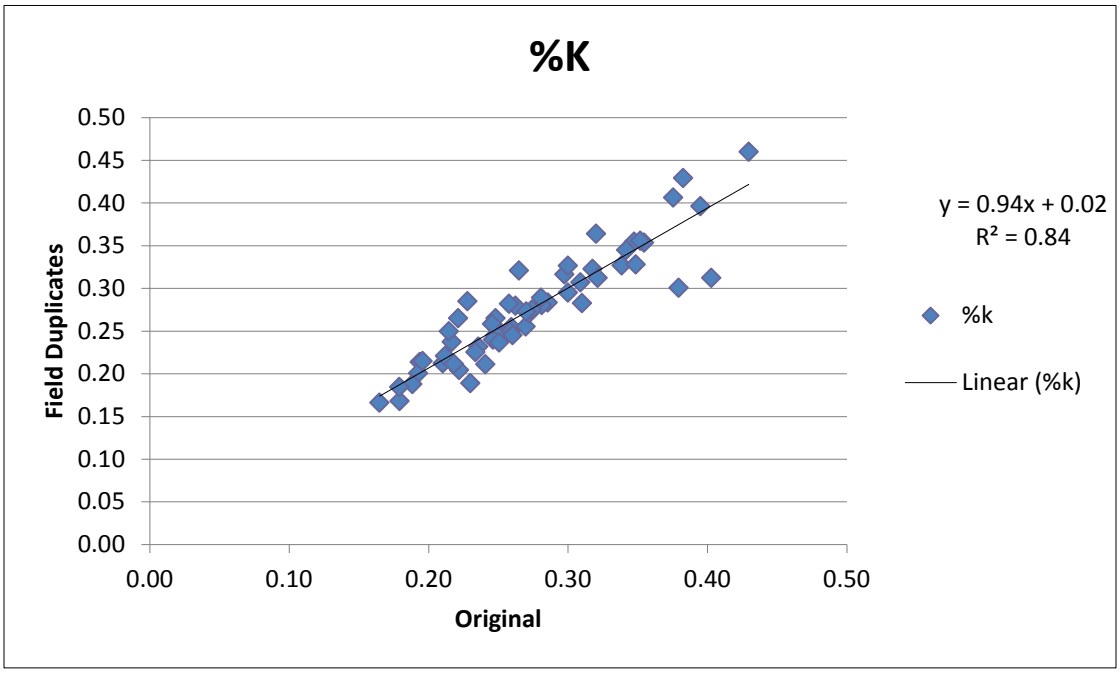


Figure 5-2. Comparison of blind duplicate K+ values to original brine samples.

Similar reviews of the 2015 QA/QC sampling for potassium, as well as the other principal ions pertinent to solar evaporation and the production of potassium sulfate, were performed. Except for the issues noted in the chloride and sulfate values (see Section 5.1.3.6, *Cation and Anion Analyses*), the ionic concentrations are believed to be representative of the in-place geochemistry of the playa brine. After review of the original analytical data and blind brine sample comparisons, it is apparent that the sample preparation and analytical methods used by AWAL, ALS, and IGES are appropriate for determining brine geochemistry and in-place volume for the purposes of this study. Security measures are found to be of a high standard and do not compromise the results used in this technical evaluation.

5.2.2 Other Geological Database Inputs

Prior to modeling, the master database was subjected to the following standard checks for inconsistencies:

- Drillhole sample depth intervals and survey locations
- Drillhole collar elevations against regional public domain survey data
- Playa boundary mapping versus regional public domain playa mapping
- Anomalous values in moisture content, SG, and brine chemistry
- Comparison between penetrometer results and moisture content
- Comparison between laboratory assay certificates and electronic records

All observed inconsistencies and apparent errata were resolved, following checks of the base data or consultation with the concerned parties; namely the Company, consultant services, drilling contractors, and laboratories.

5.3 Geologic Model

The brine resources were reported from a gridded seam model (GSM) that covers the extent of the Sevier Playa boundary. There are two identical geologic models used as the basis for reporting brine resources:

- Metric grid model for reporting in meters
- State plane grid model for reporting in feet

The state plane grid model uses the source Central Utah NAD of 1983 (NAD83) state plane coordinate system. The metric grid model uses the UTM WGS84 Zone 12 datum coordinate system. The same UTM ellipsoid was used, WGS84, as the raw LiDAR data output and subsequent DEM data, which was provided to CPM by AeroGraphics. The UTM data were converted to State Plane for engineering purposes. The WGS84 ellipsoid translates very closely to NAD83, with such minor differences that they are not material. There is no WGS84 conversion available to Utah State Plane.

5.3.1 Spatial Correlation

The geometry of the brine aquifer was determined from the correlations of drillhole lithologic descriptions, penetrometer results, carbonate content, and moisture content measurements. The brine aquifer is confined within the boundary of the playa surface and mineral resource estimates to within controlled lease boundaries.

Along the playa boundary, there is a clear transition from surface soil to a gypsum-halite duricrust. The horizons below the duricrust, encompassing the FCZ, MCZ, and SCZ, have been correlated, as well as subhorizons within these major units. The contact between all three clay aquifers can be distinguished lithologically; however, from a hydrologic and brine chemistry perspective, the contacts are interpreted to be gradational.

The FCZ has generally high moisture contents, typically between 45% and 50%, and penetrometer readings near or below the minimum detection limit. The underlying MCZ has slightly lower moisture content, between 40% and 45%, with penetrometer readings between 0 lb/in^2 to 1.25 lb/in^2. There is a 3.4-foot stiff clay interval within the MCZ, where the penetrometer readings are up to 3.0 lb/in^2. The lower zone, comprising the SCZ brine aquifer, has slightly lower moisture content than the MCZ, noted above, typically between 35% and 45%, with penetrometer readings between 0.75 lb/in^2 and 1.5 lb/in^2. The basal contact of the SCZ is identified by the presence of a hard, dry clay, where penetrometer readings typically exceed 5 lb/in^2.

5.3.2 Brine Aquifer Interpolation

The depth from surface of the three major brine aquifers was interpolated into a two-dimensional grid model from drillhole intercepts using Carlson© software. The surface topography grid was used as the reference surface from which to stack grid estimates of brine aquifer thickness for calculating horizon top and base elevations into the model. The Carlson© grid model setup and estimation parameters are outlined in **Table 5-5**, *Carlson Brine Aquifer Model Setup and Estimation Parameters*. Source LiDAR topographic data was decluttered to 20 × 20-meter grid spacing prior to the resource estimates for efficient data processing. The surface topography grid data was smoothed after decluttering in areas of recent surface disturbance, such as along historical canals and berms in the south of the playa to ensure that the modeled brine aquifers maintained their original geologic locations across areas of manmade disturbance.

The brine aquifer elevation grids from the Carlson© grid model were imported into a MineSight® grid model for estimating top and bottom contacts of the brine aquifers. The MineSight® grid model setup and estimation parameters are outlined in **Table 5-6**, *MineSight® Model Setup and Brine Aquifer Estimation Parameters*. The MineSight® grid model served as the basis for interpolating sediment moisture content, brine grade, and ion concentrations, and, ultimately, reporting of brine resources.

Table 5-5. Carlson© Brine Aquifer Model Setup and Estimation Parameters

Parameter	Description	
Units	Metric (m)	U.S. Customary Units (feet)
Coordinate system	UTM WGS84 Zone 12 datum[7]	Utah State Plane Central NAD83 datum
Model easting (X) range	304,400 through 330,000	1,142,000 through 1,218,800
Model northing (Y) range	4,285,800 through 4,332,000	6,707,600 through 6,849,500

[7] The difference between the GRS 1980 spheroid, the basis for the NAD 1983 datum, and the WGS 1984 spheroid is 0.0001 meters in the length of the semi-minor axis - the distance between the geodetic center of the earth and the North Pole. The semi-minor axis for GRS 1980 is 6356752.3141 meters. This axis for WGS 1984 is 6356752.3142 meters, while the semi-major axis both spheroids measures 6378137 meters (https://support.esri.com/en/technical-article/000005929).

Parameter	Description	
Grid spacing	50 m (X), 50 m (Y)	164 feet (X), 164 feet (Y)
Estimation algorithm	Topography – triangulation	
	Brine aquifer thickness – inverse distance power 2	
	Brine aquifer floor elevation – topography less brine aquifer thickness	

Table 5-6. MineSight® Model Setup and Brine Aquifer Estimation Parameters

Parameter	Description	
Units	Metric (m)	U.S. Customary Units (feet)
Coordinate system	UTM WGS84 Zone 12 datum	Utah State Plane Central NAD83 datum
Model easting (X) range	304,400 through 330,000	1,142,000 through 1,218,800
Model northing (Y) range	4,285,800 through 4,332,000	6,707,600 through 6,849,500
Grid spacing	100 m (X), 100m (Y)	300 feet (X), 300 feet (Y)
Estimation algorithm	Topography – triangulation	
	Brine aquifer contact elevations – triangulation from Carlson grids	
	Brine aquifer thickness – calculated from contact elevation grids (top less base)	
	Sediment moisture content – inverse distance	
	Brine cation and anion concentrations – inverse distance	

Cross sections illustrating the subsurface extent of the three major brine aquifers are illustrated in **Figure 5-3**. The vertical scale in the cross-sections A-A' and B-B' have been increased to 25 times the horizontal scale, and cross-section C-C' has been increased to 50 times the horizontal scale. This was done to better illustrate the spatial variability of the brine aquifer. The cross sections illustrate the extent of the three modelled saturated brine aquifers, namely FCZ, MCZ, and SCZ. The underlying dry clay zone has not been modelled but is illustrated in the cross sections to be at a maximum depth of 520 feet below surface. This is 20 feet below the maximum exploration drillhole depth of 500 feet from hole SN2-400, which did not penetrate any solid basement rock formations. As such, the dry clay zone may extend well beyond the depth limit, as illustrated in the cross sections.

Color contour plots of the brine horizon thickness are illustrated in **Figure 5-4**, and brine horizon floor elevations are illustrated in **Figure 5-5**. Observation of these plans and cross sections indicate an overall increase in thickness and depth from the margins of the playa to the center of the playa. Exploration drilling results and cone penetration test drilling confirm a considerable thinning of lakebed sediments at the playa boundary.

5.3.3 Moisture and Brine Grade Interpolation

The estimation of moisture content and brine grade (cations and anions) and SG into the MineSight® grid model was influenced by the results of geostatistical analyses of the source drillhole sample data, as well as by differences in sampling method and results between direct-push and sonic holes.

Histograms (frequency distribution plots) of sample moisture content and brine chemistry were used to identify outliers in the sample data. The moisture and brine grade histograms are illustrated in **Figure 5-6**. The distribution of the source sample data indicates an overall normal distribution with no materially considerable outliers. No top cuts were applied to the sample data used for modeling.

Unidirectional, two-dimensional semi-variogram charts from composite brine aquifer intervals in the drillhole records are illustrated in **Figure 5-7**. The semi-variogram depicts the spatial autocorrelation of the measured sample points in meters. The distance where the model first flattens out (as a value on the y axis) is known as the range. The value that the semi-variogram model attains at the range is called the sill. Sample locations that are separated by distances closer than the range are spatially autocorrelated whereas locations farther apart than the range are not. The best-fit experimental semi-variograms from the charts, illustrated in **Figure 5-7**, indicate a maximum range-to-sill of approximately 9,842 feet beyond which the relationship between sample grade pairs is viewed as random or inferred.

Table 5-7, *Geologic Model Estimation Methods*, outlines the moisture and brine grade estimation methods used for estimating sediment moisture content and brine grades into the MineSight® model.

Table 5-7. Geologic Model Estimation Methods

Resource Classification	Algorithm	Minimum Number Samples (n)	Maximum Number Samples (n)	Maximum Search Distance (m)
Measured	Inverse distance	1	16	1,500
Indicated	Inverse distance	1	16	3,000
Inferred	Inverse distance	1	16	9,000

The brine resource classification is influenced by the results of the semi-variogram analysis of the brine cation and brine anion sample data. The search ranges outlined in **Table 5-7** are also used to tag the block estimates as measured, indicated, or inferred. All grade and moisture content estimates used lithologic matching. To reduce the potential for dilution of MCZ brine samples from lower SCZ brine, the upper zone brine grade estimation has been limited to the samples sourced from direct push holes that typically only penetrated the FCZ and MCZ aquifers.

The distribution in estimated gravimetric moisture content composited across three brine aquifers is illustrated in **Figure 5-8**. The moisture content in the brine aquifers shows a slight decrease from center of the playa toward lakebed margins. Moisture content is also highest in the FCZ when compared to the underlying MCZ and SCZ.

The concentration of potassium in the brine is the primary ion of interest, since its concentration is the principal limiting constituent in the production of SOP potash. The distribution of brine cation and anion estimates for the three brine aquifers are illustrated in **Figures 5-9** through **5-13**. The brine grade plans illustrate increasing concentrations from the playa boundary toward the center of the playa, where, for example, the concentration of potassium, exceeds 3,000 mg/L. The lowest concentrations of potassium in all three clay aquifers are in the northeastern and eastern shoreline, where the concentration of potassium is mostly less than 2,500 mg/L. A likely explanation for this low concentration is the close proximity of this region to the Sevier River inlet where fresh water ingress during flood events likely has a diluting effect on potassium concentrations. In general, brine sampled from the SCZ in the northern half of the playa has lower potassium concentration than the overlying MCZ and FCZ brines. Overall, the

potassium concentrations for brine samples taken from the southern half of the playa for all three clay aquifers show a greater concentration of potassium over a wider area than those observed for brine samples taken from the north.

5.3.4 Brine Aquifer Porosity Calculations

The brine aquifer porosity percentage is used as a measure of the brine volume found in the saturated sediments. The following formula is applied:

$$BV = \frac{AV x MT x BSG}{MT x BSG + (\frac{1}{SGS-(BSG-1)})}$$

Where:
BV = brine volume (m^3), also referred to as porosity in saturated brine clays
AV = aquifer volume (m^3) reported from geologic model
MT = in-place gravimetric moisture content (Wt%/100) reported from model
SGS = dry sediment solids SG, a constant set at 2.84[8] g/cc

The calculated brine resource (in tonnes) using the above formula is:

$$BT = BV \times BSG$$

Where:
BT = brine tonnes
BSG = brine SG reported from geologic model

Using the above formula, the reported porosity has been compared with direct measurement of porosity in 18 shelby tube samples at IGES. Average direct measurement of porosity from the 18 samples was 52.9%. The average calculated porosity for the same samples, using the formula above, was 54.6%. This absolute difference of 1.7% between the two results is considered sufficient validation of the porosity formula given the potential for compression of the sediments during sampling that would result in an underreporting of porosity when compared to in-place or undisturbed porosity.

5.3.5 Geologic Model Validation

The block model estimates were validated against the source drillhole sample database by comparing the drillhole sample data against the nearest grid estimates. This comparison is best illustrated with the aid of swath plots that compare the mean drillhole sample grades with mean grid estimates at regular intervals across the model area.

The west-east-oriented swath plots are illustrated in **Figure 5-14**, and the south-north-orientated swath plots are illustrated in **Figure 5-15**. No overestimation or underestimation trends were observed in any of the plots.

5.4 Mineral Resource Statement

Brine mineral resource estimates were derived from the GSM of the Sevier Playa that was created using the Company's current drilling and analytical data. The estimated brine mineral resources and associated major dissolved cations and anions for the FCZ, MCZ, and SCZ brine aquifers are listed by lease in **Table 5-8,** *Federal Lease In-Place Potassium and Major Ion Mineral Resources*; **Table 5-9**, *State Lease In-Place Potassium and Major Ion Mineral Resources*; and **Table 5-10**, *LUMA Lease In-Place*

[8] Derived from average of 43 clay sediment samples, prior PFS (CH2M 2013a) estimates used 2.88 SG from 25 clay samples.

*Potassium and Major Ion Mineral Resources***.** Resource plans, illustrating the distribution of brine mineral resources by levels of assurance for the FCZ, MCZ, and SCZ, are shown in **Figure 5-16**.

Table 5-11, *Total In-Place Potassium and Major Ion Mineral Resources*, outlines metric tonnages of mineral equivalent compounds that could be created using the available cations and anions in the brine mineral resource. A total measured plus indicated in-place potassium brine mineral resource is estimated to be 6,777 million tons (Mton). Given that sufficient sulfate is present in the brine to use all the potassium ions, the in-place equivalent of K_2SO_4 using the measured plus indicated brine is calculated to be approximately 38.1 Mton. An inferred potassium brine mineral resource is estimated at 364 Mton with a K_2SO_4 equivalent of 1.8 Mton. The equivalent compounds outlined in **Tables 5-8** through **5-11** are based on in-place brine tonnages and do not consider recovery factors related to the percentage of brine that can be extracted from the playa sediments, nor losses of potassium to other mineral precipitates prior to the brine arriving at the SOP production ponds.

Mineral equivalent compounds are calculated based on atomic weights of the constituent elements and their molecular ratios. Using potassium (K^+) to potassium sulfate (K_2SO_4) as an example, the calculation of mineral equivalent compounds is as follows:

Atomic weights:

- Potassium: 30.0983
- Sulfur: 32.065
- Oxygen: 15.9994
- Atomic weight K_2SO_4: [K_2 (78.1966) + S (32.065) + O_4 (63.9976)] = K_2SO_4 (174.2592)
- Atomic weight based on one K molecule: ½ (K_2SO_4) = 87.1296
- Ratio K_2SO_4 to K: (87.1296/30.0983) = **2.228475**

Therefore, the in-place mineral equivalent K_2SO_4 contained in the total measured plus indicated brine is calculated as:

Total In-place K (15.506 Mt) * Ratio (2.228475) = Total In-place K_2SO_4 (34.554 Mt)

The measured plus indicated mineral resources of available potassium brine tons has increased from the 6,273 Mton reported in the Company's PFS (CH2M 2013b) for the Project (November 2013) to 6,777 Mton (as outlined in **Tables 5-8** through **5-11,** effective date June 30, 2017, a difference of 504 Mton or 3%). The inferred mineral resources of available potassium brine tons have decreased from 525 Mton, reported in the PFS (CH2M 2013b), to 364 Mton, a difference of 161 Mton or 31%. The material change in the mineral resource estimates from the PFS estimates to the current FS estimates is due to the drilling of 12 strategically placed exploration holes on the playa during the 2015 drilling campaign. Other, though less considerable, impacts on the mineral resource estimates between the PFS (CH2M 2013b) and NI 43-101 Technical Report (CPM 2018a) include the following:

- Changes in modeling setup from 3D block model to GSM
- Modification in porosity calculation formula to account for precipitated salts
- Brine SG adjustments to reflect major ion concentration trends

Table 5-8. Federal Lease In-Place Potassium and Major Ion Mineral Resources

Horizon	Classification	Thickness (m)	Aquifer Volume ('000 m³)	Moisture Content (%)	Porosity (%)	Brine Volume ('000 m³)	Brine Density (g/cc)	Brine Tons ('000 ton)	Potassium		Sulfate		Chloride		Sodium		Magnesium	
									Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)
FCZ	Measured	3.9	1,343,708	48.9	59.9	804,756	1.12	996,188	3,117	2,765	23,410	20,766	117,805	104,504	76,865	68,187	3,849	3,415
	Indicated	3.8	37,830	43.9	57.3	21,662	1.12	26,848	3,259	78	20,137	481	119,612	2,856	77,701	1,855	4,091	98
	Measured plus indicated	3.9	1,381,538	48.8	59.8	826,418	1.12	1,023,036	3,120	2,843	23,324	21,247	117,853	107,361	76,887	70,042	3,856	3,512
	Inferred	3.7	6,669	41.8	56.1	3,739	1.13	4,639	3,399	14	18,655	77	120,670	497	78,393	323	4,390	18
MCZ	Measured	5.4	1,792,273	42.9	56.7	1,016,111	1.12	1,256,455	3,070	3,439	23,298	26,096	116,844	130,873	76,102	85,239	3,812	4,270
	Indicated	4.3	41,165	39.4	54.5	22,453	1.12	27,702	3,181	78	20,016	495	114,742	2,840	74,561	1,845	3,951	98
	Measured plus indicated	5.3	1,833,438	42.9	56.6	1,038,563	1.12	1,284,157	3,073	3,517	23,228	26,591	116,798	133,712	76,069	87,085	3,815	4,367
	Inferred	4.0	7,171	38.3	53.8	3,859	1.12	4,765	3,379	14	17,809	76	115,868	493	75,019	320	4,306	19
SCZ	Measured	14.9	4,141,824	41.5	55.8	2,309,577	1.11	2,832,976	2,777	7,070	20,526	52,257	108,014	274,989	70,482	179,437	3,445	8,771
	Indicated	15.1	855,391	44.1	57.0	487,997	1.10	590,830	2,285	1,229	18,563	9,986	93,716	50,412	61,470	33,066	2,877	1,548
	Measured plus indicated	15.0	4,997,214	42.0	56.0	2,797,574	1.11	3,423,807	2,692	8,299	20,188	62,243	105,546	325,401	68,927	212,503	3,347	10,318
	Inferred	10.7	21,204	35.5	51.9	10,997	1.11	13,464	3,107	37	17,379	211	106,460	1,291	69,177	839	3,932	47
Total	Measured	10.5	7,277,805	43.2	56.8	4,130,443	1.12	5,085,620	2,916	13,273	21,776	99,120	112,113	510,366	73,121	332,862	3,615	16,455
	Indicated	14.2	934,386	43.9	56.9	532,112	1.10	645,380	2,364	1,386	18,691	10,961	95,696	56,108	62,707	36,768	2,973	1,743
	Measured plus indicated	11.0	8,212,190	43.3	56.8	4,662,555	1.12	5,731,000	2,854	14,659	21,429	110,081	110,265	566,474	71,948	369,630	3,543	18,198
	Inferred	8.0	35,044	37.3	53.1	18,596	1.12	22,867	3,223	66	17,728	364	111,303	2,281	72,264	1,480	4,103	84

Table 5-9. State Lease In-Place Potassium and Major Ion Mineral Resources

Horizon	Classification	Thickness (m)	Aquifer Volume ('000 m³)	Moisture Content (%)	Porosity (%)	Brine Volume ('000 m³)	Brine Density (g/cc)	Brine Tons ('000 ton)	Potassium		Sulfate		Chloride		Sodium		Magnesium	
									Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)
FCZ	Measured	3.7	57,781	43.9	57.2	33,027	1.12	40,647	3,347	122	17,044	621	112,142	4,083	72,812	2,651	4,212	153
	Indicated	3.6	3,805	41.9	56.2	2,139	1.13	2,664	3,654	9	18,426	43	125,324	295	81,456	192	4,507	11
	Measured plus indicated	3.7	61,586	43.8	57.1	35,166	1.12	43,312	3,366	130	17,129	664	112,953	4,378	73,343	2,843	4,230	164
	Inferred	0.0	0	0.0	0.0	0	0.00	0	0	0	0	0	0	0	0	0	0	0
MCZ	Measured	5.3	81,035	39.6	54.7	44,297	1.12	54,604	3,216	157	17,502	854	114,037	5,568	73,928	3,610	4,060	198
	Indicated	3.1	3,287	37.9	53.7	1,765	1.13	2,192	3,547	7	17,967	35	122,079	238	79,103	154	4,333	9
	Measured plus indicated	5.2	84,322	39.5	54.6	46,062	1.12	56,797	3,229	164	17,520	890	114,347	5,806	74,127	3,763	4,071	207
	Inferred	0.0	0	0.0	0.0	0	0.00	0	0	0	0	0	0	0	0	0	0	0
SCZ	Measured	9.7	123,576	38.1	53.7	66,306	1.11	81,456	3,102	227	16,935	1,238	110,772	8,096	71,545	5,229	3,927	287
	Indicated	11.2	13,296	32.7	50.0	6,644	1.12	8,220	3,405	25	17,827	130	118,135	865	76,468	560	4,153	31
	Measured plus indicated	9.9	136,873	37.6	53.3	72,950	1.12	89,676	3,129	251	17,017	1,368	111,447	8,962	71,997	5,789	3,947	317
	Inferred	0.0	0	0.0	0.0	0	0.00	0	0	0	0	0	0	0	0	0	0	0
Total	Measured	7.0	262,392	39.8	54.7	143,630	1.12	176,707	3,193	506	17,135	2,713	112,096	17,747	72,573	11,489	4,034	638
	Indicated	8.5	20,389	35.3	51.7	10,548	1.12	13,077	3,480	41	17,972	209	120,261	1,398	77,926	906	4,255	50
	Measured plus indicated	7.1	282,781	39.5	54.5	154,178	1.12	189,785	3,213	546	17,193	2,922	112,659	19,145	72,942	12,395	4,049	688
	Inferred	0.0	0	0.0	0.0	0	0.00	0	0	0	0	0	0	0	0	0	0	0

Table 5-10. LUMA Lease In-Place Potassium and Major Ion Mineral Resources

Horizon	Classification	Thickness (m)	Aquifer Volume (‘000 m³)	Moisture Content (%)	Porosity (%)	Brine Volume (‘000 m³)	Brine Density (g/cc)	Brine Tons (‘000 ton)	Potassium		Sulfate		Chloride		Sodium		Magnesium	
									Concen. (mg/L)	Tons (‘000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)
FCZ	Measured	3.6	80,972	42.0	56.0	45,383	1.11	55,726	2,570	129	21,288	1,065	109,612	5,484	71,207	3,563	3,939	197
	Indicated	3.7	121,562	40.7	55.2	67,144	1.11	82,368	2,535	187	21,461	1,588	108,590	8,037	70,545	5,222	3,886	288
	Measured plus indicated	3.7	202,534	41.2	55.6	112,526	1.11	138,093	2,549	316	21,391	2,653	109,003	13,521	70,812	8,783	3,907	485
	Inferred	3.7	91,623	41.3	55.6	50,972	1.11	62,578	2,521	141	21,390	1,202	109,476	6,151	71,093	3,995	3,899	219
MCZ	Measured	6.1	134,338	37.2	53.0	71,263	1.11	87,475	2,517	197	20,666	1,624	109,263	8,583	70,979	5,575	3,957	311
	Indicated	6.1	201,263	37.1	53.0	106,604	1.11	130,752	2,495	293	20,897	2,456	108,377	12,735	70,406	8,274	3,900	459
	Measured plus indicated	6.1	335,600	37.2	53.0	177,867	1.11	218,227	2,504	491	20,804	4,079	108,732	21,319	70,635	13,849	3,923	769
	Inferred	6.1	153,057	37.3	53.1	81,246	1.11	99,761	2,506	225	20,901	1,872	109,560	9,812	71,151	6,372	3,904	349
SCZ	Measured	12.3	308,757	36.5	52.3	161,479	1.09	194,456	2,372	422	17,139	3,051	88,949	15,832	57,789	10,287	3,093	551
	Indicated	13.8	480,400	37.1	52.7	253,197	1.10	305,851	2,357	658	18,002	5,024	92,269	25,752	59,897	16,718	3,286	917
	Measured plus indicated	13.2	789,157	36.9	52.5	414,676	1.09	500,308	2,363	1,080	17,667	8,076	90,979	41,586	59,078	27,003	3,211	1,468
	Inferred	14.7	281,410	36.3	52.3	147,040	1.10	178,159	2,344	380	18,831	3,052	95,586	15,493	61,995	10,049	3,512	569
Total	Measured	9.3	524,066	37.5	53.1	278,125	1.10	337,657	2,442	748	18,737	5,739	97,622	29,899	63,420	19,424	3,457	1,058
	Indicated	10.3	803,225	37.6	53.2	426,945	1.10	518,971	2,420	1,139	19,280	9,069	98,918	46,525	64,235	30,212	3,536	1,663
	Measured plus indicated	9.9	1,327,291	37.6	53.1	705,070	1.10	856,627	2,429	1,887	19,066	14,807	98,407	76,424	63,914	49,636	3,505	2,722
	Inferred	10.3	526,090	37.5	53.1	279,258	1.11	340,498	2,424	746	19,908	6,126	102,233	31,456	66,349	20,415	3,698	1,138

Table 5-11. Total In-Place Potassium and Major Ion Mineral Resources

Horizon	Classification	Thickness (m)	Aquifer Volume (‘000 m³)	Moisture Content (%)	Porosity (%)	Brine Volume (‘000 m³)	Brine Density (g/cc)	Brine Tons (‘000 ton)	Potassium		Sulfate		Chloride		Sodium		Magnesium	
									Concen. (mg/L)	Tons (‘000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)	Concen. (mg/L)	Tons ('000 ton)
FCZ	Measured	3.9	1,482,461	48.4	59.6	883,166	1.12	1,092,561	3,097	3,015	23,065	22,452	117,177	114,070	76,426	74,399	3,867	3,765
	Indicated	3.7	163,197	41.4	55.7	90,944	1.12	111,880	2,735	274	21,071	2,113	111,634	11,188	72,522	7,269	3,950	396
	Measured plus indicated	3.9	1,645,658	47.7	59.2	974,110	1.12	1,204,441	3,064	3,289	22,899	24,565	116,700	125,259	76,077	81,668	3,875	4,161
	Inferred	3.7	98,292	41.3	55.7	54,712	1.11	67,217	2,581	155	21,201	1,279	110,249	6,648	71,597	4,318	3,933	237
MCZ	Measured	5.4	2,007,646	42.4	56.4	1,131,670	1.12	1,398,534	3,041	3,793	22,907	28,574	116,260	145,024	75,697	94,425	3,831	4,780
	Indicated	5.7	245,715	37.5	53.2	130,822	1.11	160,646	2,628	379	20,705	2,986	109,662	15,813	71,241	10,272	3,915	564
	Measured plus indicated	5.4	2,253,361	41.9	56.0	1,262,493	1.12	1,559,180	2,999	4,172	22,707	31,560	115,636	160,837	75,258	104,697	3,839	5,344
	Inferred	6.0	160,228	37.3	53.1	85,106	1.11	104,527	2,545	239	20,760	1,948	109,848	10,305	71,327	6,691	3,922	368
SCZ	Measured	14.6	4,574,157	41.1	55.5	2,537,362	1.11	3,108,889	2,760	7,718	20,220	56,546	106,894	298,918	69,716	194,952	3,436	9,609
	Indicated	14.6	1,349,087	41.5	55.4	747,838	1.10	904,902	2,319	1,911	18,367	15,140	93,449	77,029	61,075	50,344	3,027	2,495
	Measured plus indicated	14.6	5,923,244	41.2	55.5	3,285,200	1.11	4,013,791	2,661	9,631	19,852	71,687	104,054	375,948	67,945	245,296	3,352	12,103
	Inferred	14.4	302,614	36.3	52.2	158,037	1.10	191,622	2,397	418	18,729	3,263	96,350	16,784	62,499	10,886	3,541	617
Total	Measured	10.4	8,064,263	42.8	56.4	4,552,198	1.12	5,599,984	2,896	14,527	21,446	107,572	111,239	558,012	72,518	363,777	3,619	18,153
	Indicated	12.3	1,758,000	40.9	55.2	969,605	1.10	1,177,428	2,401	2,565	18,943	20,238	97,389	104,032	63,550	67,886	3,235	3,456
	Measured plus indicated	10.7	9,822,263	42.4	56.2	5,521,803	1.11	6,777,412	2,810	17,092	21,071	127,811	109,046	662,044	71,109	431,662	3,558	21,607
	Inferred	10.1	561,134	37.5	53.1	297,854	1.11	363,367	2,474	812	19,771	6,489	102,804	33,737	66,722	21,896	3,723	1,222

The accuracy of mineral resource and reserve estimates is, in part, a function of the quality and quantity of available data as well as of engineering, geological interpretation, and judgment. Given the data available as of June 30, 2017, when this brine mineral resource estimate was prepared, the estimates presented herein are considered reasonable. However, they should be accepted with the understanding that additional data and analysis made available subsequent to the date of the estimates may necessitate revisions that could be material. There is no guarantee that all or any part of the estimated mineral resources would be recoverable. Mineral resources that are not mineral reserves do not have demonstrated economic viability.

5.5 Mineral Reserve Statement

Available reserves are defined as the quantities of potassium contained in brine that is technically extractable from the playa and delivered to the first solar evaporation pond. These values were calculated using the numerical model outputs from mining plan simulations and categorized by level of assurance into Proven and Probable Mineral Reserves.

Proven Mineral Reserves from trench production in the MCZ were calculated as the K^+ tonnage contained in the mobile porosity within the MCZ over the area encompassing Measured Mineral Resource over all Brine Mining Units (BMU). Probable Mineral Reserves in the MCZ are the remaining MCZ production from the mining plan simulation, which consist of production from the mobile porosity over the Indicated Mineral Resource area and production due to the mass transfer process. Proven and Probable Mineral Reserves in the MCZ are estimated to be 475,351 and 2,061,668 K^+ tons, respectively.

Proven Mineral Reserves of K^+, in the SCZ, were determined from the volume of the sand and gravel units in the SCZ area, encompassing a 656-foot buffer around the mining plan production wells in the Measured Mineral Resource area multiplied by a sand and gravel specific yield of 22.8%. Two-dimensional grid estimates of the sand and gravel bed depth from surface and interval thickness were generated from the exploration drillhole records. Isopach maps and cross sections illustrating the distribution of these sand and gravel beds were generated for the purpose of the reserve estimates. The remaining production from the SCZ wells in the mining plan simulation is assigned to the Probable Mineral Reserves category. Probable Mineral Reserves in the SCZ includes primary production from the area of Indicated Mineral Resource, production from the non-sand and gravel fraction of this unit, vertical leakage of brine from the lower MCZ, and mass transfer of K^+ from the immobile porosity. Proven and Probable Mineral Reserves in the SCZ are estimated to be 43,529 and 912,120 K^+ tons, respectively.

K^+ tons produced from the FCZ are assigned to the Probable Reserves category. Simulated production in the FCZ is primarily from the initial trench excavation and from some mass transfer at the FCZ and MCZ interface. Probable Mineral Reserves in the MCZ are estimated to be 332,894 K^+ tons.

Proven and Probable Mineral Reserves of K^+ and equivalent K_2SO_4 in tons are summarized in **Table 5-12**, *Available Potassium Mineral Reserves*, and **Table 5-13,** *Total Mineral Reserve Potassium Sulfate*.

Table 5-12. Available Potassium Mineral Reserves

Aquifer	Proven (tons)		Probable (tons)	
	K^+	Equivalent K_2SO_4	K^+	Equivalent K_2SO_4
FCZ	0	0	332,894	741,855
MCZ	475,351	1,059,320	2,061,668	4,595,428
SCZ	43,529	97,003	912,120	2,032,660
Total	**518,880**	**1,156,323**	**3,306,682**	**7,369,943**

Note: K^+ to K_2SO_4 production based on ratio of 2.2285 (rounded), which is based on atomic weights.

The target brine grade of 2,124 mg/L is forecast to be maintained for approximately 20 years of playa production. Following that period, the dilutive impacts of fresh water due to recharge would cause the run-of-mine grade delivered from the playa into the preconcentration ponds to decay. It is anticipated that the grade would decline by approximately 5% per year for the remaining period. The expected decline has been accounted for in the pond and process design and projected pond and process efficiencies by Novopro and is accounted for in these estimated Available Potassium Mineral Reserves.

Norwest Corporation used a process recovery factor, provided in the NI 43-101 Technical Report (CPM 2018a), of 79.79% to convert from Available Mineral Reserves to Produced Mineral Reserves. The process recovery factor accounts for leakage losses, process efficiency, evaporation, and entrainment, and is described in detail in Section 7.0, *Recovery Methods*. Produced Mineral Reserves are estimated to be approximately 6.8 Mtons.

Table 5-13. Total Mineral Reserve Potassium Sulfate

Category	Proven (tons)	Probable (tons)	Total (tons)
Available reserves	1,156,323	7,368,942	8,525,265
Produced reserves*	922,630	5,879,679	6,802,309

* Produced reserves based on overall recovery factor of 79.79% (CPM 2018a).

Remaining in-place mineral resources after the 30-year mining plan simulation are summarized in **Table 5-14**, *Remaining In-Place Mineral Resource*. Remaining in-place measured plus indicated mineral resources were determined by subtracting the total reserves from the in-place measured plus indicated mineral resources. Remaining inferred mineral resource is the initial in-place inferred mineral resource.

Table 5-14. Remaining In-Place Mineral Resource

Aquifer	Measured Plus Indicated		Inferred	
	K^+ (tons '000)	Equivalent K_2SO_4 (tons '000)	K^+ (tons '000)	Equivalent K_2SO_4 (tons '000)
Fat Clay	2,956	6,588	157	349
Marl Clay	1,635	3,644	240	535
Siliceous Clay	8,675	19,333	415	925
Total	**13,267**	**29,565**	**812**	**1,810**

Notes: K^+ to K_2SO_4 conversion based on ratio of 2.2285 (rounded) based on atomic weights.
Effective Date January 11, 2018

5.6 Summary and Conclusions

Numerical groundwater flow and transport models have been developed that integrate hydrogeological information collected over the last several years to improve the understanding of the groundwater flow and transport components of the conceptual model of the playa aquifer system. This integrated groundwater flow and transport model provided a numerical framework to support the development of the mining plan. The mining plan consists of a conceptual design layout and sequencing of MCZ trenches and SCZ extraction wells that may be required to achieve SOP-production targets during a 30-year mine life.

The forecast simulations indicate that the proposed mining plan, with the noted configuration and modeling assumptions, could potentially meet the brine-extraction targets for approximately two-thirds of the 30-year mine life. According to the model, the Project requires operation of 733 miles of recharge and extraction trenches and canals and 2,366 extraction wells at full build-out. Modeling indicates that there is a decrease in annual average K^+ concentration due to dilution of the mobile-phase brine as freshwater is recharged into the MCZ.

The accuracy of mineral resource and reserve estimates is, in part, a function of the quality and quantity of available data and of engineering and geological interpretation and judgment. Elements of the study that form the basis of the mineral reserve estimation consists of sampling and analytical methodology, the hydro-stratigraphic model construction and understanding of brine and sediment properties and variability, and the construction and calibration of the integrated groundwater flow and mass transport numerical models. These tasks were performed in succession, with standard validation and calibration exercises performed throughout each stage, culminating in the integrated numerical models from which the mineral reserve estimations have been sourced. This has led to a reasonable level of confidence that the Sevier Playa would be able to produce the quantities and grade of brine presented as Proven and Probable Mineral Reserves in this report.

Given the data available at the time this report was prepared, the estimates presented herein are considered reasonable. However, they should be accepted with the understanding that additional data and analysis available subsequent to the date of the estimates may necessitate revision. These revisions may be material.

6 Mining Methods, Project Development, and Operation

6.1 Mine Method Overview

The Project mining methods are comparable to other solar evaporation potash projects in the western United States. The mining method for the production of SOP would include the collection of naturally occurring brine from the sedimentary basin of the Sevier Playa. The method would use extraction trenches and wells to collect and divert brine into a series of solar evaporation and concentration ponds located on the surface of the playa resulting in a potassium-rich salts. Recharge water would be introduced to facilitate the transference of brines into the extraction trenches.

Based on groundwater modeling simulations, the playa has been divided into mining units called BMUs. BMUs were established to meet production targets given variances in permeability of resource zones across the playa. The BMUs would be operated to ensure that adequate brine volume at the necessary brine concentration would be supplied to the evaporation ponds for the life of the Project.

After the extraction and recharge systems are constructed, there would be an initial brine accumulation and transfer to the evaporation ponds. After this, the BMUs would continue to produce until brine concentrations were no longer economically viable. Recharge water would then be introduced and the BMUs would essentially rest until brine concentrations recovered, after which the brine would again be transferred to ponds. This process would occur throughout the life of the Project.

Brine would be pumped into the preconcentration and production ponds. The ponds are staged in series to allow the playa brine to concentrate from the in-situ grade various evaporative mineral saturation points depending on where in the evaporation process the pond is located. During this process, salts would precipitate within the footprint of the ponds.

The potassium-rich salts harvested from the production ponds would be hauled to the Processing Facility for final treatment. Purge brine decanted pre-harvest from the final production ponds would be pumped into the Purge Brine Storage Pond. Process tailings would be placed in the Tailings Storage Area.

Recharge of the brine aquifer would occur by way of precipitation, groundwater, local runoff, and inflow from the Sevier River. Recharge would be managed and conveyed to specific areas of the playa through the use of recharge canals and trenches to maintain flow as brine is continually extracted.

A general flow diagram depicting the mining process is included in **Figure 6-1**.

Construction aggregate, including structural fill (screened earthen material used to create a strong and stable base), granular road base, gravel, riprap, and other materials, would be obtained from three gravel pits. Additional aggregate materials, including railroad ballast and sub-ballast would be obtained from a commercial quarry. Two of the gravel pits (the Playa Federal Pit and the Playa SITLA Pit) would be located on Peak's leases. The third pit, referred to as the Pass Federal Pit, would be located on BLM land adjacent to the existing West Sevier Free Use Pit on Crystal Peak Road. The Playa Federal Pit would not require a mineral material contract. The gravel pits are described in *Gravel Pit Mining Plan* (CPM 2018i).

6.2 Mine Layout and Design

In general, the mine design consists of the following major components:

1) A brine extraction system consisting of the following:
   a. Extraction trenches
   b. Extraction canal
   c. Extraction wells
2) A recharge system consisting of the following:
   a. Diversion berm
   b. Diversion canal
   c. Recharge canals
   d. Recharge collectors
   e. Recharge trenches
3) Brine Mining Units
4) Evaporation ponds consisting of the following:
   a. 10 preconcentration ponds
   b. Four ponds, each divided into 4 cells for a total of 16 cells
5) Control Structure, Pipes, and Pumps
6) A Processing Facility
7) A Waste Product Storage Area consisting of the following:
   a. Purge Brine Storage Pond
   b. Tailings Storage Area

Each of these project components is shown in **Figure 6-2**.

The extraction and recharge systems would be composed of trenches and canals designed to extract brine at approximately 30,000 gpm. The extraction system would include an extraction canal that would be fed by lateral extraction trenches. A diversion berm and canal would divert water from the Sevier River that would feed recharge trenches. The recharge trench system would provide means by which water would be introduced into the system to maintain continuous brine extraction over time.

To better understand the operation of the extraction and recharge trenches, the playa area has been divided into BMUs, as shown in **Figure 6-2**. Each BMU consists of portions of the extraction and recharge systems. The BMUs would be operated in series and in parallel to ensure that an adequate volume of brine at the target concentration is supplied to the preconcentration ponds. There is a total of 21 BMUs located throughout the playa: BMU1 through BMU11; and BMU13 through BMU22.

Preconcentration ponds would be located in the northern portion of the Sevier Playa with the production ponds located in the southern portion (see **Figure 6-2**). Extracted brine would be pumped to a series of preconcentration ponds and then into a series of production ponds. Potash salts would be precipitated in production ponds where they would be harvested and processed in the Processing Facility to produce a saleable product. Waste products created within the production ponds and Processing Facility would be transferred and stored in the Waste Product Storage Area. The Waste Product Storage Area, consisting of

the Purge Brine Storage Pond and Tailings Storage Area, would be located in the southern portion of the playa, adjacent to the production ponds.

Supplemental analysis in support of the following mine design concepts is provided in several reports and technical memorandums (CH2M 2013b; CPM 2018a; IGES 2013). These documents are included in Appendix B. Summaries of modeling analysis are provided in Section 6.2.4, *Modeling to Support Extraction and Recharge Systems*, and Section 6.2.5.5, *Modeling in Support of Evaporation Pond Design*.

6.2.1 Extraction System

6.2.1.1 Extraction Trenches

Brine from the MCZ would be collected via extraction trenches that allow for gravity drainage of the brine to the trenches. Extraction trenches would be excavated throughout the playa, generally running east-west across the playa (or north-south in some areas). These trenches would drain into the extraction canal from which brine would be pumped into the preconcentration ponds. Extraction trenches would begin approximately 550 feet to 22,000 feet from the edge of the playa or lease boundaries (where the lease boundaries fall within the playa boundary) and terminate at the junction of the extraction canal. In accordance with federal regulations, extraction trenches would not be constructed within 500 feet of the lease boundary without written authorization from the Authorized Officer (AO). Extraction trenches would be spaced throughout the playa, varying from 900 to 4,900 feet apart, with recharge trenches midway between them. Extraction trenches would be approximately 20 feet deep. The side walls of the trenches would be vertical, separated by benches, with a top width of 32 feet and bottom width of 8 feet. Spoils from the extraction trenches would be placed on the playa surface at a 2H:1V (horizontal to vertical) slope a minimum of 10 feet from the edge of the trench and would measure approximately 10 feet in height and 38 feet in width at the base. A profile drawing of a typical extraction trench is shown in **Figure 6-3**.

The total extraction trenches excavated for the life of the Project includes a total length of approximately 306.2 miles, as shown in **Figure 6-2** and detailed in **Table 6-1**, *Extraction System – Lengths and Excavation Quantities during Life of the Project.*

6.2.1.2 Extraction Canal

Brine from the extraction trenches would be discharged into a main north-south-trending extraction canal located near the middle of the playa. The extraction canal would convey the brine by gravity flow to a pump station located on the north end of the playa and adjacent to the northern end of the preconcentration ponds. With a planned depth of 20 feet, the extraction canal would be constructed similar to the extraction trenches. The side walls of the canal would be vertical, separated by benches, with a top width of 32 feet and a bottom width of 8 feet. Spoils from the extraction canal would be placed on the playa surface at a 2H:1V slope, a minimum of 10 feet from the edge of the canal, and would measure approximately 10 feet in height and 38 feet in width at the base (see **Figure 6-3**).

The extraction trenches and canal would be one of the first mining features constructed in order to provide brine to the pond system and begin evaporation as soon as possible. Construction of the recharge systems would follow.

Table 6-1. Extraction System – Lengths and Excavation Quantities during Life of the Project

Feature	Number	Approximate Length (miles)	Typical Average Excavated Volume (lcy)
Extraction trenches	159	306.2	23,186,616
Extraction canal	1	25.5	1,934,045

Note: lcy = loose cubic yards

6.2.1.3 Extraction Wells

Extraction wells equipped with pumps would be used to extract brine from the lower portions of the MCZ and the SCZ. Pumps would operate continuously during the production period of the well. Pumping rates would be determined on a well by well basis using drawdown to 80% as the main criteria. These wells would be equipped with piping that would drain extracted brine into the nearest extraction trench. Extraction wells would be drilled throughout the playa in rows that are approximately 400 to 2,600 feet apart and at an approximate distance of between 130 feet and 1,300 feet from the extraction trenches. A typical drawing of the layout of the extraction wells and piping in relation to the extraction and recharge trenches is shown in **Figure 6-4**. Wells located north of the preconcentration ponds would be connected via a manifold piping system that would be discharged into the extraction canal. Other wells that are some distance from the extraction trench would also be connected to a manifold system that is piped to the nearest extraction trench.

The average flow rate per well has been determined to be approximately 5.2 gpm, based on groundwater flow modeling. Flows range from 0.3 gpm to 18.5 gpm depending on the hydraulic conductivity of the SCZ sediments. Based on the flow modeling, over the life of the Project, 2,366 6-inch-diameter wells would be required to provide supplemental brine flow to the preconcentration ponds. The average depth of wells would be approximately 77 feet. However, well depths may vary from 61 to 111 feet based on the depth of the brine resource. The wells would be screened from the bottom of the SCZ to the lower 10 feet of the MCZ, typically an interval of about 50 feet. A cross section of a typical extraction well and associated features is shown in **Figure 6-5**.

Power would be supplied to the extraction wells by solar panels. Each extraction well would be equipped with a solar power system sufficient to operate the pump at the necessary capacity. The solar power system would be composed of common components typically used to power agricultural and industrial wells. For each extraction pump, a typical installation would include solar panels, mounting brackets, integrated wiring, control and voltage regulation, and a battery storage component. The size and number of panels would vary depending on the requirements of the pump. Solar panel sizes would vary from 65 to 154 inches wide by 80 inches high. Each panel would be connected to a metal pole extending approximately 8 feet above ground and be buried about 4 feet bgs. There would be two poles and two solar panels, situated approximately 8 feet apart, at each extraction well. Wiring would connect each panel to batteries. The lead-acid batteries would be contained in a steel lockbox. Depending on the amount of batteries, the box size could vary in size from approximately 2 × 2 × 2 feet to approximately 4 × 4 × 2 feet. The box would be posted to the metal post that holds the solar panels. The steel box would provide containment necessary to prevent potential leakage in the event the battery was damaged. Wiring from the batteries would continue down the well to the pump. A typical solar system connection to an extraction well is shown in **Figure 6-6**.

6.2.2 Recharge System

As indicated in Section 3.3, *Hydrogeology*, the clays and fine-grained sediments have hydraulic conductivities ranging from 0.08 to 120 ft/day. The higher values are representative of the fine-grained silts and gravel lenses while the lower values are representative of the clays and fine silts. Since the majority of playa sediments are composed of clays and silts, brine seeps slowly through them. Thus, hydraulic head is required to maintain a reasonable extraction rate. Water that flows into the basin from the Sevier River, rainfall, and from the surrounding mountain ranges provides hydraulic head and is referred to in aggregate as "recharge water." Recharge of the brine aquifer is necessary to ensure that enough brine is available over the life of the mine to maintain target extraction rates.

6.2.2.1 Sevier River Drop Structure

The Sevier River Drop Structure would be located on the main flow path for the lower segment of the Sevier River approximately 2,500 feet upstream of the Sevier River Diversion Berm and Canal. The Sevier River Drop Structure would control an existing head cut that has developed within the Sevier River channel and is progressing upstream. The northing and easting of the head cut was recorded in the field during a site visit and is approximately at 4329279.7N, 327155.8E (UTM NAD 83 Zone 12). This structure would be located on-lease, as shown in **Figure 6-7**.

Access to the Sevier River Drop Structure would be along an existing two-track road and then via overland travel (both approximately 15 feet wide), which would be completely on-lease. This access would not require any road construction but would entail equipment and vehicles driving over the surface.

The Sevier River Drop Structure would be excavated into the head cut, where the upstream edge of the structure would follow the natural channel and ground surface. The lower end of the structure would blend into the downstream channel and would ensure that the water flow releases water in a controlled fashion. The Sevier River Drop Structure would generally be approximately 2 to 3 feet in height. The width of the structure would be approximately 200 to 300 feet, with wing-walls extending to between 150 and 250 feet out from the drop area to collect the drainage. The Sevier River Drop Structure would consist of gabions and reno mattress segments, which are wire baskets filled with coarse rock fragments that provide stability to the channel. The reno mattress segments would be placed along the base of the structure while the gabion baskets would be constructed on top of the upstream portion of the mattresses. The wire baskets would be prefabricated and hauled to site. Rock fragments would be hauled to site and placed into the baskets. As each layer of mattress and baskets is placed, coarse aggregate backfill would be placed against the gabions. This coarse aggregate would be minus 3 to ¼ inch gravel with native materials covering this fill. The wing-walls would consist of gabions laid end-to-end on the natural ground. Along the upstream side of the wing-wall gabions, natural materials would be pushed to create a 3H:1V slope that would direct the runoff toward the central portion of the Sevier River Drop Structure. A typical drawing depicting the Sevier River Drop Structure is included in **Figure 6-8**.

6.2.2.2 Sevier River Diversion Berm and Canal

To manage and control recharge of the brine aquifer, natural and acquired flows from the Sevier River would be directed by a diversion berm into a new canal near the location where the river enters the Sevier Playa, as shown in **Figure 6-7**. The intent of this diversion berm is not to impound water within the Sevier River floodplain but to redirect river water into the proposed diversion canal. As such the berm is angled to divert stream flow into the diversion canal to minimize backwater. The backwater

minimization would be achieved by the diversion canal having a flow capacity greater than the natural channel. Therefore, the diversion canal would direct and convey flow arriving via the Sevier River, toward the recharge canal surrounding the playa, and then to the recharge trenches distributed throughout the playa (CH2M 2017a). The diversion canal would have the same or steeper slope than the natural drainage channel. Thus, based on the canal bottom width of 20 feet and side slopes of 3.5H:1V, compared to the natural channel width of 15 feet and side slopes of 1.5H:1V, the flow capacity of the diversion canal would be greater than the natural channel. Further, the flow depth within the diversion canal would be equal to or less than the flow depth in natural channel. Under larger than design flows, there may be some backwater due to turbulence. However, such turbulence and backwater would also occur within the natural channel. Additionally, the effect of such backwater would not extend more than 1500 feet upstream to the planned drop structure.

The diversion structure would include construction of a low, earth-filled diversion berm located across the existing river channel from top of flow zone within the channel on both side at the edge of the Sevier Playa and immediately downstream of the diversion point, as shown in **Figures 6-7** and **6-9**. The diversion berm would be designed to accommodate flow rates up to 213 cubic feet per second (cfs). Flows exceeding 213 cfs would be conveyed either over the diversion berm and onto the playa and/or down the diversion canal. As discussed above, the diversion canal would have a higher flow capacity than the natural channel, therefore, additional flow can be conveyed within the canal. CH2M (2017b) indicated that extreme events which could potentially overtop the berm could occur once every 30 to 50 years. If this occurred, extreme flood events would exceed the natural channel upstream of the playa and flood the surrounding areas and would increase the flow down the diversion canal. Under higher flows, the flows could discharge over the Sevier River diversion berm and spread out over the northern portion of the Sevier Playa. The risk of flooding was captured as a residual or “accepted” Project risk, as referenced in the NI 43-101 Technical Report (CPM 2018a). The berm would be constructed to minimize impoundment of water within the Sevier River channel and would only direct river water into the diversion canal. The diversion canal would be constructed with a slope equal to or greater than the natural channel. Therefore, the potential for back water would not be expected.

The 213 cfs flow rate represents an arbitrary design flow rate based on the proposed height of the diversion berm. This design value is considerably more than expected project flows within the Sevier River channel. For the project flows, water will be released from Conks Dam, a diversion structure located approximately 22 miles upstream of the project Diversion Dam, operated by the local water users. The currently planned release flow of only 95.24 cfs (69,000 gpm) from Conks Dam is the estimate flow necessary to ensure that the required flow (30,000 gpm) reaches the playa after accounting for transmission losses (CH2M 2017b; SWCA 2017a). Transmission loss estimates were determined at multiple points along the channel to delineate variations in losses. Based on the loss estimates, the flow would decrease along the reach between Conks Dam and the playa. Therefore, the full release flow is not expected at the proposed diversion berm but represents a conservative design value. The planned flow would be conveyed within the historic channel between Conks Dam and the playa. Therefore, for normal flows for the reach below Conks Dam, the Diversion Dam have sufficient capacity to divert the flows and not overtop. Also, the diversion will not cause backwater effects within the upstream channel.

Based on aerial photograph evidence, the channel below Conks Dam has exhibited considerable migration in both the historic and geologic past as a result of various stream flows. There are a number of small reaches where historical channel adjustments were made on the upper portion of the channel. Where these adjustments were not maintained, the river has quickly started to adjust the channel shape and grade to balance energy within this segment of the river. As defined by Lane (1955), river function and hydraulics are driven by four main factors: discharge, stream slope, sediment grain size, and

sediment volume supply. As the natural channel is only used to convey water that would be flowing within the channel if not diverted for agricultural purposes, some natural movement of the channel due to both design and natural flow would likely occur. Such changes to the channel are to be expected just as they would in any channel. Such changes are anticipated to be minor and self-correcting. Unless the adjustment affected the ability of the river to deliver the required flow, CPM would not be involved in channel maintenance.

The Company does not plan any channel improvements beyond installing the Sevier River Drop Structure as discussed above and shown in **Figure 6-8**.

The diversion berm would be constructed to be about 312 feet long, with a minimum crest width of 10 feet, maximum height of 15 feet, 3.5H:1V side-slopes, and an approximate base width of 82 feet at the widest point, as shown in **Figure 6-9**. The base of the berm would be built on the existing river topography. No subsurface excavation is planned below the berm. The berm would be constructed with native materials from the playa or excavated materials from the diversion canal. Imported riprap would be used on the upstream and downstream slopes of the berm. The northing and easting of the center of the berm is approximately at 4328941.5N, 326815.9E (UTM NAD 83 Zone 12) (CH2M 2017a).

The generally straight diversion canal would be constructed to mimic the overall natural gradient of the existing river channel with the purpose of retaining natural flow rates and maximizing the amount of water available to recharge the brine aquifer. The slope along the full length of the canal bottom would be constructed to a 0.02% or steeper gradient to match the natural channel gradient and to limit maximum flow velocities to approximately 2.5 feet per second, which is the highest permissible water velocity for fine sand transporting colloidal silts (Fortier and Scobey 1926), and represents the flow in the lower Sevier River and the recharge canals. This would minimize erosion in the clay to fine sand soil without modifying upstream flow rates. The final slope may be adjusted during final design to ensure that the river upstream of the diversion point is not affected.

The diversion canal dimensions required to convey the design flow would be approximately 2,000 feet long and 20 feet wide at the bottom. Side-slopes would be 3.5H:1V. Depth of the canal would range between 6.5 and 20 feet, depending on the surrounding terrain and the need to maintain a constant gradual slope for the canal. The canal top width would vary from 46 to 125 feet, again depending on surrounding terrain (**Figure 6-10**). Based on site topography, sections of the diversion canal may be excavated through an area where the topography rises slightly. The diversion canal would be excavated to maintain a slope consistent with the existing river channel. The canal plan view and cross-sectional area are provided in **Figure 6-10**. Final design drawings would be provided to the BLM at a later date.

The diversion canal would be excavated from native materials and, if needed, native clay, sourced from the planned on-playa excavations, would be used to line portions of the canal to protect against seepage losses. Imported riprap would only be used for canal protection in areas where slope transitions result in erosive conditions.

A one-lane concrete box culvert, measuring approximately 8 feet wide × 4 feet high (minimum) and constructed at a 0.5% slope, would be placed in the diversion canal, at the location where the diversion canal is crossed by Perimeter Road. The culvert would be needed to convey the design flow and allow travel on the Perimeter Road over the diversion canal. The location of the culvert is approximately 4328606.9N, 326668.6E (UTM NAD 83 Zone 12) and is shown in **Figure 6-7** and as Feature C in **Figure 6-10**. The one-lane culvert would be constructed to span 16 feet of Perimeter Road to allow construction and operation equipment to cross the diversion canal (CH2M 2017a).

The diversion canal would empty into a sump, referred to as the Diversion Sump, from which the flow would be diverted into either the west recharge canal, east recharge canal, or both. The location of the Diversion Sump is shown in **Figure 6-7. Figure 6-11** includes a typical Diversion Sump detail. The Diversion Sump, measuring approximately 55 x 55 feet, would be excavated into natural materials below the surface grade of the playa. Excavated materials would be placed in berms adjacent to the sump and canal areas on top of the playa. To minimize flow gradient the Diversion Sump would not be built up or elevated above the playa. Head gates would be used to allow water to be discharged into either the west or east recharge canal or both canals simultaneously.

Construction and operation of the diversion canal and berm would be subject to a State Stream Alteration Permit approved by the Utah Division of Water Rights (UDWRi), in accordance with Utah Code 73-3-29.

6.2.2.3 Recharge Canals and Collectors

The Sevier River flow would be diverted from the diversion canal into the recharge canals. The recharge canals would be constructed around the outside perimeter of the playa to provide water to the recharge trenches. The recharge canals would consist of two canals: one that follows the western edge of the playa and one that follows the eastern edge of the playa. The canals along both edges of the playa would be constructed from the north to south, as needed, to provide water to the recharge trenches. In addition to conveying water from the Sevier River, the recharge canal would also capture any runoff entering the playa from the surrounding landscape.

The recharge canals would be trapezoidal in shape and have a bottom width ranging from 5 to 10 feet, with 3H:1V side-slopes. Depths would range from 5 to 7 feet, with a top width ranging from 35 to 52 feet. Spoils would be placed approximately 6 feet away from the canal, at slopes of 2H:1V. Spoils would measure 5 feet in height with a bottom width of 20 feet (see **Figure 6-3**).

Due to the topography on the south end of the playa, the east recharge canal would require two pump stations to lift water into the southeast portions of the playa (see **Figure 6-2**). The pump stations would each consist of one low-head pump. A typical pump station is shown in **Figure 6-12**. Pump stations would be required on the southeast portion of the east recharge canal to provide recharge water to the 5.9-mile-long section of the southeast recharge canal. The east recharge canal, approximately 28.5 miles in length, would start from the Diversion Sump at the end of the diversion canal and run south along the east perimeter of the playa where it would terminate at the southernmost recharge trench on the east side of the playa.

The west recharge canal would require two pump stations to lift water into the southwest portions of the playa (see **Figure 6-2**) due to topography issues similar to the east recharge canal. The pump stations would also both consist of one low-head pump as shown in **Figure 6-12**. The west recharge canal, approximately 40.3 miles in total length, would flow from the Diversion Sump at the end of the diversion canal and run west and then south along the west perimeter of the playa, where it would terminate at the southernmost recharge trench on the west side of the playa.

CPM would maintain a supply of parts, replacement motors, and pumps to ensure continued operations.

Total recharge canal lengths and excavated material are detailed in **Table 6-2**, *Recharge System – Lengths and Excavation Quantities for Life of the Project.* Additional details on pumps are included in Section 6.2.6, *Control Structures, Pipes, and Pumps*.

The majority of recharge trenches would be fed from recharge collectors that branch off of the east and west recharge canals. A profile of a typical turnout from the recharge canal to a recharge collector or

trench is presented in **Figure 6-13**. A ditch gate valve made out of galvanized steel (or similar material) with a buried pipe would be used to transfer the flow from the recharge canal to the recharge trench/collector. Recharge collectors essentially are ditches sized to convey the required recharge water to the recharge trench but have a different configuration that requires less material to be excavated. The recharge collectors would be trapezoidal in shape, have a bottom width of up to 5 feet, a depth of up to 5 feet, a maximum top width of 35 feet, and 3H:1V side-slopes. Spoils would be placed approximately 6 feet away from the collector at slopes of 2H:1V with a height of approximately 5 feet and a bottom width of approximately 20 feet (see **Figure 6-3**).

6.2.2.4 Recharge Trenches

Recharge trenches would run primarily east-to-west (some running north-south) across the playa, between and parallel with the extraction trenches. The recharge trenches would introduce water into the MCZ to maintain continuous brine extraction over time.

Recharge trenches would be constructed to a depth of 12 feet. The side walls of the recharge trenches would be vertical, separated by benches, and have a top width of 24 feet and a bottom width of 8 feet. Spoils from the recharge trenches would be placed on the playa surface at a minimum of 8 feet from the edge of the trench and would measure approximately 7 feet in height and 28 feet in width at the base (see **Figure 6-3**).

The total recharge trenches excavated for the life of the Project would be 276 miles, as shown in Figure 6-2 and detailed in Table 6-2.

Table 6-2. Recharge System – Lengths and Excavation Quantities for Life of the Project

Feature	Number of Features	Approximate Length (miles)	Typical Average Excavated Volume (lcy)
West recharge canal	1	40.3	1,282,149
East recharge canal	1	28.5	940,650
Recharge collectors	152	36	771,873
Recharge trenches	155	276.1	11,401,526
Diversion Berm	1	0.06 (312 feet)	*
Diversion Canal	1	0.38 (2,000 feet)	46,200*

Note: lcy = loose cubic yards

* Total excavated volume for the diversion canal is approximately 42,000 bcy. Of this, approximately 13,649 bcy would be used to construct the berm.

The freeboard on the recharge canals and trenches would allow some flood flow to discharge through the system. However, extreme flood events could discharge over the Sevier River diversion canal and spread out over the northern portion of the Sevier Playa. The risk of flooding was captured as a residual or “accepted” Project risk, as referenced in the NI 43-101 Technical Report (CPM 2018a).

6.2.3 Brine Mining Units

Each BMU consists of portions of the extraction and recharge systems (i.e., extraction trenches, recharge collectors, and recharge trenches). There are 21 BMUs: BMU1 through BMU11 and BMU13 through BMU22.

Each BMU would step through the various operational phases, as discussed in Section 6.6, *Mine Life and Operational Phases*. As the BMUs cycle through the phases, individual BMUs would be turned on or off to meet brine flow requirements. Extraction and recharge trench lengths and excavation volumes by BMU are presented in **Table 6-3**, *Extraction and Recharge Trenches Lengths and Excavation Volumes by BMU.*

Table 6-3. Extraction and Recharge Trenches Lengths and Excavation Spoil Volumes by BMU

BMU	Extraction Trench				Recharge Trench				Recharge Collectors			
	Quantity	Feet*	Miles*	Volume (lcy)*	Quantity	Feet*	Miles*	Volume (lcy)*	Quantity	Feet*	Miles*	Volume (lcy)*
BMU1	13	127,772	24.2	1,832,351	12	115,860	21.9	906,279	12	10,231	1.9	41,558
BMU2	14	79,439	15.0	1,139,212	14	78,416	14.9	613,385	14	9,408	1.8	38,214
BMU3	9	82,802	15.7	1,187,445	9	82,814	15.7	647,789	11	13,642	2.6	55,410
BMU4	12	153,727	29.1	2,204,555	12	149,082	28.2	1,166,149	12	13,371	2.5	54,312
BMU5	6	52,555	10.0	753,684	7	58,871	11.1	460,499	8	12,607	2.4	51,207
BMU6	6	35,974	6.8	515,891	6	30,153	5.7	235,861	3	8,244	1.6	33,485
BMU7	24	271,844	51.5	3,898,446	23	261,060	49.4	2,042,071	24	24,049	4.6	97,684
BMU8	10	89,705	17.0	1,286,440	9	79,603	15.1	622,676	6	3,281	0.6	13,327
BMU9	8	72,818	13.8	1,044,263	9	71,101	13.5	556,168	9	7,903	1.5	32,100
BMU10	4	12,877	2.4	184,669	5	11,901	2.3	93,093	5	1,047	0.2	4,251
BMU11	5	70,325	13.3	1,008,510	6	59,400	11.3	464,638	4	6,774	1.3	27,514
BMU13	12	90,787	17.2	1,301,956	10	52,708	10.0	412,297	13	18,922	3.6	76,858
BMU14	9	168,591	31.9	2,417,725	8	127,478	24.1	997,164	8	8,138	1.5	33,055
BMU15	4	28,965	5.5	415,378	4	22,826	4.3	178,551	3	5,939	1.1	24,123
BMU16	4	62,810	11.9	900,744	5	65,080	12.3	509,069	3	19,110	3.6	77,622
BMU17	3	22,662	4.3	324,983	2	17,875	3.4	139,824	3	4,916	0.9	19,967
BMU18	4	54,461	10.3	781,004	4	54,437	10.3	425,819	5	16,017	3.0	65,059
BMU19	3	20,662	3.9	296,313	2	16,511	3.1	129,153	2	976	0.2	3,965
BMU20	3	72,442	13.7	1,038,866	3	72,853	13.8	569,874	2	1,446	0.3	5,875
BMU21	3	21,885	4.1	313,852	2	12,560	2.4	98,244	2	600	0.1	2,436
BMU22	3	23,732	4.5	340,330	3	16,993	3.2	132,925	3	3,410	0.6	13,853
Total	**159**	**1,616,835**	**306.2**	**23,186,616**	**155**	**1,457,582**	**276.1**	**11,401,526**	**152**	**190,030**	**36.0**	**771,873**

Note: lcy = loose cubic yards;

* Numbers are rounded.

6.2.4 Modeling to Support Extraction and Recharge Systems

Modeling was performed to support the brine extraction and recharge system designs and are found in the following sections. The models are as follows:

- Probabilistic Reservoir Model – GoldSim, Version 10.5 (see Section 6.2.4.1, *Probablistic Reservoir Model Sevier Playa*)
- A comprehensive groundwater flow and transport model was constructed to support the mine design (see Section 6.2.4.2, *Hydrogeologic Modeling and Analysis for Extraction and Recharge*), which included the following:
    - Pre-mine groundwater flow model – MODFLOW-SURFACT, Version 4.0
    - Mine planning groundwater flow and Dual Domain mass transport – MODFLOW-SURFACT, Version 4.0
- *Stability Analysis* – Slope/W 2012, Version 8.14 (see Section 6.2.4.3, *Site Investigation and Stability Analyses*)

6.2.4.1 Probabilistic Reservoir Model Sevier Playa

A probabilistic reservoir model was developed (CH2M 2013d), revised, and updated (CH2M 2017b) for the Sevier Playa using GoldSim software (GoldSim Technology Group, Version 10.5). The initial model simulated variations in inflows, including river inflow, runoff to the Sevier Playa, precipitation onto the surface of the playa, and mountain block recharge; as well as outflows, including extraction and evaporation. The updated and revised model included new information from additional recharge studies.

This updated and revised model used the precipitation, evaporation, and runoff fluxes from a 31-year period (1985–2015) to develop a water balance for the playa area. It assumed that the historical climatic data represents typical conditions within the drainage and that climatic conditions during operation of the mine would be similar. The fluxes modeled consisted of the Sevier River inflows, transmission losses within the Sevier River channel, surface runoff from the surrounding watersheds, precipitation ponding on the Sevier Playa, Mountain Block recharge, and site evaporation.

A river surplus event probability was incorporated into the model to account for surplus flow years. In general, surplus year events are flow events where, sufficient water flow occurs that are in excess of diverted uses, storage recharge, and transmission losses, so that sufficient volumes of water would likely reach the Sevier Playa to help meet mining demand. In non-surplus or small-surplus years, the estimated volume of naturally occurring source water flows (i.e., watershed runoff and ponded water on the Sevier Playa, and mountain-block recharge) may fall short of the requirements to meet mining demands. Based on a review of Sevier River flows, approximately 75% of the years do not provide sufficient water to meet target extraction rates while approximately 25% of the years do. Therefore, acquired water would be required to make up this shortfall.

The model allows a probabilistic evaluation of the anticipated flows and the most likely yearly water volumes that would need to be purchased. As with any model projection, uncertainties exist in several source parameters; specifically, transmission losses of water during surplus events and the percentage of the ponded precipitation that could be diverted into recharge trenches. The model predicted a high probability that, during a combination of normal years and using stored surplus flows, sufficient reservoir volume existed to provide the target extraction rate for 30 years. Given a comparison of the

storage within the reservoirs in the Sevier River System, the volume of irrigation water withdrawals, and the inflows to the reservoirs, as presented and discussed in the CH2M Water Balance study (2017), there is sufficient storage volume within the Sevier River drainage to hold the projected water volume.

To improve the likelihood of having sufficient source-water reach the Sevier Playa to support annual mining water demands, water purchase or lease agreements would be utilized to ensure a supply of water. The range of the additional purchase water volume that CPM would need to purchase and convey to the Sevier Playa (assuming no transmission losses) ranges from 16,413 to 44,407 acre-feet per year (ac-ft/yr), with an average of 35,164 ac-ft/yr. Leased or purchased upstream water would be conveyed to the site via the Sevier River bed. After accounting for anticipated transmission losses, it is anticipated that CPM would need to lease or purchase and convey an average volume of 50,234 ac-ft/yr and a maximum of 69,000 ac-ft/yr from upstream sources (CH2M 2017b; SWCA 2017a). These purchased and leased water scenarios assume that the climate and hydrology during the operation of the mine is comparable to the climate and hydrology during the study period.

6.2.4.2 Hydrogeological Modeling and Analysis for Extraction and Recharge

A comprehensive groundwater flow and transport model (Groundwater Vistas Version 6.96 pre-processor) was constructed to support the mine design (CPM 2018g). The modeling was based on a 3D hydrostratigraphic model that was constructed from data from the hundreds of boreholes and wells drilled during the exploration program. Three major zones were identified in the playa subsurface. These include a low-hydraulic conductivity FCZ layer underlain by a MCZ layer, and, finally, a SCZ layer. The hydrostratigraphic model was used to construct a 3D groundwater flow and dual domain transport model using MODFLOW-SURFACT (MFSF) Version 4.0, an advanced, proprietary version of MODFLOW. Field data incorporated into the models included estimates of hydraulic conductivity from wells and trench aquifer stress-test results as well as estimates based on literature values and professional judgement where field data was absent.

The playa surface is composed of a low-hydraulic conductivity FCZ of variable thickness up to about 12 feet bgs. The surficial FCZ is underlain by approximately 25 to 30 feet of a MCZ, with an agglomerated sedimentary structure that composes the upper flow system and hosts a brine resource. The agglomerated sedimentary structure of the marl creates voids that are responsible for the relatively high conductivities observed in the MCZ.

Hydraulic conductivity and an observed correlation of carbonate content that occurs contemporaneously with the voids suggest that the voids in the MCZ may reduce with depth. The MCZ is underlain by a lower brine resource zone hosted in a thick SCZ aquifer to depths of up to 100 feet bgs. Groundwater flow in the SCZ appears to be developed in silt, sand, and gravel intervals that are interbedded with the clay layers. The top of the lower SCZ could be partially bound in some locations by clay between the upper MCZ flow system and the first occurrence of permeable intervals in the lower SCZ flow zone. However, the boundary is likely transitional over some distance where permeability dominated by argillic marl gives way to permeability dominated by discrete zones typical of the SCZ.

The groundwater flow and transport model were calibrated to observed water levels from the 2015 field season. The final heads from the calibrated model were used as the initial heads for the mining simulation runs. The model simulations examined various mining plan configurations, seeking to meet the desired K^+ mass, concentration, and flow targets. The modeling used potassium because that is the

limiting brine ion needed for SOP production. Potassium was used as a surrogate for TDS in the model with the brine density and viscosity a function of the modeled potassium concentrations.

The Mining Plan was spatially discretized into BMUs to simulate a phased opening of the mining system. The mining system consists of extraction trenches and recharge trenches, located in the MCZ, and extraction wells targeting the SCZ. The hydraulic properties of the model cells containing trenches were modified to account for the void space the trenches created. Extraction of brine from the trenches was simulated using the MFSF drain package boundary condition where the amount of water removed is proportional to the head difference and conductivity between the boundary condition and the cell in which it is located. Recharge of fresh water to the system was simulated using the MFSF river package where the flow of water into the system is proportional to the same factors.

As these boundary conditions operated over the simulated 30-year mine life, the extraction trenches first recovered the mobile brine resource and then began recovering the immobile brine resource by capturing recharge water that had moved through the system and accumulated immobile brine resource via mass transfer. Once the mobile brine is removed and the fresh recharge water moves through the MCZ, the concentrations in the immobile brine resource drop over time as the resource is recovered.

Figure 6-14 illustrates results of a 3D simulation of trench extraction for 30-year period. The simulation assumes the extraction trenches are excavated to 20 feet bgs, and the water level in the extraction trenches is approximately 15 feet bgs. The trench layout is shown as red lines and the concentrations shown are a color flood, ranging from a K^+ concentration of 1.0 grams per liter (gram/L) to 4 gram/L. The concentrations are for the MCZ immobile brine resource and demonstrate that initial concentrations were generally 2.5 gram/L or higher being reduced to below 1 gram/L in the trench areas over time.

6.2.4.3 Site Investigation and Stability Analyses

Norwest Corporation carried out a geotechnical investigation and laboratory test program at the Project site to assess the stability of the recharge and extraction trenches. The results of the site investigation program were used to support feasibility level geotechnical designs for the overall project evaluation. The data collected from the 2016 site investigation supplemented previous information gathered during earlier stages (2011–2013, 2015) of project evaluation. Overall, the 2016 program confirmed the relatively homogeneous strata profile for the upper playa and similar strength characteristics for the playa upper strata materials.

The site investigation and laboratory testing programs provided data for support stability analyses for trenches, pond berms, and the tailings storage area. In addition, the fieldwork provided valuable experience related to construction and configuration of the production trenches, which informed construction schedules and costing. Geotechnical studies and results are presented in Section 6.4, *Geotechnical Investigations*.

6.2.5 Evaporation Ponds Layout and Design

6.2.5.1 General Overview

Brine collected from the extraction canal would gravity-flow to the north brine pump station where it would be pumped through pipelines into the preconcentration ponds. Ten preconcentration ponds would be used for evaporation to precipitate halite.

A pump station located at the end of the preconcentration ponds would pump the brine into the brine transfer canal to be conveyed down playa to the production ponds.

The production ponds would bring the brine to saturation with respect to potassium-rich salts; allow precipitation of these salts; and, subsequently, provide for collection of these salts for transportation to the Processing Facility.

A plan view of the preconcentration ponds is included in **Figure 6-15,** and a plan view of the production ponds is included in **Figure 6-16**.

Dividing the preconcentration and production ponds into a series of containment areas provides greater flexibility and control over the chemistry of each pond's brine. Since ponds operating in series operate at their end-brine composition, each pond would have different chemistry as illustrated in **Table 6-4**, *Brine Species Concentration for Inter-Evaporation Ponds Streams*, and **Table 6-5**, *Brine Elemental Concentration for Inter-Evaporation Ponds Streams.*

Table 6-4. Brine Species Concentration for Inter-Evaporation Ponds Streams

Stream	$CaSO_4$ (Wt%)	NaCl (Wt%)	KCl (Wt%)	$MgCl_2$ (Wt%)	$MgSO_4$ (Wt%)	K_2SO_4 (Wt%)	Na_2SO_4 (Wt%)	SG
Preconcentration Ponds								
Playa brine to P-1	0.15	12.55	0.00	0.00	1.29	0.45	0.14	–
P-1 to P-2	0.18	15.09	0.00	0.00	1.55	0.55	0.16	1.221
P-2 to P-3	0.14	19.14	0.00	0.00	1.97	0.69	0.21	1.221
P-3 to P-4	0.06	24.44	0.00	0.00	2.75	0.97	0.29	1.222
P-4 to P-5	0.04	22.37	0.00	0.00	5.62	1.98	0.59	1.225
P-5 to P-6	0.03	21.65	0.00	0.00	6.36	2.23	1.35	1.236
P-6 to P-7	0.02	21.41	0.00	0.00	7.05	2.58	0.77	1.236
P-7 to P-8	0.02	21.14	0.69	0.00	7.52	2.29	0.00	1.236
P-8 to P-9	0.01	20.13	2.35	0.00	8.22	1.13	0.00	1.236
P-9 to P-10	0.01	18.62	4.32	0.30	8.92	0.00	0.00	1.236
Production Ponds								
P-10 to Brine Mixing Sump	0.005	15.29	6.57	2.29	8.96	0.00	0.00	1.236
Process recycle brine to Brine Mixing Sump	0.000	9.93	4.03	3.85	16.94	0.00	0.00	1.331
Recovered entrained brine	0.02	21.58	0.00	0.00	9.24	5.40	0.69	–

Stream	$CaSO_4$ (Wt%)	NaCl (Wt%)	KCl (Wt%)	$MgCl_2$ (Wt%)	$MgSO_4$ (Wt%)	K_2SO_4 (Wt%)	Na_2SO_4 (Wt%)	SG
Brine Mixing Sump to Pond H1	0.002	11.85	4.94	3.29	14.07	0.00	0.00	–
Pond H1 to Pond H2	0.00	6.54	4.72	13.01	7.86	0.00	0.00	1.240
Pond H2 to Pond H3	0.00	3.63	3.68	18.95	5.64	0.00	0.00	1.300
Pond H3 to Pond H4	0.00	1.19	0.86	26.99	3.88	0.00	0.00	1.310
Pond H4 to Purge Brine Storage Pond	0.00	0.58	0.21	30.56	3.25	0.00	0.00	1.320

Note: Brine composition is shown as chemical species to respect phase diagram conventions.

– = not applicable

Table 6-5. Brine Elemental Concentration for Inter-Evaporation Ponds Streams

Stream	Na	Mg	S	Cl	K	Ca	Units
Preconcentration Ponds							
Playa brine to P-1	4.98	0.26	0.49	7.61	0.20	0.04	Wt%
P-1 to P-2	5.99	0.31	0.59	9.15	0.24	0.05	Wt%
P-2 to P-3	7.60	0.40	0.73	11.61	0.31	0.04	Wt%
P-3 to P-4	9.71	0.56	0.99	14.82	0.44	0.02	Wt%
P-4 to P-5	8.99	1.14	2.01	13.57	0.89	0.01	Wt%
P-5 to P-6	8.96	1.28	2.42	13.14	1.00	0.01	Wt%
P-6 to P-7	8.67	1.42	2.53	12.99	1.16	0.01	Wt%
P-7 to P-8	8.32	1.52	2.43	13.15	1.39	0.01	Wt%
P-8 to P-9	7.92	1.66	2.40	13.33	1.74	0.00	Wt%
P-9 to P-10	7.32	1.88	2.38	13.58	2.27	0.00	Wt%
Production Ponds							
P-10 to Brine Mixing Sump	6.01	2.39	2.39	14.10	3.45	0.00	Wt%
Process recycle brine to Brine Mixing Sump	3.91	4.41	4.51	10.82	2.12	0.00	Wt%
Recovered entrained brine	8.60	1.43	2.46	13.09	1.21	0.01	Wt%
Brine Mixing Sump to H1	4.90	3.54	3.67	12.07	2.51	0.00	Wt%
Pond H1 to Pond H2	2.57	4.91	2.09	15.90	2.48	0.00	Wt%
Pond H2 to Pond H3	1.43	5.98	1.50	18.06	1.93	0.00	Wt%
Pond H3 to Pond H4	0.47	7.68	1.03	21.23	0.45	0.00	Wt%
Pond H4 to Purge Brine Storage Pond	0.23	8.46	0.87	23.20	0.11	0.00	Wt%

6.2.5.2 Preconcentration Ponds

Because the higher-grade resource is located primarily in the central and southern portions of the Sevier Playa, the preconcentration ponds would be located in the north.

Ten preconcentration ponds (P-1 through P-10) would be used for evaporation. Brine collected from the extraction system would gravity flow through the extraction canal to a pump station where it would be pumped through pipelines into P-1. Pond-to-pond brine transfer would require pumps or weirs, depending upon the pond. A typical weir drawing would be provided as part of the as-built drawing submittal. Through evaporation, preconcentration ponds would bring potassium up to saturation but they would not allow it to precipitate. Preconcentration ponds would also reduce the amount of commercially valueless minerals precipitated in the production ponds by having them precipitate in the preconcentration ponds.

Minerals deposited in preconcentration ponds trap a certain mass of brine. This phenomenon is known as brine entrainment and is accounted for in the design of the ponds. The SOP equivalent quantity entrained in each preconcentration pond is presented on a 3-year basis in **Table 6-6**, *Equivalent Mass of SOP Lost in Entrained Brine in Preconcentration Ponds.*

Table 6-6. Equivalent Mass of SOP Lost in Entrained Brine in Preconcentration Ponds

Ponds	Years of Operation	Total Salt Thickness (feet)	Total Equivalent SOP in Entrained Brine (tons)
P-1	3	0.00	0
P-2	3	0.02	303
P-3	3	0.38	7,110
P-4	3	1.94	76,642
P-5	3	1.67	7,936
P-6	3	2.39	12,465
P-7	3	2.83	17,417
P-8	3	2.66	20,371
P-9	3	2.60	23,682
P-10	3	2.45	38,896
Total	–	–	**204,822**

– = not applicable

Recovering all the brine entrained in P-1 through P-4 is subject to challenges, primarily due to the pond extents. Because of their size, these ponds contain a large volume of heel brine or entrained brine. The heel brine is the volume of brine constituted by the supernatant brine (above the deposited salt layer). Draining and filling these ponds is a challenge due to the surface extents of the ponds. In addition, the amount of SOP equivalent lost in P-1 through P-4 is small, given the grade of the brine the relative size of these ponds. For these reasons, heel brine recovery from P-1 through P-4 is not considered at this time.

P-5 through P-10 are considerably smaller and, for this reason, have a more manageable heel brine volume when compared to P-1 through P-4. Additionally, these ponds contain considerably more

entrained equivalent SOP per area, since they contain more concentrated brines. It is assumed that about 40% of the entrained brine in these ponds can be recovered, based on the operation of similar ponds at regional operations.

To complete the heel brine recovery process, P-5 through P-10 would be drained one pond at a time. A mobile pump would be placed on the berm of a pond to transfer brine into a non-evaporative pond referred to as the Heel Brine Pond. The salts within that pond being drained would be windrowed using bulldozers and graders to allow the entrained brine within the salts to be recovered. The windrowed salts would then be pushed to the side to be contained within the confines of the pond berms for the life of the Project. The heel brine that was pumped into the Heel Brine Pond would then be pumped back into the windrowed pond and combined with the brine recovered from the windrowed salts. Run on a 3-year cycle, this procedure would only occur during the winter period and would start 3 years after startup of the preconcentration ponds.

The entrainment factors in **Table 6-7**, *Preconcentration Pond Design Factors*, are assumptions based on the operation of similar evaporation ponds.

Table 6-7. Preconcentration Pond Design Factors

Item	Value	Units	Notes
Entrainment factor*	0.3	Per mass of salt deposited	Each ton of salt kept in the preconcentration ponds entrains 0.3 tons of brine
Leakage rate	0.098	–	Source: Norwest Corporation in email communication, dated June 9, 2017
Pond area design factor	20	%	–

* DSB International 2013

– = not applicable

The equivalent mass of potassium that can be recovered from each pond is presented in **Table 6-8**, *Recoverable Equivalent Mass of SOP in Preconcentration Ponds.*

Table 6-8. Recoverable Equivalent Mass of SOP in Preconcentration Ponds

Ponds	Years of Operation	Total Salt Thickness (feet)	Recoverable SOP Equivalent (tons)
P-5	3	0.51	3,035
P-6	3	0.73	4,766
P-7	3	0.86	6,660
P-8	3	0.81	7,789
P-9	3	0.79	9,055
P-10	3	0.75	14,873
Total	**–**	**–**	**46,178**

Note: Considers a 40% entrained brine recovery and a 95% harvest pond and process recovery.

– = not applicable

The disposal method for precipitated halite, bloedite, gypsum, and polyhalite generated in the preconcentration ponds would be to store these salts in the preconcentration ponds for the life of the mine. Storage within these ponds would require berm raises as described in **Table 6-11,** *Preconcentration Pond Berm Height and Deposited Salt Thickness Summary*).

In addition to halite, appreciable amounts of bloedite and trace amounts of gypsum and polyhalite would also precipitate in the preconcentration ponds. **Table 6-9***, Annual Mass of Solids Deposited in the Preconcentration Ponds*, presents the salt types and the anticipated amounts of salt that would precipitate in each preconcentration pond annually. Precipitation of the halite and other salts within the preconcentration ponds minimizes their co-precipitation with potash salts in the production ponds. Management of precipitated salts generated in the preconcentration ponds would be contained within the berms, storing it in place.

Table 6-9. Annual Mass of Solids Deposited in the Preconcentration Ponds

Ponds	Halite (tons/yr)	Gypsum (tons/yr)	Polyhalite (tons/yr)	Bloedite (tons/yr)	Total (tons/yr)
P-1	–	–	–	–	0
P-2	–	48,134	–	–	48,134
P-3	753,358	53,728	–	–	807,086
P-4	4,244,107	16,966	–	–	4,261,073
P-5	232,150	–	2,882	–	235,032
P-6	258,707	–	1,804	58,144	318,654
P-7	231,931	–	1,059	137,818	370,808
P-8	211,225	–	842	134,890	346,957
P-9	190,209	–	574	119,115	309,898
P-10	209,837	–	423	124,227	334,487
Total	**6,331,523**	**118,828**	**7,584**	**574,194**	**7,032,129**

Note: Windrowed *salts* have a bulk SG of 1.25.

– = not applicable

Areas of preconcentration ponds are detailed in **Table 6-10,** *Preconcentration Pond Areas*. The total pond area of the ponds is 17,563 acres. The design area acreage represents the evaporative area of the ponds. The footprint acreage of the ponds with the berms will be provided at a later date (Section 6.12.5, *Disturbance over the Life of the Project*). The design area also includes the Heel Brine Pond. The design area considers the effect that variation in precipitation and brine composition may have on pond efficacy.

Table 6-10. Preconcentration Pond Areas

Ponds	Design Area (acres)
P-1	3,623
P-2	3,779
P-3	3,717
P-4	3,839
P-5	421
P-6	395
P-7	397
P-8	397
P-9	350
P-10	397
Heel brine pond	248
Ponds Total	**17,563**

– = not applicable

Accumulation of salts in the preconcentration ponds is the major driver of berm heights. The berm heights of P-1 through P-4 include some allowance for the accumulation of brine from October to April. Pond-to-pond brine transfer is achieved using pumps or weirs, depending on the pond. When gravity is used to transfer brine, berm heights include allowances for fluid head. Berm raises were designed with 1-foot minimum increase for constructability. **Table 6-11** presents the berms heights required to accommodate the precipitated salts, including 3 feet of freeboard. Berm heights stated represent the average calculated height of each pond from the playa topography to the top of the berm. The source of material to lift the berms would be sourced from outside the pond area, referred to as a borrow area as shown on **Figure 6-15**.

Table 6-11. Preconcentration Pond Berm Height and Deposited Salt Thickness Summary

Year Raise Completed	Total Years of Pond Storage	P-1		P-2		P-3		P-4		P-5		P-6		P-7		P-8		P-9		P-10		Heel Brine Pond
		Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)	Deposited Salt Thickness (feet)	Required Berm Height (feet)
Year 2	3	9.0	0.0	6.2	0.0	6.3	0.4	7.2	1.9	7.7	1.0	7.4	1.4	7.1	1.7	6.7	1.6	6.4	1.6	6.1	1.5	9.0
Year 8	5	9.0	0.0	6.3	0.0	6.5	0.6	8.5	3.2	8.7	1.7	8.4	2.4	8.1	2.8	7.7	2.7	7.4	2.6	7.1	2.5	9.0
Year 10	7	9.0	0.0	6.3	0.1	6.8	0.9	9.8	4.5	9.7	2.3	9.4	3.4	9.0	4.0	8.7	3.7	8.4	3.6	8.0	3.4	9.0
Year 12	9	9.0	0.0	6.3	0.1	7.0	1.1	11.1	5.8	10.7	3.0	10.4	4.3	10.0	5.1	9.7	4.8	9.4	4.7	9.0	4.4	9.0
Year 14	11	9.0	0.0	6.3	0.1	7.3	1.4	12.4	7.1	11.7	3.7	11.3	5.3	11.0	6.2	10.7	5.9	10.3	5.7	10.0	5.4	9.0
Year 16	13	9.0	0.0	6.3	0.1	7.5	1.6	13.6	8.4	12.7	4.3	12.3	6.2	12.0	7.4	11.6	6.9	11.3	6.8	11.0	6.4	9.0
Year 18	15	9.0	0.0	6.3	0.1	7.8	1.9	14.9	9.7	13.6	5.0	13.3	7.2	13.0	8.5	12.6	8.0	12.3	7.8	12.0	7.4	9.0
Year 20	17	9.0	0.0	6.4	0.1	8.0	2.1	16.2	11.0	14.6	5.7	14.3	8.1	13.9	9.6	13.6	9.0	13.3	8.8	12.9	8.3	9.0
Year 22	19	9.0	0.0	6.4	0.1	8.3	2.4	17.5	12.3	15.6	6.3	15.3	9.1	14.9	10.8	14.6	10.1	14.3	9.9	13.9	9.3	9.0
Year 24	21	9.0	0.0	6.4	0.2	8.5	2.6	18.8	13.6	16.6	7.0	16.2	10.1	15.9	11.9	15.6	11.2	15.2	10.9	14.9	10.3	9.0
Year 26	23	9.0	0.0	6.4	0.2	8.8	2.9	20.1	14.9	17.6	7.7	17.2	11.0	16.9	13.0	16.6	12.2	16.2	12.0	15.9	11.3	9.0
Year 28	25	9.0	0.0	6.4	0.2	9.0	3.1	21.4	16.2	18.5	8.3	18.2	12.0	17.9	14.2	17.5	13.3	17.2	13.0	16.9	12.3	9.0
Year 30	27	9.0	0.0	6.4	0.2	9.3	3.4	22.7	17.5	19.5	9.0	19.2	12.9	18.9	15.3	18.5	14.4	18.2	14.0	17.9	13.3	9.0

Note: Operating level = salts level + brine level; berm height = operating level + freeboard+ buffer

Typical cross sections of preconcentration pond berms are presented in **Figure 6-17**. Low-ground-pressure dozers and excavators would use material from the playa to construct the berms. To reduce erosion on the interior berm slopes during storm and wind events, the interior and exterior sideslopes would be 3H:1V. The initial berm height of the preconcentration ponds would range from 6.5 to 9 feet and would periodically increase to a maximum height of approximately 23 feet to ensure that the freeboard (3.3 feet) is held to the design standard. The freeboard does include consideration for wind, based on provided wind data for the site.

Exterior pond berms are raised by the downstream method. Internal pond berms would be raised by the centerline method; hence, the clay material on the interior slope would be partially placed on top of the salts precipitated on the interior slope and the previous lift's clay material. The top berm width has been designed to remain at 18 feet. The base width of the outside of the external berms would increase to maintain a sideslope of 3H:1V. The lateral curtain (i.e., low-permeability fat clay layer) for each preconcentration pond berm, which runs from the top of the berm down to the FCZ, would need to be increased to the top of the berm with each berm raise and up and over the top on the final lift. The berms would be compacted to achieve increased stability and decreased permeability with final designs for these berms to be developed during future engineering phases. Trucks and equipment would access the preconcentration ponds along the top of the berms, as necessary. No roads would be constructed but the berms would be sufficiently compacted to provide a drivable surface and maintain berm stability.

6.2.5.3 Brine Transfer Canal and Pipeline

A pump station, located in P-10, would pump preconcentrated brine into the brine transfer canal for conveyance to the production ponds. The brine transfer canal would be located adjacent to the Perimeter Road on the east side of the playa extending from the preconcentration ponds to the production ponds (see **Figure 6-2**). The canal would be approximately 2 to 6 feet deep. The side walls of the canal would be sloped at 2H:1V with a bottom width of 3 feet. Spoils from the canal would be placed on the playa surface at a 2H:1V slope a minimum of 6 feet from the edge of the canal and would be approximately 5 feet in height with a base width of 20 feet. A profile drawing of a typical brine transfer canal is shown in **Figure 6-18**. Approximately 148,776 loose cubic yards (lcy) of playa material would be excavated and stockpiled for the entire length of the canal.

Due to grade, the brine transfer canal would have five pump stations. A profile view of the brine transfer canal and pump station locations is shown in **Figure 6-18**. Based on the design, the flow between the preconcentration ponds to the production ponds is expected to be about 3,300 gpm. Using a channel slope of between 0.01 and 0.02%, with a bottom width of 3 feet and 2H:1V sideslopes, this flow can be accommodated in a typical 2-foot-deep channel (see **Figure 6-3**). However, given the adverse slope, the channel depth would increase as the channel extends south. Once it reaches a depth of 6 feet bgs, the flow would be lifted via a pump. The pump is sized for 3,300 gpm, which would lift the brine to the next channel section conveying the flow further downstream. Additional pump stations would be used until the canal reaches the toe of the production pond embankment. There, the flow is lifted again via pump and conveyed by the brine transfer pipeline along the production pond berm and into the Brine Mixing Sump, a concrete sump located within the production ponds.

6.2.5.4 Production Ponds

The production ponds are comprised of the following components: four ponds divided into four cells for a total of 16 cells, the Process Recycle Buffer Pond, the brine feed canal, the Brine Mixing Sump and

Pump, a haul road berm road network, pumps and weirs (to move brine), and the purge brine canal. The Brine Transfer Pipeline would transfer preconcentrated brine into a Brine Mixing Sump located within the Process Recycle Buffer Pond. The Brine Mixing Sump is a concrete brine mixing pit used to mix the preconcentrated brine with process recycle brine, a residual solution from processing potash salts in the Processing Facility. The process recycle brine would not be available until the Processing Facility begins operations. The process recycle brine is pumped from the Processing Facility via a pipeline (shown in **Figure 6-2**) into the Process Recycle Buffer Pond. This pond is divided into two cells (1 and 2) to allow for one section to be drained into the other and cleaned. The process recycle brine in the Process Recycle Buffer Pond is pumped into the Brine Mixing Sump (via a pump located right next to the sump) and is mixed with the preconcentrated brine. From the Brine Mixing Sump, the mix of process recycle brine and preconcentrated brine is pumped into the Brine Feed Canal. This distributes brines to the first pond, Pond H1, into cells H1-A, H1-B, H1-C, and H1-D via overflow weirs. A typical weir is shown in **Figure 6-19**. From the cells in Pond H1, the brine flows via overflow weirs to the second pond, Pond H2, cells H2-A, H2-B, H2-C, and H2-D. This process continues to the third pond , Pond H3, cells H3-A, H3-B, H3-C, and H3-D and finally to the fourth pond , Pond H4, cells H4-A, H4-B, H4-C, and H4-D. For example, brine that initially enters cell H1-A would move into cell H2-A, then cell H3-A, and finally cell H4-A. This sequence (H1-A through H4-A) is called a “train”. From the H-4 pond cells, the purge brine is transferred via overflow weirs into the purge brine canal where it is pumped into the purge brine pipeline and transferred to the purge brine storage pond. A flow chart depicting this process is shown in **Figure 6-20.**

Dividing the production ponds into 16 cells provides operational flexibility by allowing the flow to be shut off in one pond while the precipitated potassium minerals are removed for processing. This system would also allow for reduced flow rates in response to operational needs. To allow for harvesting the production ponds would be de-brined (using weirs as described above) and harvested one at a time. Harvesting of the crude potassium ore would be conducted year-round. Road graders would be used to windrow the deposited salt floor from the production ponds for pickup and delivery to the Processing Facility using a loader and haul trucks. The crude potassium ore would have a brine content of over 15 Wt%.

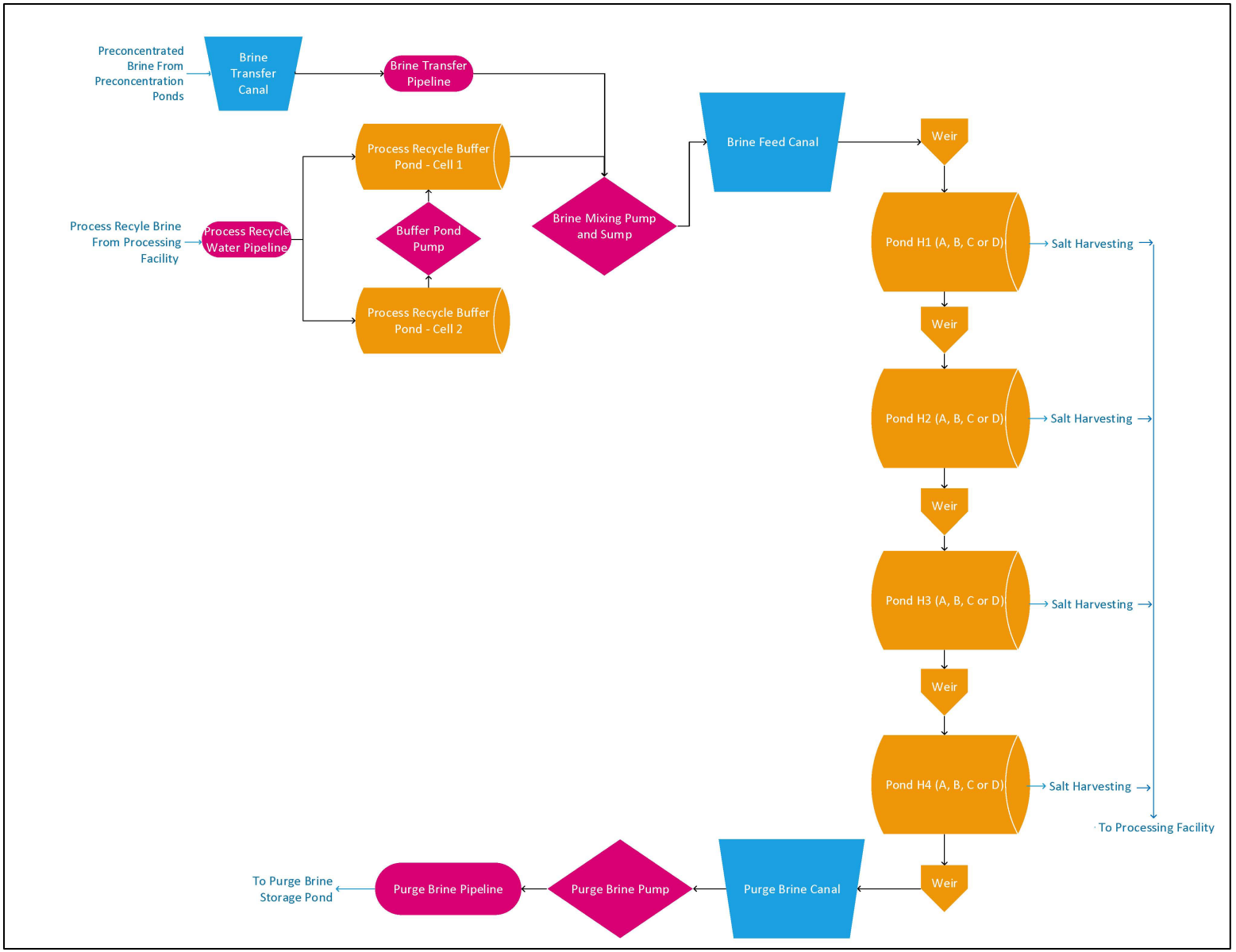


Figure 6-20. Production Pond Process Flow Overview.

As discussed earlier, minerals deposited in the production ponds trap a certain mass of brine. This brine entrainment is accounted for in the design of the ponds. The entrainment factors in **Table 6-12**, *Production Pond Design Factors*, are assumptions based on the operation of similar evaporation ponds.

Table 6-12. Production Pond Design Factors

Item	Value	Units	Notes
Entrainment factor*	0.18	Per mass of salt harvested	Each ton of salt entrains 0.18 ton of brine when windrowed and harvested.
Leakage rate	0.098	Inches/year	Source: Norwest Corporation in email communication dated June 9, 2017
Pond area design factor	20	%	–

* DSB International 2013

– = not applicable

The total area of the production ponds is about 2,539 acres and is detailed below in **Table 6-13**, *Production Pond Areas*. The design acreage represents the evaporative area of the ponds. The actual footprint of the pond with the berms will be provided at a later date (see Section 6.12.5, *Disturbance over the Life of the Project*).

Table 6-13. Production Pond Areas

Description	Name	Design Area (acres)
Pond H1	Pond H1 (cells: H1-A, H1-B, H1-C, H1-D)	1,227
Pond H2	Pond H2 (cells: H2-A, H2-B, H2-C, H2-D)	376
Pond H3	Pond H3 (cells: H3-A, H3-B, H3-C, H3-D)	504
Pond H4	Pond H4 (cells: H4-A, H4-B, H4-C, H4-D)	216
Process Recycle Buffer Pond	–	212
Subtotal Production Ponds	–	**2,539**

– = not applicable

The production ponds are expected to be constructed in the same manner as the preconcentration ponds but without the need for berm lifts or raises. The production pond drawings are shown in the plan view layout (see **Figure 6-16**) and in cross-section view (**Figure 6-21**). Along with the berms, a series of roads would be constructed on and adjacent to certain containment berms. To accommodate haul trucks and construction and maintenance equipment, roads on the berms would include a geotextile material underlaying an 8-inch layer of crushed rock over 8 inches of borrow sand as a sub-base. The other berms would accommodate lower traffic and would have 3 inches of crushed rock. A cross-section depicting typical road cross sections on the production ponds is shown in **Figure 6-22**. The roads are used for maintenance access as well as for salt harvesting haul routes.

Berm height for the production ponds is based on the amount of salt deposited in 1 year, considering that a 1-foot halite base is also present in each pond[9]. To harvest a production pond train, the brine for each pond must be transferred into another pond through an overflow weir (see **Figure 6-16**). Berm heights include transfer capacity and 1.6 feet of freeboard. Pond-to-pond brine transfer is done by gravity and by pumping through an overflow weir, where required. The weir widths presented are for individual cells (A/B/C/D) of each pond. A typical weir is shown in **Figure 6-19**.

The approximate dimensions of the production pond berms are designed at 6 to 8.5 feet in height. The berm heights, berm volumes, and pond weir widths are summarized in **Table 6-14**, *Production Ponds Berm Data and Weir Widths*. A typical section of various berm types used to contain the production ponds is presented in **Figure 6-21.**

Table 6-14. Production Ponds Berm Data and Weir Widths

Ponds	Berm Height (feet)	Berm Volume (bcy)	Weir Head (inches)	Weir Width (feet)
Brine Recycle Buffer Pond	7	371,000	4	varies
Pond H1 (cells: H1-A, H1-B, H1-C, H1-D)	8.5	936,000	4	3
Pond H2 (cells: H2-A, H2-B, H2-C, H2-D)	7.5	313,000	4	2
Pond H3 (cells: H3-A, H3-B, H3-C, H3-D)	6.5	341,000	4	1
Pond H4 (cells: H4-A, H4-B, H4-C, H4-D)	6	242,000	4	1

Note: bcy = bank cubic yards

6.2.5.5 Modeling in Support of Evaporation Pond Design

Two types of modeling were performed to support the evaporation pond designs: USGS Survey's PHREEQC Software (Version 3) (USGS-PHREEQ) and Microsoft Excel, and Slope/W 2012 (Version 8.14). They are described below.

USGS-PHREEQC and Microsoft Excel

The preliminary pond model used to determine the number and size of evaporation ponds has been updated by Novopro based on pre-test work performed during the FS. Thermodynamic software (USGS-PHREEQC) was used with test-work validated data to provide pond chemistry parameters. Microsoft Excel was used to provide an iterative model based upon the evaporation rate curve, material balancing, pond area determination, cut-off points, and chemical composition supplied by the USGS-PHREEQC database. The following section discusses project parameters and assumptions. Project parameters include average playa brine composition, leakage rate from the pond base, brine entrainment contained

[9] Based on pond design and operations expert, David Butts of DSB International, and Pond Operations Expert, Russ Draper.

in salt crystallization, site-specific evaporation rate, annual precipitation, pond seasonality, and process recovery.

The preliminary modeling used the following average playa brine composition: sodium 7.290 Wt%, magnesium 0.381 Wt%, sulfate 2.160 Wt%, chloride 11.140 Wt%, potassium 0.298 Wt%, and calcium 0.064 Wt%. Pond chemistry was modeled at 86^{o} F to anticipate the high range of brine temperatures expected in the summer season. It is understood that 86^{o}F is on the high end of expected brine temperature.

The preliminary process pond model utilized a leakage rate from the pond base of 0.007 mm per day. The total leakage for ponds P-1 through P-10 amounts to 197,200 tons/yr. The leaked brine has an average potassium concentration of 0.66 Wt% and a density of 1.36 tons/m^3. The total leakage for ponds H1 through H4 amounts to 24,250 tons/yr. The leaked brine has an average potassium concentration of 1.89 Wt% and a density of 1.42 tons/m^3. This translates to less than a 2% potassium loss. Brine entrainment factor of 0.30 was estimated based on experience with similar projects (DSB International 2013).

After conducting an evaporation rate review, the annual precipitation rate and the evaporation rate curve from the PFS (CH2M 2013b) used in the PFS pond model were confirmed. The evaporation rate curve presents annual evaporation as a function of dissolved magnesium in the brine and is also the lowest evaporation rate in the Project's database. The selected evaporation curve ranges from 2.0 mm per day evaporation with 0.0 Wt% magnesium in the brine and follows a linear relationship of decreasing evaporation rate following increasing dissolved magnesium in the brine ending with negligible evaporation occurring near the 9 Wt% magnesium mark. Evaporation rates are taken as average annual daily evaporation after correction for rainfall.

The following assumptions were selected concerning pond seasonality to define the pond and buffer capacities:

- The main evaporation season is 5-months long (May–September) with very little evaporation occurring in the remaining months (referred to as the winter season for simplicity).
- Pond area is based on annual average evaporation.
- Playa brine would be extracted year-round while pond brine would only move from pond to pond during the evaporation season. Buffer capacity would be required to store the winter season playa brine before evaporation begins. Modeling indicates the first preconcentration pond can provide this buffer capacity. The first preconcentration pond, therefore, serves two functions: to evaporate brine during the evaporation season and to store accumulated fresh playa brine during the winter season. No salt is precipitated in the first preconcentration pond as it functions below halite saturation.

Due to the iterative nature of the process design, and leaving the Filter Cake Tailings as the only exit point of potassium in the Processing Facility, the overall resulting Processing Facility recovery from the preliminary process model is 96.4%. The process recovery was determined from the mass balance and test work data which is discussed in more detail in Section 4. The tailings leach portion of the test work demonstrated the potassium concentration in the brine that is leaving the process. Understanding that 20% moisture is a reasonable assumption for the Filter Cake Tailings and knowing how much potassium is in the brine, a loss of potassium was calculated.

A 20% contingency was added to nominal pond area to determine design pond area. The 20% increase from the nominal pond area would account for the contingency factors or downtime when the ponds are unavailable for evaporation and allows additional residence time within the pond system for a fixed

input flowrate. This could include meteorological factors as well as time for when ponds are being de-brined for harvesting.

The results of the pond design model are summarized as follows:

- Minimum area of preconcentration ponds: 25.4 square miles
- Minimum area of production ponds: 7.1 square miles
- Average continuous brine inflow to P1: 29,946 gpm

In the current design, the 4 production ponds are each divided into 4 cells for a total of 16 cells. The flow rate into these ponds would be approximately one-half the full development flow rate. Dividing the production pond system into parallel trains provides operational flexibility by allowing flow to be shut off in one pond train for removal of waste salt precipitates while maintaining flows through the system in the parallel trains.

Slope/W

Stability analysis was completed using the software Slope/W 2012 (Version 8.14) from GEO-SLOPE International Ltd. The analysis is based on the non-optimized Spencer Method, a limit equilibrium analysis incorporating both force and moment equilibrium. Geotechnical investigations and results are included in Section 6.4, *Geotechnical Investigations*.

6.2.6 Control Structures, Pipes, and Pumps

Several pumping stations and pipelines would be required to convey brine and recharge water throughout the mine. The pump stations specified are based on the current mine development sequence. If the development sequence is modified, the recharge flow requirements change and pump sizing for the recharge canal would need to be adjusted. Temporary pumps may also be used to convey recharge water at the pump stations or excess brine among the production ponds and/or Processing Facility. A typical pump station is depicted in **Figure 6-12**. Planned locations of the pump stations are shown in **Figure 6-23,** and additional information on the pumps is included in **Table 6-15**, *Summary of Pumps Needed for Mining Operations*.

Table 6-15. Summary of Pumps Needed for Mining Operations

Name	Equipment Type	Use	Quantity
West recharge canal	5,000-gpm pumps	West recharge canal low-head pump stations (40 hp) – Two pump stations with one pump each	2
East recharge canal	7,000-gpm pumps	East recharge canal pump stations (60 hp) – Two pump stations with two pumps each	4
Playa brine pump station	15,000-gpm pumps	Playa brine pump station to lift brine from extraction canal to preconcentration ponds (250 hp) – One motor and two pumps operating at a time	2 motors/ 4 pumps
Preconcentration ponds inter-pond pumps	25,000-gpm pumps	Inter-pond transfer from P-1 to P-2 (150 hp)	2
	20,000-gpm pumps	Inter-pond transfer from P-2 to P-3 (100 hp)	2
	15,000-gpm pumps	Inter-pond transfer from P-3 to P-4 (75 hp)	2
	12,000-gpm pumps	Inter-pond transfer from P-4 to P-5 (60 hp)	2

Name	Equipment Type	Use	Quantity
	15,000-gpm pump	Heel brine pumps (75 hp)	2
P-10 brine pump station to production ponds	3,300-gpm pump	P-10 brine pump station to move brine to brine transfer canal (25 hp)	1
Brine transfer canal pump lift stations	3,300-gpm pumps	Brine transfer canal pump stations (20 hp) - One pump at each lift station	5
Brine transfer pump	3,300-gpm pump	Brine transfer canal to brine transfer pipeline pump (75 hp)	1
Brine mixing pump station	8,030-gpm pumps	Brine mixing pump (75 hp)	2
Buffer pond pump station	4,600-gpm pump	Process recycle brine pump	1
Tailings leach brine pump station	322-gpm pump	Tailings Leach Pipeline pump (20 hp)	1
Process recycle brine pump	4,600-gpm pump	Process recycle brine pump (25 hp)	1
Purge brine pumps	700-gpm pump	Purge brine pump (75 hp)	2
Extraction wells	5-gpm submersible pumps	Well pumps to pump brine from SCZ extraction wells into extraction trenches (1/2 hp)	1,500
	20-gpm submersible pumps	Well pumps to pump brine from SCZ extraction wells into extraction trenches (3/4 hp)	866

Because the brines would have high specific gravities and salt content, the pumps that are used to convey these brines would likely require regular maintenance. Alternatively, CPM may consider installing back-up pumps at locations which require considerable maintenance.

A description of each pump and associated pipeline, if applicable, is discussed directly below. Provided pumping rates are approximate and may vary due to site conditions.

West Recharge Canal Low-Head Pump Stations: The west recharge canal would flow by gravity to where the adverse grade would require installation of a series of two pump stations each with one pump located adjacent to each other (see **Figure 6-23**). Pump Station 1 would lift the recharge flow of 4,740 gpm about 3 feet in elevation. Pump Station 2 would lift that same flow an additional 5 feet or so. Both pump stations would be based on the typical layout shown in **Figure 6-12**. The pumps would be vacuum-assisted, end-suction centrifugal pumps are capable of lifting 5,000 gpm up 3 to 5 feet to the next section of the canal.

Based on the proposed production schedule, Pump 1 would be required at the start of recharge operations for BMU8. Pump 2 would be required once BMU10 entered production.

East Recharge Canal Low-Head Pump Stations: The east recharge canal would flow by gravity to the point where the adverse grade would require a series of two pump stations with two pumps each located adjacent to each other to be installed (see **Figure 6-23**). Pump Station 1 would lift the recharge flow of 12,655 gpm about 4 feet in elevation. Pump Station 2 would lift that same flow an additional 3 feet or so. Both pump stations would be based on the typical layout shown in **Figure 6-12**. The pumps would be vacuum-assisted, end-suction centrifugal pumps that are capable of lifting 13,000 gpm up to the next section of the canal.

Based on the proposed production schedule, Pump Station 1 would be required at the start of recharge operations. Pump Station 2 would be required once BMU11 and BMU13 entered production.

Playa Brine Pump Station: A playa brine pump station would be located in a sump at the north end of the extraction canal, adjacent to the preconcentration ponds (see **Figure 6-23**). The brine pump station would consist of an excavated sump with two bank-mounted motors, each with two submersible pumps that would pump brine from the sump into the preconcentration ponds. This sump and bank-mounted pump system design is illustrated in **Figure 6-24**. It is anticipated that each of the two bank-mounted motors (located adjacent to each other) would each drive two 15,000 gpm submersible pumps in the sump. The motors would operate for alternating periods. This would maintain a continuous flow rate of about 30,000 gpm to Preconcentration Pond P-1.

Each pump would have a pipeline running from the playa brine pump station to the preconcentration ponds and constructed of 42-inch-diameter high-density polyethylene (HDPE) pipe. The system would be installed once preconcentration ponds were completed.

Preconcentration Ponds Pump Stations: From May to October, for preconcentration ponds P-1 through P-4, brine would be transferred from P-1 to downstream preconcentration ponds using pump stations. **Figures 6-15** and **6-23** show the locations of these pump stations. Four pump stations are planned for P-1 through P-4, each with two pumps. Each pump would consist of a vacuum-assisted, end-suction centrifugal pump placed on a gravel pad on the bank of the pond berm that was designed to support the requisite pumps and transfer piping, as shown in **Figure 6-12**.

P-5 through P-10 would convey the brine flow between the ponds via weirs. Two temporary mobile heel brine pumps, located within the Heel Brine Pond, would transfer brine into and out of this pond to allow temporary draining of P-5 through P-10 for salt harvesting and for the collection of entrained brine.

Preconcentration Pond P10 Pump Station: A pump station, located in the southwest corner of P-10 (see **Figures 6-15** and **6-23**), would pump preconcentrated brine via a 24-inch-diameter HDPE pipeline from the pond to the brine transfer canal. The pump station would consist of a standard HDPE intake line to a bank-mounted pump, similar to the pumps used on preconcentration ponds P-1 through P-4. One pump capable of pumping 3,300 gpm would be required to convey the brine to the transfer canal. The pump station would be based on the layout shown in **Figure 6-12**.

Brine Transfer Canal Pump Stations: A 20.4-mile-long canal would convey brine from P-10 to the production ponds (**Figure 6-23**). The alignment of the canal would be governed by a portion of the eastern section of the Perimeter Road and by the location of the various extraction and recharge trenches (as shown in **Figure 6-2)**. The brine transfer canal would consist of a trapezoidal-shaped canal with a 3-foot bottom width and 2H:1V side-slopes (see **Figure 6-3**). The canal slope, in various segments, would vary between 0.01 and 0.02%. Due to adverse grade along the alignment, a series of five low-head, pump stations would be required. These pump stations would each consist of one pump capable of pumping 3,226 gpm, along with inlet and outlet piping to convey the flow to the downstream section. **Figure 6-12** shows the typical pump configuration.

Brine Transfer Pipeline Pump Station and Pipeline: A pump station, located in the northeast corner of the production ponds (**Figure 6-23**), would pump preconcentrated brine via a 24-inch-diameter HDPE pipeline from a sump at the end of the brine transfer canal to the Brine Mixing Sump at the south end of the production ponds. The pump station would consist of a low point at the end of the canal with a bank-mounted horizontal turbine pump similar to the preconcentration pond pump stations P-1 through P-4. The approximately 5.5-mile-long, 14-inch-diameter HDPE pipeline would require one pump capable of pumping 3,300 gpm to convey the brine to the production ponds. **Figure 6-12** shows the typical pump configuration.

Brine Mixing Pump Station: A pump station located in the Brine Mixing Sump (shown in **Figures 6-16** and **6-23**) would lift the preconcentrated brine (that was mixed with process recycle brine in the Brine

Mixing Sump) into the Brine Feed Canal. These brines would then feed the H1 production ponds via weirs. The pump station would consist of a bank-mounted pump similar to the preconcentration pond inter-pond pumps with a pump capable of pumping 8,030 gpm to convey the mixed brine to the production ponds. **Figure 6-12** shows the typical pump configuration.

Tailing Leach Brine Pump Station and Pipeline: A pump station located along the southeastern extraction trench in BMU13 would transport unconcentrated brine to the Processing Facility for use in floatation tailings process (**Figure 6-23**). The approximately 1.2-mile-long, 6-inch-diameter HDPE pipeline would require a 20 horsepower (hp) pump to provide a 322 gpm flow. **Figure 6-12** shows the typical pump configuration.

Process Recycle Brine Pump Station and Pipeline: A pump station located in the Processing Facility area would transport process recycle brine to the Process Recycle Buffer Pond, which is located at the head of the production ponds (**Figure 6-23**). The approximately 0.58-mile-long, 14-inch-diameter HDPE pipeline would require a 25 hp pump capable of pumping 4,600 gpm. **Figure 6-12** shows the typical pump configuration.

Buffer Pond Pump Station: A pump station located in the Process Recycle Buffer Pond (at the south end of production ponds, as shown in **Figures 6-16** and **6-23**) would lift the concentrated brine between the cells of the Process Recycle Buffer Pond. The pump station would contain a bank-mounted 75 hp pump similar to the preconcentration pond pumps.

Purge Brine Pumps and Pipeline: At the north end of the production ponds, the purge brine would flow from the various H4 ponds via weirs into the Purge Brine Canal (located within the production ponds footprint) and toward the northwest corner of the production ponds. At the northwest end of the Purge Brine Canal, two 75 hp pumps capable of pumping 700 gpm would transfer the purge brine from a sump to a pipeline that would convey the purge brine to the Purge Brine Storage Pond located west of the production ponds **(Figures 6-16** and **6-23)**. An approximately 3.7-mile-long, 8-inch-diameter HDPE pipe is anticipated. **Figure 6-12** shows the typical pump configuration.

During initial phase of the Project, pumps would be powered by diesel generators. These generators are included in the equipment list (see Section 6.10, *Mining Equipment*). Power to the pumps is discussed in Section 6.3.

6.2.7 Processing Facility

The Processing Facility would be located at the south end of the playa on a parcel leased by CPM from SITLA (shown in **Figure 6-2)**. The Processing Facility (**Figure 6-25**) would contain numerous buildings that are described in detail in **Table 6-16**, *Building Sizes and Construction Materials.* A detailed drawing of the Processing Facility layout is provided in **Figure 6-26**.

The Processing Facility (see **Figures 6-25** and **6-26**) would include numerous buildings listed in **Table 6-16**, a substation, a propane storage tank, a 634,000-gallon process and fire water tank (measuring 40 feet wide × 32 feet high, of which, 330,000 gallons are dedicated to fire-suppression water), a bulk fuel storage tank and various other supporting areas/facilities. A single-level administration building, with adjoining employee parking area, would house office space as well as an on-site laboratory designed to characterize, analyze, and evaluate various samples throughout the duration of the Project.

The process operations within the Processing Facility would be separated into the following three main processing buildings (described in **Table 6-16** and shown on **Figures 6-25 and 6-26**):

- A wet plant - Raw pond solids feed through the SOP crystallizer

- A dry plant - Crystallizer centrifuge to product screens
- A compaction building and bagging plant

All processing structures would be uninsulated, steel clad buildings with insulated built-up roofing on steel decks.

In addition to the three main processing buildings, there would be 7 support buildings (described in **Table 6-16** and shown on **Figures 6-25 and 6-26**). They are as follows:

- Warehouse and maintenance building and washrooms
- Administration building
- Guard house and gate, and fire truck building
- Compressor building
- Water treatment (for potable water)
- MOP plant
- Loadout electrical

In addition, to these buildings additional support areas/facilities within the Processing Facility shown on **Figures 6-25 and 6-26** include:

- A storm water collection pond
- Waste water treatment area
- Diesel refueling stations
- Propane storage tank
- Covered bay for loading
- Loadout silos
- MOP unloading area
- Parking area
- An area designated for future associated minerals
- A below grade crude salt unloading area
- Process and fire water tank (located within the footprint of the wet plant)
- Main electrical substation
- Processing Facility Communication Tower

Collectively, the three main processing buildings, support buildings, and support areas/facilities would occupy an area up to about 50 acres. The tallest structures at the Processing Facility would be the main processing buildings and product loadout silos, which would not exceed a maximum height of 100 feet. The Processing Facility would be fenced, using non-reflective materials, to provide security and protect public safety. A security guard house and gate would be located at the entrance to the Processing Facility.

The Processing Facility communication tower would be connected to the administration building and would support telephone and data communication. Water for processing and other uses at the facility would be supplied by the freshwater wells and pipeline.

Next to the preconcentration and production ponds there would be trailers which would provide a break room and restroom (outhouses) for the workers at the ponds. The north preconcentration ponds trailer would be located next to the preconcentration ponds. South production ponds trailers 1 and 2 would be located next to the production ponds. Final placement of these trailers has not been determined and would be provided as part of the as-built drawings. They each would be powered by a generator.

Table 6-16. Building Sizes and Construction Materials

Building Name	Building Height (feet)	Building Length (feet)	Building Width (feet)	Footprint Area (square feet)	Operating Levels	Envelopes[1]		Systems					Description	Location of Building in Figure 6-25
						Roof	Walls	HVAC	Water	Drainage	Fire Deterrent	Fire Protection		
Process Buildings														
Wet processing	74	185	123	22,755	Multiple	Insulated built-up roofing on steel deck	Uninsulated steel cladding with louvers	Wall-mounted fans/ louvers combination	Process, cold potable	Surface, sanitary, storm	No	(Hose stations) Dry fire extinguishers. fire loop hydrants outside	Specific equipment within building	Wet plant
Crude salt crushing	72	55	55	3,025	Multiple	Insulated built-up roofing on steel deck	Uninsulated steel cladding with louvers	Wall-mounted fans/ louvers combination	Cold potable	Surface, sanitary, storm	No	(Hose stations) Dry fire extinguishers, fire loop hydrants outside	Specific equipment within building	Wet plant
Drying	96	80	55	4,400	Multiple	Insulated built-up roofing on steel deck	Uninsulated steel cladding with louvers	Wall-mounted fans/ louvers combination	Cold potable	Surface, sanitary, storm	No	(Hose stations) Dry fire extinguishers, fire loop hydrants outside	Specific equipment within building	Dry plant
Compaction	98	175	80	14,000	Multiple	Insulated built-up roofing on steel deck	Uninsulated steel cladding with louvers	Wall-mounted fans/ louvers combination	Cold potable	Surface, sanitary, storm	No	(Hose stations) Dry fire extinguishers, fire loop hydrants outside	Specific equipment within building	Compaction building and bagging plant
Bagging	19	105	32	3,360	1	Insulated built-up roofing on steel deck	Uninsulated steel cladding with louvers	Wall-mounted fans/ louvers combination	Cold potable	Surface, sanitary, storm	No	(Hose stations) Dry fire extinguishers, fire loop hydrants outside	Specific equipment within building	Compaction building and bagging plant
Support Buildings														
Warehouse and maintenance	22	235	82	19,270	1	Built-up roofing on insulated steel deck	Insulated steel cladding	Central air handling unit with A/C separate exhausts for lab area and kitchen, separate unit for washrooms	Hot and cold potable	Oil separators, surface, sanitary, storm	Yes	Sprinklers for office, hose stations, fire extinguishers	Facility includes the following areas: welding area, plate workshop, electrical/instrumentation workshop, carpenter shop, and warehouse	Warehouse and maintenance building and washrooms
Administration building	12	150	75	11,250	1	Built-up roofing on insulated steel deck	Insulated steel cladding	Central air handling unit with A/C separate exhausts for lab area and kitchen, separate unit for washrooms	Hot and cold potable	Sanitary, surface, storm	Yes	Sprinklers, hose stations, fire extinguishers	Facility includes the following areas: 12 closed offices, 8 open working stations, 40-person dining area c/w lunch area, medical clinic, and laboratory	Administratio n building
Guard house and gate and fire-fighting equipment	14	36	24	864	1	Built-up roofing on insulated steel deck	Insulated steel cladding	Split A/C units	Hot and cold potable	Sanitary, surface, storm	Yes	Hose stations	Security/reception/toilet/storage turn style gate (Kiosk type)	Guard house and gate and fire truck building
Compressors building	15	50	32	1,600	1	Insulated steel deck	Insulated steel cladding	Louvered building (10%) exhaust fans	No	Surface, storm	Yes	Fire extinguisher	Facility includes air compressor package	Dry plant
Potable water treatment	15	13	20	260	1	Insulated steel deck	Insulated steel cladding	Air-handling unit	Potable water (cold)	Surface, storm	Yes	Hose stations	Facility includes potable water treatment	Potable water treatment
North preconcentration ponds trailer	9	24	40	960	1	Pre-fab	Pre-fab	Wall-mounted A/C units	Office water cooler	Local septic tank emptied via truck	Yes	Fire extinguisher	Washroom/sink, O/H E-line connection, fridge, coffee machine, cabinet/drawer, table, HVAC, and small locker section	–
South production ponds trailer 1	9	24	40	960	1	Pre-fab	Pre-fab	Wall-mounted A/C units	Office water cooler	Local septic tank emptied via truck	Yes	Fire extinguisher	Washroom/sink, fridge, coffee machine, cabinet/drawer, table, wall-mounted HVAC unit, and small locker section	–

Building Name	Building Height (feet)	Building Length (feet)	Building Width (feet)	Footprint Area (square feet)	Operating Levels	Envelopes[1]		Systems					Description	Location of Building in Figure 6-25
						Roof	Walls	HVAC	Water	Drainage	Fire Deterrent	Fire Protection		
Production plant washrooms	10	16	10	160	1	Built-up roofing on steel deck	Block	Electric heater/fan	Hot and cold potable	Sanitary	No	No	WC/exhaust fan	Dry plant
South production ponds trailer 2	9	24	40	960	1	Pre-fab	Pre-fab	Wall-mounted A/C units	Office water cooler	Local septic tank emptied via truck	Yes	Fire extinguisher	Washroom/sink, O/H E-line connection, fridge, coffee machine, cabinet/drawer, table, HVAC, and small locker section	–
Electrical Rooms														
Salt crushing electrical room ER-3	14.5	20	8	160	1	Pre-fab	Pre-fab	Rooftop packaged fresh air unit	No	Surface	Yes	Fire panel, horn strobes, pull stations, smoke/heat detectors, dry fire extinguisher	Enclosed area	Wet plant
Wet plant electrical room ER-1	14.5	40	24	960	1	Pre-fab	Pre-fab	Rooftop packaged fresh air unit	No	Surface	Yes	Fire panel, horn strobes, pull stations, smoke/heat detectors, dry fire extinguisher	Enclosed area	Wet plant
MOP handling electrical room ER-4	14.5	20	8	160	1	Pre-fab	Pre-fab	Rooftop packaged fresh air unit	No	Surface	Yes	Fire panel, horn strobes, pull stations, smoke/heat detectors, dry fire extinguisher	Enclosed area	MOP plant
Plant control room CCR	14.5	40	24	960	1	Pre-fab	Pre-fab	Rooftop packaged fresh air unit	No	Surface	Yes	Fire panel, horn strobes, pull stations, smoke/heat detectors, dry fire extinguisher	Enclosed area	Dry plant
Dry plant electrical room ER-2	14.5	40	24	960	1	Pre-fab	Pre-fab	Rooftop packaged fresh air unit	No	Surface	Yes	Fire panel, horn strobes, pull stations, smoke/heat detectors, dry fire extinguisher	Enclosed area	Dry plant
Loadout electrical room ER-5	14.5	20	8	160	1	Pre-fab	Pre-fab	Rooftop packaged fresh air unit	No	Surface	Yes	Fire panel, horn strobes, pull stations, smoke/heat detectors, dry fire extinguisher	Enclosed area	Loadout electrical

[1] Floors will be included in the envelope columns when design information is available, prior to the Final Mining Plan.

Propane gas would be used for the drying units at the Processing Facility and to provide heat at the Processing Facility buildings during the first approximately 5 years of production (depending on when the Natural Gas Pipeline becomes operational). Project propane consumption is estimated to be about 2,730 gallons per day (gpd). The primary components of the propane supply and storage system would be as follows:

- A 60,000-gallon above-ground propane gas storage tank located within the perimeter security fence at the Processing Facility. The capacity of this tank would be sufficient to supply a minimum 2-week period during the higher-usage winter months.
- An approximately 0.25-mile-long, 8-inch-diameter buried propane gas pipeline connecting the propane gas storage tank to the wet plant building at the Processing Facility.

Propane would be transported by truck to the Processing Facility using either a highway transport truck or a smaller bulk-delivery truck. Approximately eight shipments of propane per month from a local gas supply company would be required. Propane shipments would occur on weekdays only during daylight hours. Trucks would either travel south from Delta on SR 257 or north from Beaver or Milford on SR 21 and/or SR 257 to Crystal Peak Road. From Crystal Peak Road, the trucks would access the Rail Loadout Facility directly or continue to the Processing Facility. No road improvements or additional ROWs would be required for propane storage, use, or delivery.

During the initial 5 years of production, CPM would construct a new 8-inch-diameter pipeline to replace propane use with natural gas. Once the Natural Gas Pipeline is operational, CPM would discontinue the use of propane at the Processing Facility. Propane storage tanks would be removed and the propane pipelines would be decommissioned and properly abandoned in place, and the associated disturbance reclaimed in accordance with the Reclamation Plan (CPM 2018c).

Potash salts from the production ponds would be harvested year-round. The purge brine would be pumped from the production ponds to the Purge Brine Storage Pond. One production pond train, consisting of four cells (for example, H1-A, H2-A, H3-A and H4-A) would be drained at a time and all four cells would be harvested simultaneously. The salts would be fed directly to the Processing Facility feed tank. Road graders would be used to windrow the potash salts for pickup and delivery to the crude salt unloading area using a loader and haul trucks.

Once the raw potash salts enter the Processing Facility, they would be subjected to a series of processes designed to separate and produce SOP as outlined in Section 7.0, *Recovery Methods*. The Processing Facility would use or produce the following chemicals, which would be stored in the Processing Facility:

- Flotation collector: Flotigam 8122- Amine collector or equivalent
- Flotation extender: Kerosene flotation frother – methyl isobutyl carbinol
- Anti-dusting agent: mineral oil, equivalent to RHT22-85 supplied by the Commercial Oil Company
- Potable water decontamination: Sodium hypochlorite

Recovery methods are discussed in Section 7.0, *Recovery Methods*.

6.2.7.1 Water Supply and Distribution

Fresh water would be used to support SOP production at the Processing Facility, for potable and service water needs at the Project's administration facilities, and potentially for dust suppression. Four

freshwater wells would be needed to meet the freshwater demands of the Project. The principal components of the water supply and distribution facilities are located off-lease and include:

- Four approximately 1,500-foot-deep, 14-inch-diameter production wells located on BLM-administered and SITLA-administered lands (Water Supply Wells 1, 2, 3, and 4, west to east).
- A Water Supply Pipeline extending from the Processing Facility to the intersection of Crystal Peak Road and Water Supply Well Access Road 3.
- Four Water Supply Pipeline spurs. Each Water Supply Pipeline spur would be a 4-inch-diameter pipeline extending from each water supply well to the Water Supply Pipeline, each numbered to match its corresponding water supply well.
- Four aboveground 12.47-kV power line spurs that would connect from the 12.47-kV Power and Communication Line along Crystal Peak Road to pole-mounted transformers located adjacent to each water supply well.
- Four existing north-south-trending dirt two-track well supply access roads (each numbered to match its corresponding water supply well) stemming from Crystal Peak Road to the well house locations would be used for well construction and maintenance. These roads may be improved, as necessary. Water Supply Well Access Road 2 is a county-maintained, Class B road that would not require a ROW.

Additional water supply and distribution details are included in the POD (CPM 2018e).

6.2.8 Waste Product Storage Area

A preliminary footprint location for the Waste Product Storage Area is shown in **Figure 6-27.** The Waste Product Storage Area, which covers approximately 1,196 acres, includes on-playa areas for the storage of the process tailings and purge brine streams.

The Waste Product Storage Area includes zones for the storage of purge brine (bitterns brine) and process tailings (Filter Cake Tailings). Both the purge brine, stored in the Purge Brine Storage Pond, and the filter cake, stored in the Tailings Storage Area, are located on-playa next to the production ponds.

The Waste Product Storage Area would be constructed in phases. Utilizing design expansions, storage capacity would be increased as the operations progress and storage requirements increase. The same construction methods used for the evaporation ponds would be used for the Waste Product Storage Area.

6.2.8.1 Purge Brine Storage Pond

Purge brine would be removed pre-harvest from the final evaporation pond stage and would contain high concentrations of dissolved magnesium chloride with low levels of potassium. As needed, the purge brine would be used as dust suppressant for roads or developed areas, as discussed in Section 9.1.1, *Water Use and Water Rights*. The purge brine would be pumped from the final production ponds to the Purge Brine Storage Pond located on the playa in the Waste Product Storage Area, west of the production ponds. As shown on **Figure 6-27**, a purge brine fill station would be located along the purge brine pipeline to provide access to the purge brine to use for dust suppression or as necessary.

The Purge Brine Storage Pond would function as the final evaporation pond with the pond being filled over the 4- to 5-month summer evaporation/production season. The pond design includes a freeboard allowance for carry-over of some unevaporated brine following the production season, as well as containment of year-round precipitation. As the height of brine rises to fill the containment pond, and as

the operational years proceed, Purge Brine Storage Pond expansions would be constructed. The Purge Brine Storage Pond design incorporates a 5-foot minimum freeboard during all stages of operation.

Figure 6-27 shows the configuration of the Purge Brine Storage Pond at its projected, full footprint. The final footprint of the Purge Brine Storage Pond is 746 acres.

The construction and pond expansions (raises or lifts) for the Purge Brine Storage Pond have been designed as follows:

- Lift 1: Initial Build-Out
  - Constructed in Year 1
  - Downstream construction method
  - Two years of storage capacity
  - Lift 1 is the construction of a pond with initial storage capacity of 932.4 acre-feet (ac-ft)
- Lift 2: First Expansion Phase
  - Constructed in Years 4 to 8
  - Downstream construction method
  - Three years of additional storage capacity
  - Lift 2 is the construction of a pond beside Lift 1 (sharing a berm) and increases overall storage capacity to 2,330.8 ac-ft
- Lift 3: Second Expansion Phase
  - Constructed in Years 9 to 14
  - Downstream construction method
  - 10 years of additional storage capacity
  - Lift 3 is a perimeter berm raise that combines Lifts 1 and 2 (abandoning the shared berm between Lifts 1 and 2) and increases overall storage capacity to 6,992.4 ac-ft
- Lift 4: Third (Final) Expansion Phase
  - Constructed in Years 15 to 29
  - Downstream construction method
  - 15 years of additional storage capacity
  - Lift 4 is the final perimeter berm raise increasing overall storage capacity to 13,984.8 ac-ft

Table 6-17, *Purge Brine Storage Pond Volumes Summary*, shows the breakdown of the storage design capacities along with berm volume and berm height requirements for the Purge Brine Storage Pond.

Table 6-17. Purge Brine Storage Pond Volumes Summary

Years of Storage	Cumulative Volume Generated (cy)	Purge Brine Height (feet)	Overall Berm Height (feet)	Cumulative Berm Material Volume (bcy)
0–2	1,504,000	3	8	286,000
0–5	3,760,000	3	8	502,000
0–15	11,281,000	10	15	1,148,000
0–30	22,562,000	20	25	2,485,000

Note: bcy = bank cubic yards

Figure 6-28 shows the typical cross sections for the Purge Brine Storage Pond as the area is expanded to increase storage capacity. The typical cross sections show the materials that make up the storage area. To accommodate haul trucks and construction and maintenance equipment, roads on the berms would include a geotextile material underlaying an 8-inch layer of crushed rock over 8 inches of borrow sand as a sub-base.

6.2.8.2 Tailings Storage Area

Filter Cake Tailings generated from the Processing Facility would have a 20% moisture content and consist primarily halite and epsomite mixed with other impurities (such as insolubles or dust) that were removed during the scrubbing process. The composition of the tailings materials is presented in Table 6.18.

Table 6-18. Anticipated Tailings Composition

Item	Unit	Value	Origin	Comments
Filter Cake Tailings				
Flow Rate (Nominal)	tons/hour	82.5	-	-
% solids	%	80.0	-	-
Flotation Reagents (TOC)	ppm*	< 90	Added in the flotation circuit	Flotigam 8122, MIBC, Kerosene
Solid Composition				
Solids Flowrate	tons/hour	66.0	-	
Halite (NaCl)	%	98.5	From Harvest Pond. Naturally produced via Playa Brine.	
Schoenite ($K_2Mg(SO_4)_2 \bullet 6H_2O$)	%	0.4		
Epsomite ($MgSO_4 \cdot 7H_2O$)	%	0.5		
Polyhalite ($K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$)	%	0.6		
Brine Composition				
Brine Flowrate	tons/hour	16.5	-	
H_2O	%	65.3	Mixture of playa brine and conversion brine.	Conversion brine is produced partly from crystallization and conversion processes.

Note: ppm = parts per million

Filter Cake Tailings would be trucked as a filtered-solids material from the Processing Facility flotation circuit to the Waste Product Storage Area's Tailings Storage Area. As a part of the normal course of operations, Filter Cake Tailings would be spread and distributed with a bulldozer at the Tailings Storage Area. This traffic and placement activity would compact the material, while surface exposure would lead to evaporation ultimately forming a hardened crust on the tailings surface. This placement, spreading, and natural desiccation is common with other potash processing operations.

The full footprint of the Tailings Storage Area is shown in **Figure 6-27**. The final footprint area of the Tailings Storage Area is 450 acres.

The construction excavation and pond expansions (raises or lifts) for the Tailings Storage Area have been designed as follows:

- Lift 1: Initial Build-Out
  - Constructed in Year 4 with clay berm material
  - Upstream construction method
  - Two years of storage capacity
  - Lift 1 is the construction of a pond with an initial storage capacity of 504.6 ac-ft
- Lift 2: First Expansion
  - Constructed in Years 5 to 7 with clay berm material
  - Upstream construction method
  - Two years of additional storage capacity
  - Lift 2 is the construction of a pond beside Lift 1 (sharing a berm and increasing the overall storage capacity to 1,009.2 ac-ft)
- Lift 3: Second Expansion
  - Constructed in Years 8 and 9 with clay berm material
  - Upstream construction method
  - Two years of additional storage capacity
  - Lift 3 is the construction of a pond beside Lift 2 (sharing a berm, and increasing the overall storage capacity to 1,513.8 ac-ft)
- Lift 4: Third Expansion
  - Constructed in Years 10 and 11 with clay berm material
  - Upstream construction method
  - Two years of additional storage capacity
  - Lift 4 is the construction of a pond beside Lift 3 (sharing a berm and increasing the overall storage capacity to 2,017.6 ac-ft)
- Fourth Expansion
  - Constructed in Years 12 onwards with storage capacity increases, as required
  - Upstream construction method
  - The ultimate storage capacity requirement for Year 30 is 7,569.0 ac-ft
  - The fourth expansion is constructed out of compacted Filter Cake Tailings that have dried and would be built upon Lifts 1, 2, 3, and 4

Table 6-19, *Tailings Storage Area Volumes Summary,* shows the breakdown of the storage design capacities and berm volume and berm height requirements for the Tailings Storage Area.

Table 6-19. Tailings Storage Area Volumes Summary

Years of Storage	Tailings Quantity Generated (cy)	Tailings Height (feet)	Overall Berm Height (feet)	Cumulative Berm Material Volume (bcy)
0–2	814,000	5	5	51,911
0–4	1,627,000	5	5	88,289
0–6	2,441,000	5	5	113,422
0–8	3,225,000	5	5	133,400
0–15	6,102,000	9	5	133,400
0–30	12,205,000	17	5	133,400

Note: bcy = bank cubic yards

Figure 6-28 shows the typical cross sections for the Tailings Storage Area as it is expanded to increase capacity. The typical cross sections show the materials that make up the storage area. To accommodate haul trucks and construction and maintenance equipment, roads on the berms would include a geotextile material underlaying an 8-inch layer of crushed rock over 8 inches of borrow sand as a sub-base.

6.3 Infrastructure

6.3.1 Current Conditions

Largely in an undisturbed natural state, the property has undergone a limited amount of development with no known mining or commercial mineral harvesting having occurred to date. **Figure 6-29** presents the existing conditions adjacent to the Sevier Playa (as well as numerous proposed project features).

In the 1980s, CPMC constructed a canal, ponds, and feeder trenches in the south-central margin of the playa (as shown in **Figure 6-30)**. The 3,000-acre pond system presently contains approximately 1.1 Mton of salt. The 4.8-mile-long brine collection canal that was dug into the playa sediments is approximately 20 feet deep and bermed along the edges above the playa surface. It has been largely silted-in since brine collection and evaporation ceased. In 1993, representatives of CPMC filed for “Relinquishments on Federal Potassium Leases” and, after the required reclamation work was performed, CPMC’s Sevier Lake Project was abandoned. Because these remnant mineral harvesting structures are located in the proposed production ponds and Waste Production Storage Area, they would generally be reworked during project construction.

The property had no permanent dwellings or structures until the Company recently constructed a warehouse and storage area near the southern end of the playa. During exploration efforts, CPM and CPMC installed a network of monitoring wells. Other wells have already been installed by the BLM, Utah Department of Transportation (UDOT), and the USGS on and near the Sevier Playa (**Figure 6-30)**. Crystal Peak Road, which connects the southern portion of the playa to SR 257, has been upgraded with road base and gravel in anticipation of the future siting of mineral processing in that area. **Figure 6-29** shows the local infrastructure and the proposed Project facilities surrounding the Project lease boundary.

6.3.2 Power

Power for the Project would be needed at the Processing Facility, at the extraction wells (to operate pumps), at the pump stations, and at various other areas off-lease (discussed in Section 6.3.4, *Off-Lease Infrastructure Components*). Communication lines would be needed at the Processing Facility.

The principal components of the power and communication line infrastructure are as follows:

- A 69-kV power line and fiber optic communication line (69-kV Power and Communication Line) from the Black Rock Substation to the Processing Facility substation.
- A stepdown substation (North Playa Substation, located off-lease) located along the 69-kV Power and Communication Line on the eastern side of the playa designed to step down power from 69 kV to 25 kV for use at the preconcentration pond pump stations
- A 25-kV Power Line from the North Playa Substation to the Preconcentration Ponds
- A Processing Facility Substation
- A 12.47-kV Power and Communication Line located between the Processing Facility and Rail Loadout Facility substations
- A Rail Loadout Facility Substation
- A 12.47-kV Power Line from the Processing Facility substation to the Production Pond pump stations.
- A solar panel system at each extraction well to power the pump
- A solar panel system at the Brine Transfer Canal and recharge canal pump stations to power the pumps
- Four 12.47-kV Power Line Spurs (each would connect the 12.47-kV Power and Communication Line to each water supply well, numbered to match its corresponding Water Supply Well)

The locations of these power and communication line facilities are illustrated in **Figures 6-23** and **6-29.** The Processing Facility Substation is discussed in Section 6.2.7, *Processing Facility.* The 12.47-kV Power Line Spurs are discussed in Section 6.2.7.1, *Water Supply and Distribution.* The solar panel system for the extraction wells is discussed in Section 6.2.1, *Extraction System*. Details for the 12.47-kV Power and Communication Line and Rail Loadout Facility Substation are provided in the POD (CPM 2018e).

6.3.2.1 Power Lines

After the Project's 69-kV Power and Communication Line is constructed, power would be provided to each preconcentration pond pump station (including the inter-pond pumps, the P-10 pump, playa brine pumps, and heel brine pumps) by a newly constructed 25-kV Power Line. Power would be provided to each production pond pump station (including the purge brine pump, brine transfer pipeline pump, brine mixing pump, buffer pond pumps, and the tailings leach pump) by a newly constructed 12.47-kV Power Line.

Both the 25-kV and 12.47-kV Power Lines would be supported on single-pole structures spaced about 385 feet apart as illustrated in **Figure 6-31**. Power lines and structures would be designed to minimize the potential for operational and avian risks that result from avian interactions with power line facilities. Avian protection measures would be consistent with the guidance proposed by the Avian Power Line Interaction Committee (APLIC) and U.S. Fish and Wildlife Service (USFWS) (APLIC 2006). Specific

information regarding avian safety measures will be identified in the *Adaptive Wildlife Management Plan* (CPM 2018k).

6.3.2.2 Pump Station Solar Panel System

The brine transfer and recharge canal pumps may be powered initially by diesel generators, depending on when they are required. Starting around Year 7, or when required, the pump stations would be connected to a solar power system similar to the extraction wells. A typical installation for the solar system would include panels, mounting brackets, integrated wiring, control and voltage regulation, and battery storage components. Solar panels would be approximately 3.2 × 6.5 feet in size. A panel system would typically consist of five stacked panels. Depending on the size of the pump, the panel system would vary from 62 columns for a 20-hp pump to 93 columns for a 60-hp pump. The panels would be fixed to a metal structure and would vary in length from 409 to 614 feet (depending on the size of the pump and the number of panels required). The metal structure would be would be secured by concrete blocks. Wiring would connect each panel ultimately terminating to a set of batteries. Lead-acid batteries would be contained in a steel lockbox connected to the metal structure. The lockbox would provide the necessary containment to prevent potential leakage in the event the battery is damaged. A typical solar system for a pump station is shown in **Figure 6-32**.

6.3.3 Access Roads and Perimeter Road

Improved and unimproved roads that provide access to the Project are described in Section 1.5, *Property Location and Access,* and depicted in **Figure 1-2**.

6.3.3.1 Perimeter Road

The Perimeter Road would extend around the playa for a total distance of approximately 73.6 miles (see **Figure 6-2**). The road would typically be located on the periphery of the recharge canals. Portions of the Perimeter Road (such as Perimeter Road Segments 1 through 11) are located outside of the lease boundaries. Development and use of these segments are addressed in the POD (CPM 2018e).

The Perimeter Road would be constructed of materials adjacent to the road alignment and with a typical width of 12 feet at 3% cross-slopes and 4-foot-wide shoulders at 16H:1V slopes. On each side of the roadway, a drainage/borrow ditch would be located with a bottom width of 1 foot and 3H:1V side-slopes. The road surface would consist of 12 inches of compacted native material. Culverts would be placed where required to convey drainage from local runoff into the recharge canal. Culvert locations would be provided in the as-built drawings. Road turnouts would be constructed as required, approximately 1 per mile. Typical cross sections of the Perimeter Road are presented in **Figure 6-33**.

Select portions of the Perimeter Road may require off-site materials such as gravel. The portion of the Perimeter Road utilized by haul trucks would also include the use of off-site materials. The portion of the Perimeter Road between the Haul Roads and the Haul Road Spurs, discussed below, that haul trucks would use to go back and forth from the Processing Facility would include a geotextile material underlaying an 8-inch layer of crushed rock over 8 inches of borrow sand as a sub-base.

Travel on the Perimeter Road would be two-way and constructed to accommodate all equipment used during the Project. Speed limits for the Perimeter Road would be compliant with the *Traffic and Transportation Management Plan* (CPM 2018n)

6.3.3.2 Perimeter Road Spurs

Perimeter Road Spurs would provide access from the lease boundary to the Perimeter Road. There are seven Perimeter Road Spurs (shown in **Figure 6-29)**. Perimeter Road Spur 1A would provide overland access from Perimeter Road Spur 1 to the Sevier River Drop Structure.

The Perimeter Road Spur segments and associated lengths are as follows:

- Perimeter Road Spur 1: 0.56 mile
- Perimeter Road Spur 2: 0.02 mile
- Perimeter Road Spur 3: 0.44 mile
- Perimeter Road Spur 4: 3.13 mile
- Perimeter Road Spur 5: 0.11 mile
- Perimeter Road Spur 6: 0.12 mile
- Perimeter Road Spur 1A: 0.35 mile

The Perimeter Road Spurs would be improved and maintained as necessary to provide access to the Project during construction and operation. Typical improvement activities would include blading, drainage improvements, application of a chemical dust suppressant, and, if needed, the addition of granular road base. Typical maintenance activities would involve blading, filling in ruts, maintaining drainage structures, and the periodic application of a chemical dust suppressant. No pullout areas or other road improvements would be constructed.

Once construction is complete, the Perimeter Road Spurs would be used on an intermittent basis for monitoring, utility maintenance, and other Project needs. A 25-foot-wide area would be required for each of these access roads to allow for expected improvement and maintenance activities. The entire 25-foot-wide area may not be required. However, it is assumed that it would be needed in some areas; for example, at improved drainage crossings. The 25-foot-wide area would accommodate occasional two-way passenger vehicle traffic.

6.3.3.3 Haul Roads

From the Processing Facility, haul-trucks with tandem 40-metric-ton trailers would transport Filter Cake Tailings to the Tailings Storage Area. The haul-trucks would travel north from the Processing Facility along the Haul Road, would have an approximate 12-foot running surface at 1,560 feet long and would connect the Processing Facility to the Perimeter Road. Upon reaching the junction, trucks would travel along the Perimeter Road to the Tailings Storage Area. Once the trucks reached the Tailings Storage Area, they would leave the Perimeter Road and travel along the Haul Road Spur, which would include an approximate 12 foot wide running surface by 90 feet long. The Haul Road Spur would tie into the road network along the berms of the Tailings Storage Area and Purge Brine Storage Pond (shown in **Figure 6-27)**. The Haul Road and Haul Road Spur would include at least one turnout, similar to the Perimeter Road (shown in **Figure 6-33**), to accommodate truck passing.

Another Haul Road would be constructed to facilitate the transportation of salts from the production ponds to the Processing Facility. The Haul Road, would have an approximate 12 foot wide running surface at 1,560 feet long and would run adjacent to the Haul Road that provides access to the Tailings Storage Area. It would connect to the Perimeter Road, at which point the trucks would travel toward the production ponds. The Haul Road Spur would provide access from the Perimeter Road to the production

ponds, which would include an approximate 12 foot wide running surface by 140 feet in length. This road would tie into the road network along the berms of the production ponds (shown in **Figures 6-16 and 6-23)**. The Haul Road and Haul Road Spur would include at least one turnout, similar to the Perimeter Road (shown in **Figure 6-33**), to accommodate truck passing.

The Haul Roads and Haul Road Spurs would have two-way traffic (provided using turnouts) and a speed limit of 15 miles per hour (mph). Haul trucks would drive only on these designated Haul Roads and Haul Road Spurs. Both Haul Roads and Haul Road Spurs would have a 12-foot-wide travel surface. To accommodate haul trucks the Haul Roads and Haul Road Spurs would include a geotextile material underlaying an 8-inch layer of crushed rock over 8 inches of borrow sand as a sub-base. The roads would include 4-foot shoulders on both sides, and 9-foot side slopes, with 3H:1V slopes for drainage management. A 1-foot-wide drainage channel would be located at the bottom of the side slope on both sides of the roads. A road berm would be located on one side of the roads and a spoils berm would be located on the other side. The road design is similar to the Perimeter Road but would include the geotextile, gravel and sand. *(Haul Road locations will be added at a later date.)*

6.3.3.4 Other Roads

Equipment would access the preconcentration ponds by driving on the pond berms.

Travel within the playa would occur where necessary. Canal and trench crossings would be placed, as necessary, throughout the playa using either corrugated metal piping or concrete box culverts, depending on the specific crossing conditions and the trench flow rate.

The CPM Spur Road would be a new road constructed off the existing Crystal Peak Spur Road to the Processing Facility. The CPM Spur Road would require road base and culverts and would need to be crowned and ditched. Once constructed, this road would have an approximately 24-foot-wide running surface. Off-Lease Infrastructure Components
Off-lease infrastructure components consist of power and communication lines; propane and natural gas storage and pipelines; water facilities; communication towers; rail facility and spur track; new access roads, including portions of the Perimeter Road; portions of the preconcentration ponds, including the Heel Brine Pond; segments of the recharge canal and recharge collectors; and segments of the Brine Transfer Canal. These are discussed in detail in the POD (CPM 2018e) and shown in **Figure 6-29**. The POD would be submitted to the BLM for the purpose of evaluating development rights and establishing ROW grants for the utilities and infrastructure that would be located on private, SITLA, and BLM-administered lands outside the potash lease boundary. Construction of the Perimeter Road was previously discussed in Section 6.3.3.1, *Perimeter Road*, even though portions of Perimeter Road are outside the lease boundary.

Peak's federal lease, Special Stipulation 5, states the following:

> Survey Monuments: The Lessee at the conclusion of the mining operation, or at other times as surface disturbance related to mining may occur, will replace all damaged, disturbed, or displaced comer monuments (section comers, quarter comers, etc.) their accessories (witness trees, bearing trees, etc.), or restore them to their original condition and location, or at other locations that meet the requirements of the rectangular surveying system. This work shall be conducted at the expense of the Lessee, by the BLM, to the standards and guidelines found in the Manual of Surveying Instructions, U.S. Department of Interior. (BLM 2011c)

Coordination with other ROWs is addressed as part of the POD (CPM 2018e).

6.3.3.5 Rail Loadout Facility and Rail Spur

A Rail Loadout Facility and Rail Spur would be used to import MOP and to transport potash and associated products produced by the Project. In addition to rail transport, CPM plans to ship smaller quantities of products by truck to locations within the United States. This would occur when a quantity of product is needed on a timeline or at a destination that is not suitable for routine rail shipment. Up to 50,000 tons annually may be transported by truck.

The 12.47-kV Power and Communication Line, Rail Loadout Facility, Rail Loadout Facility access roads, Rail Spur, and Rail Spur Access Corridor would be located primarily on BLM-administered off-lease land. The Rail Spur Access Corridor would also cross private lands. With the exception of the access roads and power and communication lines, the Rail Loadout Facility components would be located within a perimeter security fence. This fenced area would include approximately 110 acres of BLM-administered off-lease lands. The Rail Loadout Facility components within the fence line would consist of a substation or pole-mounted transformer, fiber optic communication line, propane storage tank, Natural Gas Pipeline Spur, water storage tank, storage facility, train loadout, truck loadout, rail car staging tracks, and conveyor belt (**Figure 6-34**). Propane or natural gas would be used to provide heat to the administrative buildings at the Rail Loadout Facility. The surface area within the fence line would be graveled.

6.4 Geotechnical Investigations

The preconcentration and production ponds are contained within a series of berms. Geotechnical investigations were completed to support development of the trenches, canals, and berms.

Geotechnical investigations were completed on the playa in 2011–2012, 2013, 2015, and 2016. The 2011–2012 investigation began in the summer of 2011 and included borehole drilling, trench excavations, installation of wells, soil sampling, and aquifer testing. Soil samples from the field exploration were tested by IGES to provide data for site characterization and geotechnical engineering design. Laboratory testing of the representative soil samples included index testing, carbonate content, compaction testing, strength testing, consolidation testing, permeability and soil water characterization curve testing.

A preliminary geotechnical site investigation was completed in 2013 at the Processing Facility. This investigation consisted of four borings and four cone penetration tests (CPT). A series of laboratory tests were conducted on the collected soil samples including index testing, compaction testing, strength testing, and consolidation testing.

The September 2015 site investigation included a series of test pits along the playa edge, as well as test pits near the production ponds. CPTs were performed near the playa edge. Infiltration test sites were installed and monitored to characterize field scale permeability. Soil samples from the test pit program were analyzed to provide data for site characterization and geotechnical engineering design. IGES completed a series of laboratory tests on the samples including index testing, carbonate content testing, compaction testing, strength testing, consolidation testing, and permeability testing.

The 2016 site investigation consisted of test pitting, borehole drilling, trench excavations, CPT and infiltration testing. The laboratory tests conducted on the samples, completed by IGES, were conducted on the samples for index testing, strength testing, consolidation testing, and hydraulic conductivity testing.

The purpose of the 2016 investigation was to characterize the foundation conditions at the playa, and to support the design of the Processing Facility, trenches, canals, preconcentration ponds, production ponds, and waste product storage areas.

6.4.1 Geotechnical Foundation Model

For the purpose of developing a geotechnical model for stability analyses, the sediments were divided into five separate units. The surficial material is generally variable, weathered, and desiccated materials about 1.5 feet thick. This surficial material underlies the FCZ; a grey, high plastic clay, approximately 13 feet thick. Below the FCZ is the MCZ; a fissured, low plastic clay that extends to a depth of approximately 33 feet. The SCZ, approximately 65 feet thick, is further underlain by a hard clay. The groundwater table is generally shallow and assumed at a depth of 3 feet.

6.4.1.1 Design Criteria

The design criteria for the geotechnical structures are based on Factor of Safety (FoS) values. The minimum FoS values used for the stability analysis are referenced from the USACE Slope Stability Design Manual (USACE 2003) and are presented in **Table 6-20**, *Design Criteria for Evaporation Pond Berms.*

Table 6-20. Design Criteria for Evaporation Pond Berms

Analysis Condition	Minimum Allowable FoS
End-of-construction	1.3
Long term	1.5
Rapid drawdown	1.1–1.3
Seismic loading*	1.1

*Minimum FoS for pseudo-static analysis.

The berm configuration was evaluated for a maximum height of 25 feet for the four conditions listed in **Table 6-20**. The use of the 25-foot configuration for the end of construction case is conservative, as the current schedule shows the preconcentration pond berms being raised in stages over the life of the Project to a maximum of 23 feet in height.

The trenches were designed with a lower minimum FoS value of 1.2 since some degree of sloughing is acceptable and can be managed over time with maintenance and cleaning.

6.4.1.2 Material Parameters

Based on laboratory test results, a general characterization of five units (desiccated soils, FCZ, MCZ, berm fill, and clay fill) has been completed that takes into consideration data collected in previous site investigations. Material parameters for the SCZ and hard clay have been omitted from stability analyses because of their relative depth and are not discussed further in this section. In addition to laboratory testing, the hydraulic conductivity values considered results from Sealed Single Ring Infiltrometer (SSRI) and Sealed Double Ring Infiltrometer (SDRI) tests completed by IGES.

Table 6-21, *Material Parameters*, presents the material parameters used in the slope stability analyses. The common fill materials have been included in this table for completeness.

Table 6-21. Material Parameters

Unit	Depth (feet)	Unit Weight (pcf)	Effective Friction Angle (°)	Cohesion (psf)	Hydraulic Conductivity (in/s) [cm/s]
Desiccated soils	0.0–1.5	124.1	25	210	3.9E-6 [1E-5]
Fat clay	1.5–13.0	124.1	25	210	3.9E-8 [1E-7]
Marl clay	13–33	124.1	25	310	3.9E-6 [1E-5]
Common fill	–	124.1	30	0	3.9E-6 [1E-5]
Low permeability fill	–	124.1	30	0	3.9E-8 [1E-7]

Note: – = not applicable; pcf = pounds per cubic foot; psf = pounds per square foot

Common fill and low-permeability fill would be used to construct the preconcentration ponds, production ponds, and waste product storage area berms (shown in **Figures 6-17, 6-21,** and **6-28**, respectively). The material parameters presented in **Table 6-21** are intended to provide an average strength (base case) for the foundation materials and fills for the Project.

6.4.1.3 Stability Modeling Failure Mechanism

The FCZ is estimated to be the weakest layer within the geotechnical model. The FCZ is an intermediate- to high-plastic silt and clay with relatively high moisture contents and is continuous across much the playa. Failure through this material is considered the critical failure mechanism for the trenches and berm structures.

6.4.1.4 Wind and Wave Run-up Estimate

An estimation of wave heights generated by wind forces on the impounded brine and tailings has been carried out as part of the preconcentration pond and tailings storage area to verify that freeboard requirements of these ponds is appropriate. Wave heights were calculated in general accordance with methods contained in the USACE's *Shore Protection Manual* (Coastal Engineering Research Center 1984), specifically using equations 3-39 and 3-40 as presented in the manual. Wave heights were calculated for the ponds for 5-year, 15-year, and 30-year brine depths. The design sustained-wind speed was estimated at 78 mph based on back-calculations using the CH2M instantaneous peak wind speed estimate (CH2M 2016a).

Table 6-22, *Wave Run-up Estimate Results* presents the results of the wind tide estimate. The wave heights were calculated using a web-based calculator provided by the USGS (USGS 2014). The recommended freeboard levels were calculated by multiplying the critical wave height by 1.5.

Table 6-22 shows the recommended freeboard allowed for in the current design phasing exceeds the calculated critical wave height for all impoundments.

Table 6-22. Wave Run-up Estimate Results

Preconcentration Pond	Critical Fetch (miles)	Critical Fetch (km)	Critical Wave Height/Year (feet / yr)	Critical Wave Height/Year (m / yr)	Minimum Recommended Freeboard (feet)	Minimum Recommended Freeboard (m)
P-1	6.4	10.3	1.3 / 5	0.40 / 5	2	0.61
P-2	6.2	10.0	1.3 / 5	0.40 / 5	2	0.61
P-3	5.4	8.7	1.3 / 5	0.40 / 5	2	0.61
P-4	4.3	6.9	1.3 / 5	0.40 / 5	2	0.61
P-5	2.0	3.2	3.6 / 30	1.1 / 30	5.5	1.68
P-6	1.9	3.1	2.2 / 30	0.67 / 30	3.5	1.07
P-7	1.9	3.1	1.4 / 5	0.43 / 5	2.5	0.76
P-8	1.9	3.1	1.3 / 5	0.40 / 5	2	0.61
P-9	1.9	3.1	1.2 / 5	0.37 / 5	2	0.61
P-10	1.9	3.1	1.1 / 5	0.34 / 5	2	0.61
Tailings Storage Area	1.6	2.6	4.3 / 30	1.31 / 30	6.5	1.98

6.4.2 Stability Analysis

A stability analysis was completed using the software Slope/W 2012 (Version 8.14) from GEO-SLOPE International Ltd. The analysis is based on the non-optimized Spencer Method, a limit equilibrium analysis incorporating both force and moment equilibrium. The FoS derived from the Slope/W analysis represents the ratio of resisting forces to driving forces. The FoS provides a statistical indication on the tendency of a given slope to fail under specified conditions.

Static stability analyses were carried out on typical sections of trenches and berms. Pseudo-static analyses were completed for the berms and show that the structures meet design criteria.

6.4.2.1 Trench and Canal Stability

The trenches and canals would extend down through the desiccated soils and FCZ, terminating in the MCZ.

The multi-benched trench/canal; which includes the extraction trenches, extraction canal, and recharge trenches (see **Figure 6-3**); would have the following characteristics:

- Maximum depth of 20 feet
- Bottom width of 8 feet
- Maximum top width of 32 feet
- Maximum bench width of 10 feet
- Maximum bench height of 8 feet
- Minimum water level of 4 feet below the surface of the playa
- Overall slopes of 1H:1V

This modeled groundwater level is 4 feet bgs on both sides of trench walls and then follows the slope of the walls to the trench floor. The stability of the trenches is dependent on maintaining the water levels within the trenches and canals at or above this level. During operations, rapid drawdown of the water level must be avoided (i.e., over-pumping), as this could lead to sloughing and/or degradation of the trench slopes.

6.4.2.2 Berm Stability

The berms would be constructed of common fill material and low permeability fill to limit seepage through the structure. The fill would be sourced from the upper playa soils, then compacted to meet the engineered fill specifications. Laboratory testing and small-scale test fills on the playa have shown the materials are suitable.

The berms were analyzed for geotechnical stability to determine the overall slopes which satisfy the FoS against failure design criteria.

Stability analyses were completed for a range of tailings stack heights up to approximately 65 feet assuming a conservative outer slope angle for the stack of 2H:1V. The strength characteristics for the filtered tailings were based on representative data for tailings materials from potash operations in Saskatchewan, where surface storage of tailings solids has been carried out for several decades. Analyses showed that overall slope FoS for piles in excess of 60 feet was greater than 1.5 using the foundation conditions of the southern playa with increasing FoS values for the slopes (3H:1V) proposed in the Mining Plan. With respect to stability issues related to dissolution or erosion of the outer slopes of the proposed facility, experience with the Saskatchewan facilities (which experience higher overall precipitation than the Sevier Lake region) has shown the dissolution and/or erosion of the surficial tailings can be dealt with as an operational issue. Active water management and regrading of the slopes where erosion gullies and localized over-steepening have occurred are a part of the standard operational and maintenance program for surface potash stacked tailings facilities. The Project would develop an operational, surveillance and maintenance program, which incorporates these activities.

6.5 Construction Schedule

Initial construction would occur during the first 4 years of the Project. Upon completion of the Processing Facility and the initiation of production, the Project would move into operations and maintenance (O&M). Construction would continue on-lease during the life of the Project as different project components are required. With the exception of the Natural Gas Pipeline, which would be completed during Project O&M, off-lease construction would be completed before Project O&M. Berm and BMU construction and off-lease infrastructure maintenance would continue during Project O&M.

The overall anticipated construction schedule is presented in **Table 6-23**, *Anticipated Project Construction Schedule*. Additional details regarding construction and operation of off-lease facilities are provided in the POD (CMP 2018e).

Table 6-23. Anticipated Project Construction Schedule

Permitting Schedule	Year																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Off-Lease Features																																
Long Ridge Communication Tower construction																																
Black Rock Communication Tower construction																																
Power to Processing Facility - 69-kV Power and Communication Lines construction																																
Power to Rail Loadout - 12.47-kV Power and Communication Line construction of the portion that would supply power to the 12.47-kV Power Line Spurs																																
Power to water supply wells - 12.47-kV Power Line Spurs construction																																
Power to Rail Loadout - 12.47-kV Power and Communication Line construction to the Rail Loadout																																
Power to preconcentration ponds - 25-kV Power Line Construction																																
Rail Spur and Rail Loadout Facility construction																																
Natural Gas Pipeline construction																																
Water supply wells, pipelines, and spurs construction																																
Access road construction																																
Perimeter Road construction																																
Preconcentration pond construction																																
Brine transfer canal																																
Recharge canal																																
Recharge collectors																																
On-Lease Features																																
Ponds and Processing Facility																																
Perimeter Road construction																																
Preconcentration pond construction																																
Production pond construction																																
Power to production ponds - 12.47-kV Power Line construction																																
Processing Facility construction																																
Processing Facility startup																																
First salt harvest for partial SOP production																																
Purge Brine Storage Pond	Lift 1			Lift 2					Lift 3										Lift 4												
Tailings Storage Area				Lift 1	Lift 2			Lift 3		Lift 4																						
Extraction Canal, Brine Transfer Canal, Recharge Canal, and Sevier River Berm and Diversion																																
Extraction canal																																

Permitting Schedule	Year																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Brine transfer canal																																
Recharge canal																																
Sevier River berm, diversion, and drop structure																																
BMUs																																
BMU1, BMU2, BMU3, BMU4, BMU5																																
BMU15																																
BMU21, BMU19, BMU17																																
BMU22																																
BMU9																																
BMU20																																
BMU14																																
BMU18																																
BMU16																																
BMU13																																
BMU7																																
BMU11																																
BMU6																																
BMU8																																
BMU10																																
Extraction Wells																																
169 wells																																
392 wells																																
404 wells																																
184 wells																																
1,026 wells																																
191 wells																																

Construction

Operation and maintenance/drilling

Production

Note: BMU12 is no longer included in the construction and production schedule. The BMUs were not renumbered to address this.
Schedule Version 02-26-18, revision 6.

6.5.1 Evaporation Pond Development

The preconcentration ponds would be built within the first 2 years of the Project. The initial berm height of the preconcentration ponds would range from 6 to 9 feet. The preconcentration pond's berm height would increase periodically to a maximum height of approximately 23 feet to maintain freeboard of 3.3 feet. Salt accumulation in the preconcentration ponds is the major driver of berm heights. The source of berm material for the initial preconcentration pond berm construction would be the interior of the ponds. The source of material to lift the berms would be sourced from outside the pond area, referred to as a borrow area as shown on **Figure 6-15**.

The production ponds are to be constructed during the Project's first year. The production ponds are expected to be constructed in the same manner as the initial preconcentration ponds but without the need for berm lifts. The source of material to construct the berms would be from the interior of the ponds.

6.5.2 Waste Product Storage Area Development

The Purge Brine Storage Pond would be built within the first year of the Project. The initial berm height of the Purge Brine Storage Pond would be 8 feet. The construction and pond expansions (raises or lifts) for the Purge Brine Storage Pond have been designed to proceed in four lifts in order to accommodate the growing quantity of material (see **Figure 6-27**). The Purge Brine Storage Pond's berm height would increase periodically to a maximum height of 25 feet to maintain a freeboard of 5 feet. The source of berm material for the initial Purge Brine Storage Pond berm construction would be the interior of the pond. The source of material to lift the berms would be sourced from outside the pond area, referred to as a borrow area as shown on **Figure 6-27**.

The Tailings Storage Area would be constructed during the year 4 of the Project. The initial berm height of the Tailings Storage Area would be 5 feet. The construction of the tailings storage area would include the initial build-out and four expansions to accommodate the growing amount of material from the processing facility, as shown on **Figure 6-27**. The Tailings Storage Area's berm height would increase periodically to a maximum height of 17 feet. The source of berm material for the initial build out and the first three expansions of the Tailings Storage Area berm construction would be the interior of the pond. The fourth expansion is constructed out of compacted Filter Cake Tailings as shown on **Figure 6-27**.

6.5.3 BMU Development

Initial construction would include the excavation of select BMUs. This would allow brine to flow into the trenches as early as possible. Groundwater modeling was used to determine when extraction trenches within the BMUs would need to be excavated in order to meet production requirements. The BMUs that would be excavated during initial construction would include: BMU1 through BMU5, BMU9, BMU14 through BMU15, and BMU17 through BMU22. **Figure 6-35** depicts the BMUs that would be constructed during Years 1 through 4.

Table 6-24, *Length and Type of Trench by BMU During Initial Construction*, lists the total lengths of extraction and recharge trenches, which would be excavated during initial construction.

Table 6-24. Length and Type of Trench by BMU During Initial Construction

BMU	Extraction Trench		Recharge Trench		Recharge Collectors	
	feet	miles	feet	miles	feet	miles
BMU1	127,772	24.2	115,860	21.9	10,231	1.9
BMU2	79,439	15.0	78,416	14.9	9,408	1.8
BMU3	82,802	15.7	82,814	15.7	13,642	2.6
BMU4	153,727	29.1	149,082	28.2	13,371	2.5
BMU5	52,555	10.0	58,871	11.1	12,607	2.4
BMU9	72,818	13.8	71,101	13.5	7,903	1.5
BMU14	168,591	31.9	127,478	24.1	8,138	1.5
BMU15	28,965	5.5	22,826	4.3	5,939	1.1
BMU16*	62,810	11.9	65,080	12.3	19,110	3.6
BMU17	22,662	4.3	17,875	3.4	4,916	0.9
BMU18	54,461	10.3	54,437	10.3	16,017	3.0
BMU19	20,662	3.9	16,511	3.1	976	0.2
BMU20	72,442	13.7	72,853	13.8	1,446	0.3
BMU21	21,885	4.1	12,560	2.4	600	0.1
BMU22	23,732	4.5	16,993	3.2	3,410	0.6
Total	**982,513**	**186**	**897,677**	**170**	**108,604**	**20**

– = not applicable

* BMU16 is constructed from Years 4 to 5.

After initial construction, additional BMUs would be constructed as necessary throughout the life of the mine to meet production requirements. These additional BMUs are BMU6 through BMU8, BMU10, BMU11, and BMU13 (**Table 6-25**, *Length and Type of Trench by BMU During O&M*).

Table 6-25. Length and Type of Trench by BMU During O&M

BMU	Extraction Trench		Recharge Trench		Recharge Collectors	
	feet	miles	feet	miles	feet	miles
BMU6	35,974	6.8	30,153	5.7	8,244	1.6
BMU7	271,844	51.5	261,060	49.4	24,049	4.6
BMU8	89,705	17.0	79,603	15.1	3,281	0.6
BMU10	12,877	2.4	11,901	2.3	1,047	0.2
BMU11	70,325	13.3	59,400	11.3	6,774	1.3
BMU13	90,787	17.2	52,708	10.0	18,922	3.6
Total	**634,322**	**120.0**	**559,905**	**106.0**	**81,427**	**16.0**

– = not applicable

Construction timing of BMUs over the life of the mine is shown in **Figure 6-36**.

As discussed in Section 7.6, *Tailings Leach*, a pipeline, referred to as the Tailings Leach Pipeline (shown in **Figure 6-2**) would bring playa brine to the Processing Facility to reduce the need for fresh water. The source of this playa brine is an extraction trench in BMU13. This BMU is not scheduled for construction until Year 5. To provide the brine to the Processing Facility at startup, one extraction trench within the BMU would be constructed in Year 1.

6.5.4 Canals, Sevier River Berm, and Diversion Development

Initial construction would also include excavating most of the extraction canal and recharge canals. The entire extent of the brine transfer canal and the Sevier River berm and diversion canal would also be constructed during the initial construction.

The majority (21.7 miles) of the extraction canal would be constructed during Years 1 and 2. When necessary, the extraction canal would be further excavated to the south to connect additional BMUs to the canal. Once complete, the extraction canal would be 25.5 miles long.

The entire extent (19.6 miles) of the brine transfer canal would be constructed during Years 1 and 2.

The recharge canals along both edges of the playa and the recharge collectors would be developed from the north to the south. Excavation would occur as needed to provide recharge water to the various BMUs throughout the life of the Project, extending the canals further south over time. During Years 1 and 2, construction would consist of approximately 66.1 miles of recharge canals. The entire extent of the recharge canals would be 68.8 miles.

Table 6-26, *Length of Canal by Type*, lists the footage and miles for each type of canal during initial construction and O&M.

Table 6-26. Length of Canal by Type

Area	Initial Construction		O&M		Total	
	feet	miles	feet	miles	feet	miles
Extraction canal	114,717	21.7	20,147	3.8	**134,864**	**25.5**
Brine transfer canal	103,577	19.6	–	–	**103,577**	**19.6**
West recharge canal	120,400	22.8	92,530	17.5	**212,930**	**40.3**
East recharge canal	123,000	23.3	27,243	5.2	**150,243**	**28.5**
Total	**461,694**	**87**	**139,920**	**27**	**601,614**	**114**

– = not applicable

The Sevier River diversion berm and diversion canal would be constructed during Year 1 to allow for recharge water to flow into the recharge canals and trenches.

6.5.5 Extraction Well Development

Starting in Year 5, extraction wells would be drilled as required. **Table 6-27**, *Wells and Footage by Year*, provides an estimate of the number of wells that would be drilled over the various periods.

Table 6-27. Wells and Footage by Year

Year	Wells	Footage
Year 5–6	169	14,552
Year 9–10	392	33,755
Year 11–12	404	34,788
Year 13–14	184	15,844
Year 17–18	1,026	88,347
Year 19–20	191	16,447
Total	**2,366**	**203,733**

Figure 6-37 illustrates the placement of the wells that would provide the initial SCZ brines, which would occur in Years 8 and 9. **Figure 6-38** depicts the placement and timing of well production for the 2,366 wells that would be installed over the life of the mine.

6.5.6 Processing Facility Development

The Processing Facility would be constructed during Year 3 with production of SOP beginning the following year.

6.5.7 Permitting and Construction Summary

A preliminary permitting summary is provided in **Table 6-28**, *Preliminary Permitting Schedule*.

Table 6-28. Preliminary Permitting Schedule

Permit	Description	Approval Date	Status
Air Permit	Approval for evaporation ponds, trench construction, Processing Facility construction,	Approval to be obtained before start of construction	In process
Fugitive Dust Control Plan	Materials movement; surface disturbance	Approval to be obtained before start of construction	In process
Water Appropriations	Water rights for operational needs for processing minerals, dust suppression, administrative office needs, and other industrial purposes	April 2014	Complete
UPDES	Stormwater permits for construction and operational activities	Approval to be obtained before start of construction	To be submitted nine months before start of construction
Groundwater Discharge Permit	Processing facility and evaporation ponds	Approval to be obtained before start of construction	To be submitted one year before start of construction

Permit	Description	Approval Date	Status
USACE 404 Permit	Jurisdictional Determination that the Sevier Playa is not a regulated feature under Section 404 of the Clean Water Act	June 2013	Jurisdictional Determination obtained in June 2013 was good for 5 years. In October 2017, Peak re-delineated the Sevier Playa, as well as other waters that may be affected by the Project. In April 2018 CPM received the Jurisdictional Determination for these features (USACE 2018).
State Stream Alteration Permit	Approval by UDWRi for alteration of the Sevier River channel to construct the Sevier River Diversion Berm and Canal features	Approval to be obtained before start of construction	Design to be finalized prior to construction
Antenna Structure Registration Notification to Federal Aviation Administration Form 7460-1	Microwave communication tower construction.	Approval to be obtained before start of construction	Design to be finalized prior to construction
New crossing application for rail crossing; application includes a plan of the development and engineering drawings Encroachment permit for rail crossing	Rail crossing	Approval to be obtained before start of construction	Design to be finalized prior to construction of the rail
Encroachment permit for crossing SR 257 Statewide utility license agreement for crossing SR 257	Pipeline construction across Utah State Route 257 (SR 257)	Approval to be obtained before start of construction	Anticipated submittal - June 2019

A timeline depicting the initial construction and O&M, as well as production of the various mine components, is presented in **Table 6-23**.

6.6 Mine Life and Operational Phases

Based on a minimum Project life of 30 years and production of approximately 328,490 ton/yr; with peak production of approximately 372,030 ton/yr declining to approximately 245,940 ton/yr; a total of about 10.2 Mton of SOP would be produced. Other potential associated mineral products are also likely to be produced such as magnesium chloride, calcium sulfate, and magnesium hydroxide.

As detailed above, initial construction and O&M would occur as necessary for each of the components throughout the life of the mine. If necessary, during operation throughout the life of the Project, if any sloughing occurs, the trenches and/or canals would be cleaned out to maintain adequate flow. Inspections would occur, as needed, to determine if the trench and/or canal require maintenance.

The goal is to produce adequate brine volume and concentration to the preconcentration ponds from multiple BMUs and extraction wells. The Project calls for approximately 30,000 gpm of brine at a potassium concentration of 0.298 Wt%; assuming 95% availability and year-round operation, resulting in 8,322 hours (346.75 days) per year. Mine operations would manage the BMUs so those parameters were met. Each BMU would step through multiple operational phases. Most of the BMUs would exhibit continuous operations. As the BMUs cycle through phases, individual units would be turned on, providing brine to the main extraction canal, or turned off to stop brine flow from the BMU to the

extraction canal. The connection to the extraction canal would be cut off by placing fill inside the trench. This would occur as necessary to manage the brine flow and grade reaching the preconcentration ponds.

For some BMUs, a multifunction extraction process called “sweep and rest” would be used. During this phase, extraction of brine from the extraction trenches continue until potassium concentration drops to an unacceptable level, at which time extraction from the BMU would be temporarily suspended. The extraction trenches would be closed temporarily stopping its connection to the extraction canal. For a time, the BMU would continue to receive recharge water from the recharge canal. Due to the head difference between the extraction and recharge trenches, water would move through the MCZ toward the extraction trenches. At some point, the brine level in the extraction trenches would reach the static level of brine in the formation, similar to the water in the recharge trenches. At that point, the delivery of recharge water would cease allowing the BMU to rest. During the rest period, a diffusion process would occur providing mass transfer of minerals from the higher concentration areas in the strata to the lower concentration of the extraction trench. Following the rest period, the BMU extraction trenches would again open to the extraction canal. This sweep and rest process would repeat until brine grade declines below the target value.

6.7 Production Rate

The Project has been designed to produce designed to produce average annual SOP production over the projected 30-year life of the Project of approximately 328,500 tons/yr; with peak production of approximately 372,000 tons/yr declining to approximately 246,000 tons/yr; of potash.

The potential for increasing the annual potash production rate is discussed in Section 8.0, *Ultimate Maximum Recovery*.

6.8 Estimated Recovery Factors and Mine Life

As discussed in Section 5.0, *Mineral Resource and Reserve Estimates*, there is sufficient sulfate present in the Sevier Playa brines to utilize all the potassium ions. Based on this fact, equivalent SOP from the measured plus indicated brine is calculated to be approximately 34.7 Mton.

Based on a Project life of 30 years and average annual SOP production of approximately 328,500 tons/yr; with peak production of approximately 372,000 tons/yr declining to approximately 246,000 tons/yr; a total of 10.2 Mton of SOP would be produced. The 30-year Project life was used for economic evaluation purposes.

The potential for increasing potassium recovery at Sevier Playa is discussed in Section 8.0, *Ultimate Maximum Recovery*.

6.9 Stripping Ratios

The Project mining process involves in-situ extraction of minerals from Sevier Playa sediments without the removal of any “overburden.” Therefore, the subject of stripping ratios is not applicable to the description of mining methods for this Project.

6.10 Mining Equipment

Mining equipment required during the initial construction and O&M of the Project comprises tracked excavators, road graders, dozers, drills, rollers, scrapers, loaders, personnel transports (snow cat and

pickup trucks), and water trucks. Preliminary lists of heavy equipment that would be used for mine initial construction and O&M are shown in **Table 6-29,** *Summary of Equipment Needed for Initial Construction of the Mining Project*, and **Table 6-30**, *Summary of Equipment Needed for O&M*, respectively. These lists may change over the course of Project construction and operation, depending on specific needs.

Equipment operated on the Sevier Playa surface would need to be equipped with low-ground-pressure tracks, or tires that exhibit reduced surface pressures, as needed. It has been demonstrated that for the excavation of extraction and recharge trenches, excavators equipped with tracked pontoons with ground contact pressures of 2.0 to 3.0 pounds per square inch [lb/in^2]) perform adequately and can also maneuver and operate while afloat. A Caterpillar Model 320 LR equipped with tracked pontoons has been used successfully to excavate test trenches, though it may be slightly underpowered for excavating at depths greater than 25 feet. Similar or larger excavators would be used during Project construction and operation. Dozers would be used in berm, road, and pond construction, along with maintenance of playa features.

A road grader would be used for several applications, including road surfacing, maintenance, and crude potassium ore harvesting. In the case of harvesting crude potassium ore, the grader would be used to windrow the potassium salts into manageable configurations that can be picked up by a scrapper for transport to the Processing Facility.

Numerous pumps would be required for the brine extraction/conveyance systems and the recharge canal and pipelines system, as previously described in Section 6.2.6, *Control Structures, Pipes, and Pumps*. A preliminary list of pump equipment that would be used for mining operations is shown in **Table 6-15.** During the Project's startup, the pumps would be powered by diesel generators until long-term power is connected. These generators are included in **Table 6-29**.

Table 6-29. Summary of Equipment Needed for Initial Construction of the Project

Equipment Type	On-Lease Equipment			Off-Lease Equipment					
	Preconcentration, Heel Brine and Production Ponds and Waste Product Storage Area	Trenches / Canals / Brine Piping*	Processing Facility**	Power and Communication Lines	Communication Towers	Propane and Natural Gas Supply	Rail Loadout Facility	Water Supply Wells and Distribution	Access Road Network***
Air Compressors	0	1	3	0	0	0	0	0	0
Backhoe/Excavator	7	6	2	2	1	6	2	1	2
Bobcats	1	2	5	0	0	0	0	0	0
Boom truck	0	0	3	0	0	0	0	0	0
Cranes	1	2	3	4	1	2	2	0	0
Dozers	2	2	3	2	1	4	2	0	2
Drill rigs	0	0	2	0	0	0	0	1	0
Equipment Transport	5	6	6	3	1	2	3	0	2
Forklifts	0	0	3	0	0	0	0	0	0
Fuel Tanker	0	0	0	0	0	0	1	0	0
Generators	1	1	4	0	0	0	0	0	0
Graders	2	1	1	1	0	0	1	0	1
HDD Drilling/Boring Machine	0	0	1	0	0	0	0	0	0
HDPE Pipe fusing machine	0	0	1	0	0	0	0	0	0
Heaters and Fans	0	0	4	0	0	0	0	0	0
Light towers	6	10	12	0	0	0	0	0	0
Loaders	1	2	2	3	0	6	3	1	1
Lifts	0	1	8	0	0	0	0	0	0
Personnel transport	7	7	7	0	0	0	0	0	0
Pickup Trucks	3	3	5	11	1	26	11	2	4
Pipelayers	1	2	0	0	0	10	0	0	0
Portable pumps	2	4	1	0	0	0	0	0	0
Rollers	2	1	2	0	0	0	0	0	1
Sweepers	0	0	1	0	0	0	0	0	0
Water Tanker	0	0	0	1	0	1	0	0	1
Welding Trailer	0	0	0	0	0	4	0	0	0
Total	**41**	**51**	**79**	**27**	**5**	**61**	**25**	**5**	**14**

* Includes the Recharge Canal Segments and Recharge Collectors, and the Brine Transfer Canal Segments

** Includes the Haul Road and Haul Road Spur roads to the production ponds and waste product storage area

*** Includes the Perimeter Road (both on-lease and off-lease)

Table 6-30. Summary of Equipment Needed for Operations and Maintenance

Equipment Type	For Use in All Project Areas (not assigned to a specific area, can be relocated throughout)	On-Lease Equipment					Off-Lease Equipment*	
		Well Drilling	Preconcentration Ponds / Trenches / Canals	Equipment Transport	Waste Product Storage Area	Production Ponds	Rail Loadout Facility	Access Road Network**
Backhoe / Excavator	1	0	1	0	0	0	0	2
Bobcat	1	0	0	0	0	0	0	0
Dozer	1	0	0	0	0	0	0	2
Drill rig	0	2	0	0	0	0	0	0
Drill transport pontoon	0	0	0	2	0	0	0	0
Flatbed truck / Equipment Transport	1	0	0	0	0	0	0	2
Fuel tanker truck	1	0	0	0	0	0	1	0
Haul Truck Tandem Dump Trailers	0	0	0	0	0	7	5	0
Haul Trucks	0	0	0	0	0	6	5	0
Light towers	0	0	0	0	0	0	0	0
Loaders / Graders	1	0	2	0	1	5	1	1
Maintenance truck	1	0	0	0	0	0	0	0
Personnel transport	3	0	0	0	0	0	0	0
Pickup trucks	8	0	0	0	0	0	1	0
Portable Enclosed Conveyor	0	0	0	0	0	0	2	0
Portable genset	5	0	0	0	0	0	0	0
Portable light towers	2	0	0	0	0	0	0	0
Rollers	0	0	0	0	0	0	0	1
Scissor lift	1	0	0	0	0	0	0	0
Utility pontoons	0	0	0	1	0	0	0	0
Water tanker truck	2	0	0	0	0	0	0	1
Water/Brine truck	1	0	0	0	0	0	0	0
Welding trailer	2	0	0	0	0	0	0	0
Total	**31**	**2**	**3**	**3**	**1**	**18**	**15**	**9**

* Operations and maintenance equipment needed for the power and communication lines, communication towers, propane and natural gas supply, and the water supply wells and distribution would be provided by the equipment listed in the All Project Areas column

** Includes the Perimeter Road (both on-lease and off-lease)

6.11 Water Management during Construction and Operations

A surface water management system may need to be employed to construct various mine components during periods when excess water can accumulate on the Sevier Playa. However, it is anticipated that pooled water on the playa would not impact construction activities.

Pursuant to the BLM letter, dated July 1, 2013, which provided comments on the initial May 20, 2013, submission of the Project Mining Plan, a *Stormwater Pollution Prevention Plan* (SWPPP) (CMP 2018b) is required prior to potential complete approval of the Mining Plan. As the project is located in a terminal surface water basin, CPM is holding on-going discussions with the DWQ to determine the requirements for storm water permitting.

6.12 Mining Operations

Operations on the playa would occur primarily during daylight hours, although the Processing Facility would be operated 24 hours a day for most days of the year. Trucks transporting materials from the Processing Facility to the Rail Loadout Facility, primarily during daylight hours (two eight-hour shifts), and the Rail Loadout Facility, would conduct operations day or night, depending on the material transport timing to rail car and market. Lighting at the Processing Facility and rail yard would be limited to areas inside or immediately around the buildings and would include downward reflecting shades. Peak's federal lease, Special Stipulation 17 states the following:

> Lighting: The operations plan shall describe the measures that the operator/ lessee will take to minimize the amount of light that will be produced. These shall include but not be limited to lighting shield, directional lighting and use and placement of portable lights. The AO may require a night sky model. (BLM 2011c)

No lights would be on the playa during night hours, except at the pump stations, which would be turned on when necessary. These lights would be limited to the facilities and would include shades to focus light downward.

As necessary, Project operations would be required to maintain the side-slopes, berming, and access to pond and trench areas. Based on the results of routine inspections, maintenance operations would dredge ditches and trenches and fortify berms, as needed. Dredging could occur as often as once every 2 to 3 years in high-maintenance trenches and every 5 to 10 years in low-maintenance ditches. The primary purpose of the maintenance dredging program is to support excavation stability and to ensure a continuous flow of brine throughout the trench and ditch systems.

6.12.1 Water

Operation of the Project would require a brine extraction rate of about 29,946 gpm, or 48,339 ac-ft/yr. Extracted brine would need to be replaced at a 1:1 ratio with recharge water. Therefore, about 48,339 ac-ft/yr of recharge water would need to be delivered to balance extraction. The Sevier Playa has no perennial streams. The water that collects on the playa comes from precipitation, runoff, and terminal flow from the Sevier River. It is presumed that 100% of Sevier River inflow, as well as runoff from other drainages that flow onto the Sevier Playa would be diverted into recharge canals and trenches to provide recharge for the Project.

Sevier Playa Potash Project Feasibility Study – Water Balance Model Report (CH2M 2017b) evaluated the contribution of Sevier River surplus water, local watershed runoff, ponded precipitation, and mountain block recharge toward the total required volume of 48,339 ac-ft/yr during the 31 years for which data were available (1985–2015). During approximately 75% of the years studied, CPM would have had to purchase or lease water rights and convey those waters down the Sevier River to the playa to meet the Project's recharge water needs. Based on CH2M's estimates, and assuming no transmission losses, the amount of water that CPM would need to purchase and convey to the Sevier Playa ranges from 16,413 ac-ft/yr to 44,407 ac-ft/yr with an average of 35,164 ac-ft/yr. Leased or purchased upstream water would be conveyed to the site via the Sevier River. After accounting for anticipated transmission losses, CH2M estimates that CPM would need to lease or purchase and convey an average volume of 50,234 ac-ft/yr from upstream sources (CH2M 2017b).

Project operations would consume approximately 1,500 ac-ft/yr or 922 gpm of fresh water from the proposed freshwater wells identified in Section 6.2.7.1, *Water Supply and Distribution.* These wells are located on BLM-administered and SITLA lands, as shown in **Figure 6-29** and described in the POD (CPM 2018e). Annual water consumption would include the use of process water for production at the Processing Facility and potable water and service water for use at the Processing Facility and Rail Loadout Facility. There would be an initial fill of the 634,000-gallon fire-suppression water storage tank at the Processing Facility and the 500,000-gallon fire-suppression water storage tank at the Rail Loadout Facility. Once filled, these tanks would be periodically topped off as needed but would not require any considerable ongoing annual demand.

6.12.2 Fuel Storage

On-site vehicle fuel storage would be limited to that required for haul trucks and site vehicles and would be located in an aboveground storage tank near the truck shop located at the Processing Facility. A bulk fuel-storage site would be located within the perimeter security fence at the Processing Facility. The fueling station would service light-duty vehicles and would also be used to fill 1,500-gallon or smaller mobile tanks mounted on trucks to transport fuel to heavy equipment used in construction and operations allowing them to be refueled in place. The fueling station would consist of two petroleum fuel tanks, 25,000 gallons each, located within secondary containment near the truck shop. Delivery of fuel would likely be contracted with a local supplier. The *Spill Prevention, Control and Countermeasures Plan* (SPCC Plan) (CPM 2018l) for the Project would ensure protection of surface and ground water resources, prevent spills of petroleum products, and identify response procedures. Additional temporary fuel tanks, provided by construction contractors, would be required during construction. These mobile tanks would be used to fuel equipment on the playa and would have adequate secondary containment required under 40 CFR 112, and would be included as part of the SPCC Plan.

During the first 5 years of operation, the Project would operate using propane gas instead of natural gas. CPM proposes to truck propane in liquefied form, known as liquefied petroleum gas (LPG), to the site for on-site storage in a 60,000-gallon storage tank. The maximum monthly requirement of propane would be 107,000 gallons. The proposed 60,000-gallon storage tank would be installed aboveground at the Processing Facility, as shown in **Figure 6-25**. This tank's capacity is in excess of the 48,000 gallons needed to supply Project operations for 2 weeks during the higher-usage winter months.

The storage tank would be located within the perimeter security fence that surrounds the Processing Facility. The ground surface surrounding the tank location would be cleared, leveled, and covered in gravel, allowing vehicle access to the propane storage tank. The tank would be constructed out of high-strength steel and would measure approximately 90 feet in length × 12 feet in diameter. Including

support structures, the storage tank would not exceed a height of 17 feet. The storage tank would be manufactured and constructed in accordance with applicable code and standards of the American Society of Mechanical Engineers and have a design pressure rating of 250 lb/in^2.

The proposed propane pipeline would be a buried 8-inch-diameter pipeline able to supply the Processing Facility requirement of 2,700 gpd of propane gas. The 0.25-mile-long pipeline would connect the propane storage tank to the west side of the wet plant building at the Processing Facility. Consistent with construction methods described for the Natural Gas Pipeline in the POD (CPM 2018e), the pipeline would follow the natural ground surface and would generally be buried at a depth of 3 to 6 feet. Backfill would be with native material unless the material is too rocky, in which case the trench would be filled with imported, suitable fines. The footprint of the pipeline would be leveled and covered in gravel, consistent with the proposed gravel surface of the Processing Facility. The propane pipeline would be located entirely within the SITLA lease parcel for the Processing Facility and would not require a ROW on BLM-administered land.

Propane gas would be transported by truck to the propane storage tank as LPG. The propane would be transported to the Processing Facility using either a highway transport truck or a smaller bulk delivery truck (referred to as a "bobtail"). The highway transport truck carries a maximum capacity of 12,000 gallons (51,000 pounds) while the bobtail has a maximum capacity of 5,000 gallons (21,000 pounds). Approximately eight truck shipments of LPG would be required per month.

For the initial 5 years of operation, propane would also be trucked to the Rail Loadout Facility to provide heat. A 500-gallon aboveground propane storage tank would be located at the Rail Loadout Facility. The tank dimensions are 10 feet in length × 3 feet in diameter.

6.12.3 Waste Management

Solid wastes that may be generated include various chemicals or wastes from the Processing Facility or from maintenance activities as detailed in Section 9.1.2, *Potential Pollutants*. Additionally, solid waste would be generated from the site workers and administrative operations. All solid waste would be collected, stored, and properly disposed of in a permitted Resource Conservation and Recovery Act (RCRA) landfill. The *Solid and Hazardous Waste and Hazardous Material Management Plan* (CPM 2018m) would provide details regarding waste disposal handling procedures.

The amount of hazardous waste, such as spent solvents, that would be generated is expected to be minimal and would be stored properly while on-site and then documented, transported, and disposed of in accordance with RCRA and UDOT standards. Documentation of hazardous substance disposal would be maintained for reporting to the BLM Fillmore Field Office and inclusion in the waste certification required by Special Stipulation 3, which specifically states the following:

> Waste Certification: The lessee shall provide upon abandonment and/or sealing off a mined area and prior to lease termination/relinquishment, certification to the lessor that, based upon a complete search of all the operator's records for the mine and upon their knowledge of past operations, there has been no hazardous substances per (40 CFR 302.4) or used oil as per Utah State Management Rule R-315-15, deposited within the lease, either on the surface or underground, or that all remedial action necessary, including disposal in an appropriately permitted disposal facility, has been taken to protect human health and the environment with respect to any such substances remaining on the property. The back-up documentation to be provided shall be described by the lessor prior to the first certification and shall include all documentation

> Miapplicable to the Emergency Planning and Community Right-to-know Act (EPCRA, Public Law 99-499), Title III of the Superfund Amendments and Reauthorization Act of 1986 or equivalent. *All waste must be removed and all hazardous materials used or produced must be reported to the Fillmore Field Office. (BLM 2011c)

Stormwater and Sanitary Sewage Facilities. The Processing Facility would have a maintenance area where occasional vehicle washing would occur. This area would service and maintain smaller vehicles (e.g. pick-up trucks). The wash down water would be collected and filtered, as discussed in the Project's SWPPP (CPM 2017a). The water collected could be returned to the process. There would not be a wash down station on the Playa. Sewage from the Processing Facility, administrative building, and truck shop would be managed using a permitted leach field. The Waste Water System permit for the leach field, and septic system would be coordinated with the Central Utah Public Health Department. During construction, portable toilets would be provided for the construction crew, and sanitary waste would be periodically removed by a licensed hauler to an existing municipal sewage treatment facility.

6.12.4 Product Transport Logistics

The Rail Loadout Facility would be constructed and operated as described in the POD (CPM 2018e). In addition to rail transport of product, CPM plans to ship small quantities of product by truck to locations within the United States. This would occur when a quantity of product is needed on a timeline or at a destination that is not suitable for routine rail shipment. Up to 50,000 tons annually may be transported by truck.

Trucks in a single-trailer or double-trailer configuration would each carry up to 51 tons per shipment. With an empty-vehicle weight of 12.5 tons, fully-loaded vehicles would weigh up to 63.5 tons gross vehicle weight (GVW). Final truck destination would vary widely within Utah and throughout the United States, based on demand. If bridges are crossed, a permit from the UDOT would be required for use of state roads. Such a permit would allow transport of up to 129,000 pounds (64.5 tons) GVW.

Up to 1,000 trucks per year, or as many as three to four trucks per weekday, on average, could transport product from the site.

6.12.5 Mining Compliance and Inspection Plan

CPM would develop and implement a Mining Compliance Inspection Plan (MCIP) prior to Project construction commencement. The MCIP would address compliance and inspection activities in support of the non-environmental elements of the Mining Plan. The MCIP would be applicable for the on-playa and off-playa mining features during the construction, operation, maintenance, and reclamation activities.

(A draft version of the Mining Compliance and Inspection Plan will be provided at a later date.)

6.12.6 Environmental Compliance Inspection Plan

CPM would develop and implement an *Environmental Compliance Inspection Plan* (ECIP) (CPM 2018j) to address environmental compliance with the terms, conditions, and stipulations of the Final EIS, the ROD, ROW grants, the POD, supplemental plans, NTPs, and the environmental elements of the Mining Plan. The ECIP would be applicable Project-wide; to all jurisdictional permitting entities and landowners as the

Project would cross federal and state lands as well as lands owned privately. The ECIP would provide how environmental compliance for mining and ROW activities as well as ROW Project facilities inspection would occur during the construction, operation, maintenance, and reclamation.

A third-party Compliance Inspection Contractor (CIC), in coordination with the BLM, would implement the ECIP for the construction of applicable Project facilities. A CIC may also be used for certain activities during operation, maintenance, or decommissioning of the Project, depending on the complexity of those activities and availability of BLM staff. On federal lands, the CIC would inspect and monitor pre-construction and construction activities, as well as enforce the terms and conditions of the BLM's right-of-way grants. On non-federal lands, the CIC would inspect and monitor pre-construction and construction activities, document disturbance of the entire Project on all lands analyzed in the Final EIS and enforce requirements related to BLM responsibilities under the National Historic Preservation Act (NHPA) and the Endangered Species Act (ESA).

6.12.7 Disturbance over the Life of Project

Disturbance over the life of the Project is quantified in **Table 6-31**, *Project Disturbance*.

Table 6-31. Project Disturbance

(Table 6-31, Project Disturbance, to be added at a later date.)

7 Recovery Methods

The proposed process for the conversion of Sevier Playa brine into SOP would use operations commonly employed in the potash and soda ash industry and is detailed in the following sections. The basic process is outlined in **Figure 7-1** and would consist of the following steps:

1. Solar evaporation ponds and precipitation of salts
2. Process feed
3. Conversion
4. Conditioning and Flotation
5. Schoenite Leach
6. Tailings Leach
7. SOP crystallization
8. Drying, handling and shipping
9. Associated minerals

Playa brine would be collected from extraction trenches and extraction wells and pumped into a series of solar evaporation ponds. Water would be evaporated from the brine, and salts would be selectively crystallized onto pond floors, as described in Section 6.2, *Mine Layout and Design*. The potash-rich salts would be harvested and fed to the Processing Facility. The potassium rich salts would be converted to schoenite and fed to the flotation circuit. Flotation would separate schoenite from halite, epsomite, and other minor materials.

The flotation concentrate solids would be sent to SOP crystallizers. MOP, which contains potassium chloride, and water are added to the schoenite crystals to produce SOP through the following reaction:

$$2KCl_{(aq)}+MgSO_{4(aq)} \rightarrow K_2SO_{4(s)}+MgCl_{2(aq)}$$

The MOP increases the crystallizer recovery by converting some of the incoming $MgSO_4$ to SOP and $MgCl_2$. The dried SOP crystals would be screened and sized to meet desired specifications. Process steps are illustrated in **Figure 7-1**.

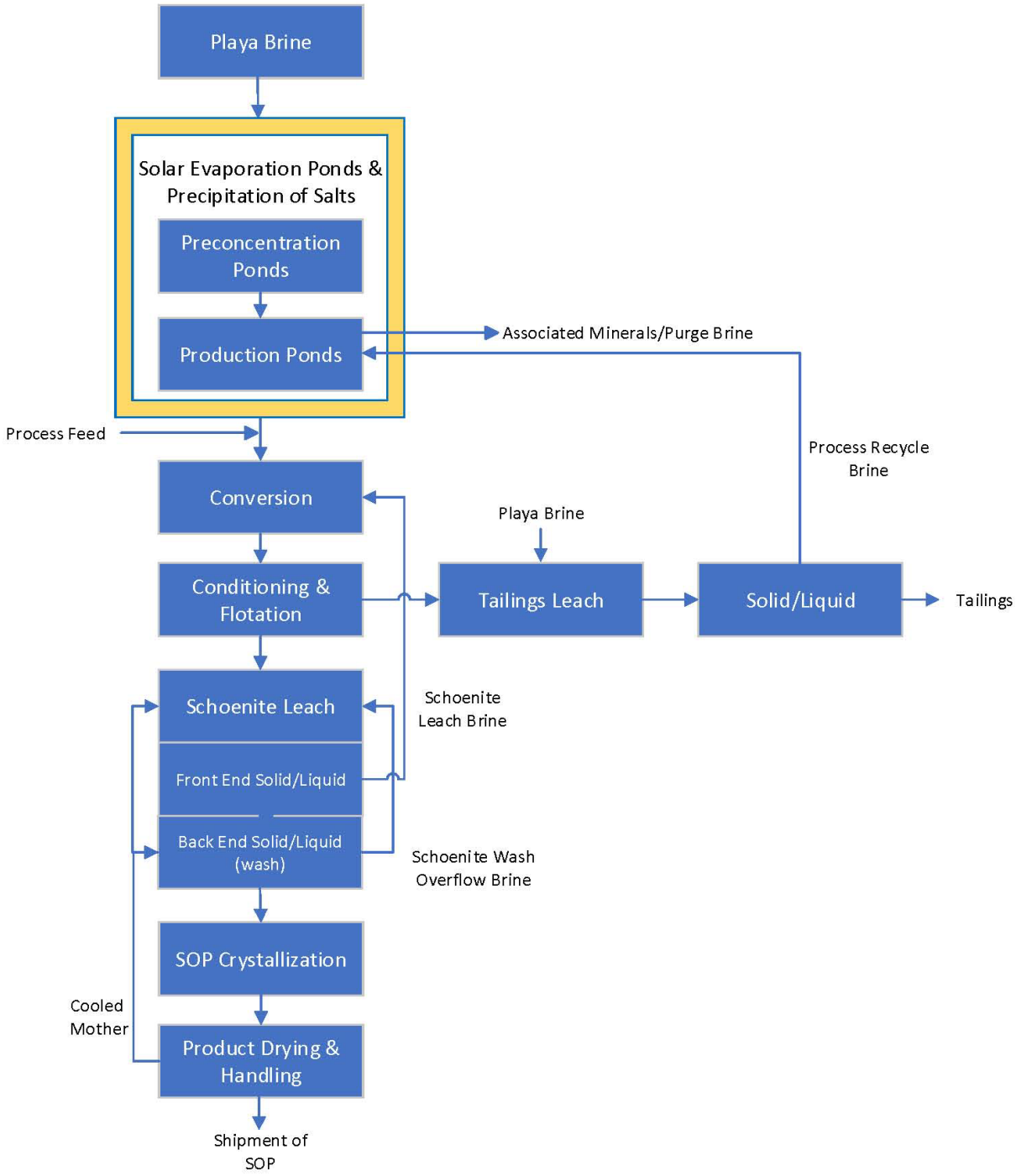


Figure 7-1. Process Overview.

7.1 Solar Evaporation Ponds and Crystallization of Salts

The playa brine would be concentrated to facilitate the precipitation of potassium bearing salts for harvesting as feed material and subsequent processing into SOP. The concentration would be accomplished by solar evaporation within a series of preconcentration and production ponds. The preconcentration ponds allow for the precipitation of the majority of the halite, minimizing the coprecipitation of halite with potash salts in subsequent production ponds. Additional information related to the evaporation ponds is included in Section 6.2, *Mine Layout and Design*.

Brine concentration in each pond has a specific target and would result in the optimal pond area to achieve the desired evaporation. Over time, solar evaporation would crystallize several dissolved salts that are likely to include the following:

- Halite
- Bloedite
- Gypsum
- Polyhalite
- Schoenite
- Kainite
- Slyvite
- Carnallite
- Thenardite
- Magnesium sulfate (hexahydrite or epsomite)

7.1.1 Preconcentration Ponds

Following the collection of brine from trenches and wells, preconcentration ponds would concentrate the brine up to the first potassium-bearing minerals saturation point. Each pond would act as an evaporator which, through selective precipitation and the gradual removal of water and impurities, such as sodium chloride, would concentrate potassium in the brine. Brine would be pumped from the preconcentration ponds into production ponds just prior to potassium salts becoming saturated.

7.1.2 Production Ponds

Production ponds would bring the brine to saturation with respect to potassium salts and deposit those salts for harvesting as process feed material. The brine from the preconcentration ponds would be transferred to the production ponds just before the point of saturation with potassium-bearing salts. Evaporation would continue within the first production pond (H1), crystallizing schoenite, halite, and epsomite until the brine becomes saturated with respect to sylvite when the brine would be transferred to Pond H2. The sylvite salts would be crystallized within the second production pond (H2) and deposited on the pond floors. In the third pond (H3), more halite and carnallite would be crystallized.

The fourth and final production pond (H4) would crystallize carnalite, halite, and epsomite/hexahydrite up until the $MgCl_2$ concentration reaches 30 Wt%. The ponds would be configured as follows:

1. Brine would be concentrated in the preconcentration ponds almost to the point of potassium saturation. Halite would crystallize during this process. Solution at the outlet of these ponds would be pumped into the brine transfer canal and sent to the production ponds.
2. The first production pond, H1, would be the mixed salts pond where further evaporation would crystallize a suite of minerals, principally halite, epsomite, and schoenite. Process recycle brine would be added to preconcentrated brine and mixed in the Brine Feed Sump before being pumped into pond H1.
3. The outlet solution from Pond H1 would flow via a weir to Pond H2. There, halite, sylvite, and epsomite would crystallize. The outlet of Pond H2 would flow via a weir to Pond H3.
4. Within Pond H3, carnalite, epsomite/hexahydrite, and halite would crystallize. The outlet of Pond H3 would flow via a weir to Pond H4.
5. Pond H4 is the final production pond and is expected to crystallize carnalite, epsomite/hexahydrite, and some halite. The mineralogy is the same as Pond H3. The solution would be concentrated up to 30% $MgCl_2$, where the brine would then be pumped to the Purge Brine Storage Pond. Small amounts of MgSO4, NaCl, and KCl is also found in the purge brine.

7.2 Process Feed

So the Processing Facility can operate year-round, the four production ponds would be divided in four separate cells (discussed above in Section 6.2.5.4) for a total of 16 cells. This configuration would eliminate the need for a harvested salts stockpile at the Processing Facility instead allowing the salts to be stored in the 16 cells and then hauled and directly fed into the Processing Facility. Each train, consisting of four cells (for example, H1-A, H2-A, H3-A and H4-A), would be drained and harvested separately. Once all four cells in a train are drained (the purge brine drained into the purge brine canal and then piped to the purge brine storage ponds), the salts from the train would be harvested and fed to the Processing Facility. Graders would scrape the pond salts into windrows, where loaders would collect them and load them into tandem dump trucks that would haul the salts to the Processing Facility.

Raw potash salts from the tandem dump trucks would be deposited into a hopper-feeder. The feeder would direct the raw salts onto a conveyer belt that would feed a single-pass impact crusher. The crushed material would be sent to a pump box where it would be slurried with process brine and pumped into the conversion reactor.

7.3 Conversion Reactor

The purpose this step is to convert all potassium salts into schoenite using a stirred tank. By converting the salts, flotation is simplified since it only has to target one potassium-containing mineral.

The conversion would occur in two reaction vessels set in series. Crushed material would be slurried with process brine from the schoenite-leach reactor. The temperature is controlled to ensure that the only potassium-containing species that crystallizes is schoenite. Technically defined as a precipitation reaction, all the potassium-containing minerals would dissolve when slurried with the schoenite-leach process brine. However, because the brine chemistry is designed so that schoenite is not soluble, the excess magnesium, potassium, and sulfate that entered the brine from the mixed salts would immediately crystallize as schoenite. However, since magnesium sulfate would be in excess for this reaction, some epsomite would also crystallize in this step.

Exiting the conversion reactor would be a slurry of halite, epsomite, and schoenite. This slurry would be pumped to the flotation conditioning tanks.

7.4 Conditioning and Flotation

The flotation circuit is designed to separate schoenite from halite and epsomite. The conversion slurry would be pumped into the first of two conditioning tanks. The flotation extender, frother, and collector would be added to the first tank. Refer to Section 9.1.3 for a list of chemicals used at the Processing Facility. The second tank increases retention time of the slurry and prevents short circuiting of the material.

The conditioning circuit provides time for the flotation chemicals to bond completely with the schoenite. Conditioned solids are fed to two flotation trains for a total of 14 rougher cells. Schoenite concentrate would be pumped to the schoenite leach step and tailings would be pumped to the tailing leach step.

7.5 Schoenite Leach Reactor

The schoenite concentrate slurry from the flotation circuit is pumped to the schoenite leach reactor where it is mixed with crystallizer mother liquor. The main purpose of this operation is to leach any remaining halite or epsomite from the schoenite prior to the final crystallization operation. Excess halite and epsomite would decrease recovery, increasing water usage. The leached schoenite slurry would be fed to a solid-liquid separation step where the entrained brine would be replaced with crystallizer mother liquor. The clean schoenite solids would be fed to the SOP crystallizer.

The schoenite leach reactor is also the point in the process where the crystallizer mother liquor is cooled to the optimal process temperature. This cooling crystallizes additional schoenite in the leach reactor that would be fed back to the SOP crystallizer. Refer to Section 9.1.3 for a list of chemicals used at the Processing Facility.

7.6 Tailings Leach

The tailings slurry from the flotation circuit would be pumped to two leach tanks. There, the flotation slurry would be mixed with enough playa brine to dissolve any schoenite that was sent with the flotation tails. After leaching is complete, process recycle brine would be sent back to the production ponds while the remaining halite and epsomite would be sent to the Tailings Storage Area. This operation ensures that no schoenite would be lost to tailings and helps maintain high potassium recovery. The tailings leach pipeline (see **Figure 6-2**) would carry playa brine to the Processing Facility for this operation. The use of playa brine in the tailings leach operation reduces the need for fresh water during processing.

7.7 SOP Crystallization

The washed schoenite cake is fed to an SOP crystallization vessel where it is mixed with fresh water and MOP. The MOP would react with $MgSO_4$ and crystallize as additional SOP. This allows for the optimization of $MgSO_4$ from the resource by converting it into the more valuable SOP product. The additional $MgCl_2$ produced in this reaction may also be sold. The addition of fresh water to the crystallizer is determined by phase chemistry equilibrium data.

7.8 Product Drying, Handling, and Shipping

The product exiting the SOP crystallizer circuit would be dried and screened to specification to produce the desired fertilizer products. Fertilizer-grade SOP would be produced as standard, granular, and soluble grades.

Standard product would be screened material from the crystallizer while granular SOP would be produced in a compaction circuit. To achieve the highest purity, the soluble product would be produced by crushing oversized SOP crystals.

The products are stored in bins on-site and would be trucked to storage at the Rail Loadout Facility.

7.9 Associated Minerals/Purge Brine

Magnesium chloride would be produced naturally in the ponds system as well as through the addition of potassium chloride to the crystallizer. In the ponds, magnesium chloride would be concentrated to approximately 30 Wt% at which point it would be transferred to the Purge Brine Storage Pond. This brine could be pumped directly into tankers for sale. Should the market so demand, a low-sulfur magnesium chloride product could be produced through the addition of lime.

8 Ultimate Maximum Recovery

Opportunities to increase the recovery of Sevier Playa minerals include increasing the potash production rate, optimizing brine resource extraction, and producing associated minerals. Implementation of these additional options would require further analysis, approvals, and/or permits.

8.1 Increased Potash Production Rate through Enhanced Aquifer Recharge

The anticipated SOP production rate for the Project as proposed is limited by recharge to the brine aquifer from precipitation and inflow from Sevier River. The potential for enhancing aquifer recharge by enhancing the infiltration of precipitation into the brine aquifer and/or by enhancing Sevier River recharge to the playa is discussed in Section 6.2, *Mine Layout and Design*.

Based on data collected to date, there is adequate recharge water available to support the proposed peak production rate of approximately 372,000 tons/yr of SOP. In addition to the existing water that reaches the playa, and as discussed in detail in Section 6.2.4.1, CPM may lease or purchase upstream Sevier River water and convey it to the playa. CPM would need an average flow of about 50,234 ac-ft/yr and a maximum flow of about 69,000 ac-ft/yr from these upstream sources (CH2M 2017b; SWCA 2017a). If studies suggest that affordable recharge water beyond this amount is available, annual potash production rates could be increased.

8.2 Resource Optimization

The amount of recoverable resource has been estimated based on current extraction and pond design, as well as current understanding of the brine aquifer. Methods and processes to optimize extraction and processing would continue as additional data are collected. Several options, which have not been presented because they require additional fieldwork and study, would continue to be evaluated to confirm viability and economical benefit.

The current plan assumes that brine would not be extracted from under preconcentration and production ponds. However, recovery of the resources may be possible in the future with the construction of extraction trenches in these areas once the resource from the rest of the playa is depleted. New ponds would need to be constructed where the resource had been extracted. The new trenches would not only access brine that was originally beneath the ponds but would also extract the higher-concentration brine that would have leaked out of the ponds over the life of the Project.

Based on current understanding of the playa brines and on the current process design, the potential exists for the production of associated minerals (discussed in Section 7.9, *Associated Minerals*). Potential associated mineral products include SOP magnesia, magnesium sulfate, bromine, and other beneficial minerals. Determination of the specific types and amounts of associated minerals that might be produced would require completion of additional process test work.

9 Environmental Factors

CPM is committed to ensuring public, worker, and environmental health and safety throughout all aspects of work. In order to document the steps CPM would take, the Company has developed plans to address specific resource issues and management requirements. These framework plans include the following:

- *Adaptive Wildlife Management Plan* (AWMP) (CPM 2018k)
- *Blasting Plan* (CPM 2018o)
- *Cultural Resources Plan* (CPM 2018p)
- *Environmental Compliance Inspection Plan* (ECIP) (CPM 2018j)
- *Fugitive Dust Control Plan* (CPM 2018f)
- *Noxious Weed Management Plan* (CPM 2018h)
- *Reclamation Plan* (CPM 2018c)
- *Site Safety Plan* (CPM 2018q)
- *Solid and Hazardous Waste Management Plan* (CPM 2018m)
- *Spill Prevention, Control, and Countermeasures (SPCC) Plan* (CPM 2018l)
- *Stormwater Pollution Prevention Plan (SWPPP)* (CPM 2018b)
- *Transportation and Traffic Management Plan* (CPM 2018n)
- *Water Monitoring Plan* (CPM 2018r)

Each plan supplements the information and requirements contained in the EIS, the Mining Plan, and the POD (CPM 2018e) and is incorporated into these documents by reference. Some of these plans contain mitigation measures or best management practices that are in addition to the measures listed in the POD and EIS. CPM would be responsible for finalizing each of these plans, including addressing any requirements identified by the BLM during the EIS process prior to any surface disturbing activities associated with the Project.

9.1 Water Use and Potential Pollution

9.1.1 Dust Suppression

Roads and disturbed areas would be treated with water and/or chemical dust suppressants as conditions warrant. Dust suppression water options may include the following:

- Water acquired from existing permitted sources
- Water from freshwater wells
- Recharge water
- Playa brine

Dust control options during operations are detailed in **Table 9-1**, *Dust Control Options* and as described in the *Fugitive Dust Control Plan* (CPM 2018f).

Table 9-1. Dust Control Options

Location			Fresh Water	Commercial Dust Suppressant*	Purge Brine	Raw Brine
On lease	On-playa	On-road	✔	✔	✔	✔
		Off-road	✔	✔	✔	✔
	Off-playa	On-road	✔	✔	✔+	
		Off-road	✔			
Off-lease	On-playa	On-road	✔	✔	✔	✔
		Off-road	✔	✔	✔	✔
	Off-playa	On-road	✔	✔	✔+	
		Off-road	✔			

Note: Lime chips would be an available option, but only on Crystal Peak Road and Crystal Peak Spur Road (both on- and off-lease).

* Commercial $MgCl_2$ or other agency-approved, commercially available dust suppressant or soil stabilizer.

+ Purge brine may be approved by BLM for use on off-playa roads following testing by CPM.

9.1.2 Water Rights

The water rights presented in **Table 9-2**, *Approved Water Rights Applications by the Utah Division of Water Rights*, were issued by the State Engineer's office on April 30, 2014. The brine, river water, and groundwater would be used to support mining operations including brine extraction, recharge of the Sevier Playa with water from the Sevier River, and brine and groundwater used to support operational needs, administrative offices, dust suppression, construction of berms, equipment washing, and other purposes.

Table 9-2. Approved Water Rights Applications by the Utah Division of Water Rights

Water Right Number	Amount Water (ac-ft/yr)	Water Source	Ownership
69-106	1,000	Freshwater: Sevier River and underground wells	EPM
69-110	20,000	Brine water	EPM
69-111	500	Freshwater-Groundwater	EPM
69-112	222,000	Brine water	Peak
69-113	28,000	Brine water	LUMA and Peak
69-117	250,000	Sevier Lake and ephemeral stream	Peak

9.1.3 Potential Pollutants

Potential chemical sources include mining construction and operation equipment, fueling station, truck shop, and the Processing Facility.

A bulk fuel-storage site would be located within the perimeter security fence at the Processing Facility. The fueling station would service light-duty vehicles and would also be used to fill 1,500 gallon or smaller mobile tanks mounted on trucks that would transport fuel to heavy equipment to be refueled in place.

The fueling station would consist of two 25,000-gallon petroleum fuel tanks, each located within secondary containment near the truck shop. Delivery of fuel would likely be contracted with a local supplier. The SPCC Plan for the Project describes operating procedures to ensure protection of surface and ground water resources, prevent spills of petroleum products, and identify spill response procedures (CPM 2018f).

There would be various oils, fuels, and solvents stored in the truck shop.

The Processing Facility would use the following chemicals:

- Flotation collector: Clariant Flotigam 8122 would be injected to flotation feed, with a dosage of up to 272 g/ton of the dry solids feed. The dry mass flotation feed is 1,975,030 tons/yr, which translates into 436 tons/yr of collector.
- Flotation Extender: Kerosene would be injected to flotation feed with a dosage of up to 73 g/ton of the dry solids feed. The dry mass flotation feed is 1,975,030 tons/yr, which translates into 159 tons/yr of extender.
- Flotation frother: Methyl isobutyl carbinol would be injected to the dry flotation feed, with dosage of approximately 18 g/ton of the dry solids feed. The dry mass flotation feed is 2,177,097 tons/yr, which translates into 109 tons/yr of frother.
- Anti-dusting agent: Anti-dusting oil is added to the product at loadout to prevent dust formation during transport and handling. The anti-dusting agent is a mineral oil (the same or equivalent to RHT22-85, supplied by the Commercial Oil Company). The dosage of oil is 0.1% oil for all SOP produced, which yields a consumption rate of 84 pounds per hour, which would be applied throughout the 7,880 operating hours of the Processing Facility. Based on this application rate, 331 tons/yr would be required.
- Potable water treatment: Sodium hypochlorite would be required for the water decontamination process for potable water supply. The quantity required would be in order of 10 gph or 78,800 gallons per year for the entire project.
- Methanol waste from the process laboratory. Methanol is used to wash brine from various mineral samples prior to analysis. This waste is collected and stored for disposal. It is estimated that the yearly usage of methanol would not exceed 55 gallons.

None of these chemicals are listed hazardous substances/wastes. Wastes would be handled and disposed of as detailed in the *Solid and Hazardous Waste Management Plan* (CPM 2018m).

Purge brine, which contains high concentrations of dissolved magnesium chloride with low levels of potassium, would be removed pre-harvest from the final evaporation pond stage and pumped to the Purge Brine Storage Pond located in the Waste Product Storage Area.

Filter Cake Tailings generated from the Processing Facility would consist of a high solids concentration of halite, epsomite, and schoenite, as well as other impurities. Transportation of the Filter Cake Tailings from the Processing Facility to the Tailings Storage Area would be via the same trucks transporting harvested salts to the Processing Facility.

A complete list of chemicals used at the Project would be identified in the final design phase of the Project.

9.2 Deleterious Material

The mining process uses naturally occurring brines, solar evaporation, and minimal additives for processing. Deleterious materials are defined in R647-1-106 as "earth, waste or introduced materials exposed by mining operations to air, water, weather or microbiological processes, which would likely produce chemical or physical conditions in the soils or water that are detrimental to the biota or hydrologic systems." UDOGM considers fuels, oils, many processing chemicals, and other materials to be deleterious (or potentially deleterious) materials. All deleterious or potentially deleterious material shall be safely removed from the site or kept in an isolated condition such that adverse environmental effects are minimized as discussed in Section 6.12.2 and 9.1.3.

Deleterious or acid-forming materials connected to the mining process have not been identified.

All materials used with mining and reclamation activities would be properly disposed of and/or stored in an isolated condition to ensure that adverse environmental effects are eliminated or controlled to the extent possible. The salts, salt brine, and brackish water, even though they may be harmful to health, are not included because they are naturally occurring and would be redeposited onto the playa or into the Waste Product Storage Area.

9.3 Stormwater Management and Erosion Control

There are no jurisdictional Waters of the United States regulated by USACE within the Sevier Playa (USACE 2013). Additionally, CPM completed a revised delineation of the Sevier Playa and areas potentially impacted by all on- and off-lease project features in 2017. In April 2018, CPM received an approved jurisdictional determination for these areas (USACE 2018).

CPM would obtain a Utah Pollutant Discharge Elimination System (UPDES) permit for stormwater discharges associated with construction activities. During operation of the Project, a separate permit for industrial stormwater discharges associated with mining activities and operation of the various Project features would be required. The stormwater permit for mining activities is required because it is anticipated that runoff could contact raw material, intermediate products, finished products, and/or byproducts or waste products associated with the Project. As part of the permits, CPM would develop the SWPPP(s) for the site (CPM 2018b) and would implement stormwater best management practices to ensure compliance with the UPDES General Stormwater Construction Permit and UPDES Multisector General Permit, Sector J (Mineral Mining and Processing Facilities) for stormwater discharges associated with industrial activities. Implementation of the SWPPP(s) would reduce or eliminate potential water quality impacts from unregulated construction and mining related soil erosion and stormwater discharge from the site.

Erosion control methods may include construction of water diversion structures and site-specific applications of mulch or other water flow dissipation materials as needed to control surface water runoff across disturbed areas. Water bars would be constructed to the size, spacing, and cross sections specified by the BLM to divert water from all erosion-prone areas and to direct drainage away from disturbed areas to established vegetation in sloped areas. Spacing intervals for water bars would be determined on a site-specific basis. Slope protection would be designed for the particular application required. Mulch would be applied on highly erodible soils and in areas with slopes greater than 15%. On steep slopes, hydromulching may be appropriate. Only mulch that has been certified to be weed free would be used.

According to Rule 647-4-111 of the Utah Administrative Code (UAC), erosion control would incorporate site-specific and regional conditions of topography, soil, drainage, water quality, and other

characteristics. Maintenance of a reclaimed on-lease Project would include stabilizing areas where erosion has taken place, revegetating areas where revegetation has not progressed in a timely manner, and mitigating any noxious weeds that may be present. The BLM would establish success criteria to determine when reclamation is adequate, which would be documented at the conclusion of Project operations. Subsequent reseedings and monitoring may be required.

Erosion and sediment control best management practices would be employed during Project construction. More details on stormwater erosion control are contained in the SWPPP (CPM 2018b).

Stormwater management and erosion control for off-lease construction activities would be managed in accordance with the POD (CPM 2018e) and the SWPPP (CPM 2018b).

9.4 Environmental Protection and Public Health and Safety

The Processing Facility would be fenced and gated. Public access to the remainder of the Project would be restricted using no trespassing and other appropriate hazard warning signs posted at all access roads leading to the playa or other work areas. The *Site Safety Plan* (CPM 2018q) addresses applicable Occupational Safety and Health Administration standards and other safety policies and procedures for employees, contractors, and public safety.

9.4.1 Fire Prevention and Control

A fire safety plan is part of the *Site Safety Plan* (CPM 2018q) prepared for the Project. It addresses emergency routes, fire preparedness and fire prevention practices. There is no vegetation on the Sevier Playa and thus no potential for wildland fire, although sufficient vegetation to support a fire exists around the playa margins. To reduce the likelihood of ignition, care would be taken to park vehicles and run generators in areas where vegetation does not come into contact with hot engines or mufflers. High-risk activities (e.g., the use of torches and welders) would be limited to areas that are clear of flammable materials. Flammable liquids would be stored appropriately. Water storage tanks would be designated for fire response actions. Fire control and response procedures are outlined in the *Site Safety Plan*.

9.4.2 Subsidence

According to the USGS, subsidence as a result of water extraction is relatively common in areas where saturated fine-grained sediments are pumped to the point where the sediments are partially or fully dewatered. This removes the water within the fine-grained sediments, which removes a portion of the support within the fine-grained matrix and results in settlement within the formation.

A series of trenches and wells, as described in Section 6.2.1, *Extraction System*, would be used to extract the brine. However, as discussed in Sections 6.2.1, *Extraction System* and 6.2.2, *Recharge System*, water removed from the brine aquifer would be replaced by recharge water. For this reason, the playa aquifer zones would not be dewatered and subsidence would not be expected.

For the freshwater production wells, CPM plans to extract 225 gpm from each of four wells for a 30-year period. In 2012, CPM drilled a test bore to a depth of 750 feet at the location of the westernmost proposed well location. Based on studies conducted by CH2M (2012, 2016b), the following details would be planned:

- Proposed wells would be 1,500 feet deep
- Diameter of each well would be 20-inch diameter borehole, with a 14-inch casing

- Depth to bedrock would be about 350 feet bgs (based on depth in test bore)
- Anticipated depth to water in the proposed well locations would be about 460 feet bgs (based on water level for test boring)
- Worst-case drawdown from the long-term operation of the proposed wells would be about 65 feet (CH2M 2016b)

The unconsolidated sediments for each well would consist of materials similar to the materials encountered in the test bore:

- Alluvium and colluvium, undifferentiated: Mixed alluvial and colluvial deposits that consist of fluvially reworked, coarse-grained colluvium and/or alluvium with a considerable colluvial component; also includes talus; mapped chiefly in mountain headwater areas that are isolated from mountain-flanking alluvial fans (CH2M 2012).

For the planned freshwater pumping, no drawdown-induced subsidence is anticipated because 1) the coarse-grained unconsolidated materials would minimize the potential for subsidence and 2) these unconsolidated sediments are not saturated because the static water level is below the bottom of the unconsolidated zone by about 110 feet.

9.4.3 Surface Water and Groundwater Pollution

Surface water inflows to the Sevier Playa would be stormwater runoff, precipitation, and inflow from the Sevier River. Chemical contamination from equipment used on the playa or in the Processing Facility presents a low risk. A SPCC Plan is being developed and would be implemented before construction activities begin. The SPCC Plan includes measures to minimize and contain potential spills, cleanup measures, and reporting requirements (CPM 2018l). Fueling stations would be equipped with secondary containment structures to contain spills. Maintenance and processing chemicals would be confined to specific use areas or storage in the facility of use, and secondary containment systems would be used as needed.

Peak's federal lease, Special Stipulation 8 states the following:

> Water Replacement: The Lessee at his expense, will be responsible to replace any water resources (that contain in a base line analysis of <10,000 mg/1 TDS), that are lost or adversely affected (quality or quantity) by their mining operations. These shall include (1) developed ground water sources existing at lease issuance or new sources that may be developed during the term of the lease, and (2) other surface and/or ground water sources that may be identified by the BLM for protection as part of the conditions for any mining plan approvals. If replacement is required, the lessee shall replace the sources with an alternate source in the same quantity and quality to maintain existing uses. The existing uses shall include but not limited to riparian habitat, fishery habitat, livestock, wildlife, domestic, agricultural, or other land uses. The lessee/operator shall obtain sufficient base line data and monitoring in order to establish parameters to show whether water resources are affected. (BLM 2011c)

Additionally, Special Stipulation 13 states the following:

> Hydrologic Analysis: Sufficient base line data shall be established prior to conducting any surface disturbing activity which shall be determined necessary by the AO. In order to accomplish this, the lessee shall submit for review and approval by the AO a plan to analyze ground and surface water interactions as part of any operations or exploration on the leases. The plan shall be submitted prior to or concurrent with a Mining or Exploration

> plan under 43 CFR 3592.1. The plan shall include, but not be limited to the following items, and shall describe how the lessee proposes to; (1) develop sufficient base line groundwater information to document existing hydrogeology associated with Sevier Lake basin fill and underlying carbonates, encompassing a reasonable area of potential resources, springs, and the alluvial and bedrock aquifers. This shall include items such as the location, size, and depth of any hole that will encounter water and/or brine as well as any information that will be collected on each hole. (2) Determine the potential impacts to existing water right holders, wells, wetlands, and surface and groundwater throughout their operations. Water chemistry (including stable isotopes as necessary), estimated flow and water quantity (water balance) shall be addressed. (3) Monitor the actual impacts to groundwater resources throughout and surrounding the operation including but not limited to changes in meteoric precipitation and springs, wells (base conditions, water levels, and chemistry conditions prior to construction and monitoring after construction), wetlands, and ditches. Wells, wetlands, and springs (at sites determined to be relevant based upon the groundwater study that would be conducted prior to development) shall be monitored during operations in order to minimize potential impacts to groundwater resources by allowing an early identification. Further, the plan shall contain sufficient detail to allow it to be independently assessed, and include such things as the type of groundwater model that would be used (and/or other methods of analysis), phasing of the analysis and proposed iterative studies. The plan shall also contain a list of people and their qualifications to accomplish the work and a list of deliverables with a timing schedule. The lessee shall be responsible for any cost incurred for the plan and the accomplishing of the work. (BLM 2011c)

Per this requirement, CPM has gathered initial baseline data to support both the Fresh Water Baseline Study (FWBS) (CPM 2018s) and *Water Monitoring Plan* (WMP) (CPM 2018r) that are included as part of the *Groundwater Discharge Permit Application* (CPM 2018d), currently being prepared for submittal to the Utah Division of Water Quality. In concert with the FWBS and WMP, CPM prepared a combined Sampling and Analysis Plan (SAP)/ Quality Assurance Project Plan (QAPP) document (CPM 2018t) detailing the sampling and laboratory procedures to be followed. The FWBS has been submitted to and accepted by the BLM to cover the monitoring of streams, springs, and wells surrounding the playa to address the lease stipulations. The WMP (CPM 2018q) covers the proposed operational monitoring for compliance with both the DWQ rules and BLM lease stipulations. This plan would be finalized prior to start of operations. This WMP outlines monitoring requirements to evaluate the actual impacts to surface water and groundwater resources throughout and surrounding the mine area during operations in order to minimize potential impacts to groundwater resources by allowing early identification. The *Groundwater Discharge Permit Application* (CPM 2018d) is being developed to also provide data to determine whether water resources that contain a baseline analysis of <10,000 mg/L TDS are affected. If water resources are affected, the determined lost or adversely affected (quality or quantity) volumes of water are required to be replaced in accordance with lease stipulations.

9.4.4 Air Resource

The EPA's Office of Air Quality Planning and Standards and the UDAQ have set National Ambient Air Quality Standards for the following criteria pollutants: nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, lead, particulate matter smaller than 10 microns in aerodynamic diameter (PM_{10}), and particulate matter smaller than 2.5 microns in aerodynamic diameter ($PM_{2.5}$). Millard County is an attainment area for National Ambient Air Quality Standards (NAAQS) for all criteria pollutants, including the PM_{10} and $PM_{2.5}$ components of fugitive dust.

Potential issues and concerns identified in association with Project effects on air quality are as follows:

- Fugitive dust emissions
- Other emissions (including construction and operation equipment)
- National Ambient Air Quality Standards
- Greenhouse gas emissions
- Climate change

The Project is required to comply with state and federal air quality regulations. The air emissions and associated dust control strategies must be approved by both the BLM and Utah Division of Air Quality (UDAQ) through the NEPA and permitting processes. Fugitive dust control measures will be included in the *Fugitive Dust Control Pla*n (CPM 2018f) and cited in the Mitigation Measures section in the EIS. The *Fugitive Dust Control Plan* must be approved by the BLM and the UDAQ.

A Modeling Protocol was developed in coordination with the BLM, EPA, and UDAQ. The protocol identifies methods and procedures for air dispersion modeling for evaluating compliance of Project emissions with the NAAQS. The protocol includes discussion of development of the emissions inventory, modeling methods, and assumptions including model selection and options, meteorological data and emission source and modeling parameters for review by stakeholders.

A Modeling Report was prepared summarizing the modeling methodology used to evaluate the Project's impact on air quality with respect to the NAAQS, Air Quality-Related Values (AQRVs) for nearby federally designated Class I areas and visibility impacts for nearby federally controlled lands designated as sensitive Class II areas. The analysis is performed using the Modeling Protocol and is based on the *EPA Guideline on Air Quality Models* (EPA 2005) with revisions in 2016–2017, *UDAQ Dispersion Modeling Guidance* (UDAQ 2013), and the federal land managers' air quality related values work group report (U.S. Forest Service et al. 2010).

A Notice of Intent (NOI) would be submitted to the UDAQ prior to construction or operation of any emitting equipment or activity. The NOI would include a final emissions inventory and modeling report, Best Available Control Technology analysis, and proposed permit limits. Information contained in the NOI would be used by UDAQ to develop an Approval Order. The Approval Order would contain permit conditions under which the facility is approved to operate as well as identify record keeping and reporting requirements, if applicable.

Peak's federal lease, Special Stipulation 15 states the following:

> Dust Control Plan: The operator/lessee shall develop a dust control plan for review by the AO prior to conducting any operations under the lease. This shall include but not be limited to (1) the treatment of road and disturbed surfaces, (2) speed limits to control dust, (3) stabilizing piles and (4) conditions under which work will cease, such as operations during high wind conditions. The costs of the controls shall be borne by the lease/operator. (BLM 2011c)

CPM would provide dust control and suppression throughout the construction period to protect surface soils from wind erosion and to minimize fugitive dust generated by construction activities. Dust control would be performed as described in the *Fugitive Dust Control Plan* (CPM 2018f).

Roads and disturbed areas would be treated with water and/or chemical dust suppressants as conditions warrant. Dust suppression water options may include the following:

- Water acquired from existing permitted sources during construction and before completion of freshwater wells
- Water from freshwater wells prior to full utilization of production-related water rights
- Water leased from upstream Sevier River water owners
- Recharge water

Peak has secured water rights 69-113 and 69-117, which include rights for dust suppression. Water application rates would vary based on weather, seasons, traffic, and frequency of chemical dust suppression applications where permitted. The *Fugitive Dust Control Plan* provides dust suppression guidance.

9.4.5 Livestock Grazing

Livestock grazing is a primary land use in the area around Sevier Playa, although the playa itself is not managed for grazing due to lack of forage and TDS in the playa water. Approximately 8,000 acres of the Sevier Playa leasing area falls within the boundaries of eight allotments surrounding Sevier Playa. The playa itself is not part of an allotment. The lands around Sevier Playa support very sparse vegetation with poor forage value due to the aridity and proximity to the salty playa. Vegetation is summarized in Section 3.6, *Vegetation*. Ground-disturbance outside the playa would be reclaimed and revegetated according to the *Reclamation Plan* (CPM 2018c). Potential issues and concerns related to livestock grazing include the following:

- Conflicts with allotment management
- Attraction of livestock to open water (brine)
- Alteration of water sources
- Loss of forage, including off-playa ROWs
- Safety concerns caused by increased Project traffic
- Achievement of rangeland health standards

A few brine resource wells on the extreme margins of the playa may fall within the boundary of adjacent grazing allotments. Several stock watering locations are located near or within the Sevier Playa lease area. CPM would coordinate with the BLM and the grazing allotment holder to identify areas of potential conflict should mine development or operation activities coincide with the allotment's active period. If necessary, CPM would schedule activities within grazing allotments to avoid potential impacts to livestock.

9.4.6 Natural Resources

Peak's federal lease, Special Stipulation 9 states the following:

> Wildlife and Plant Species: Sufficient base line data shall be established as determined necessary by the AO. In order to accomplish this, the lessee shall submit an acceptable wildlife and plant inventory prior to conducting any surface disturbing activity. Prior to conducting the inventory, an inventory plan shall be submitted and approved by the AO for the mining and/or exploration plan. The inventory plan shall include Federally Listed or Candidate species, as well as BLM Sensitive plant or wildlife species, including FWS

> Birds of Conservation Concern (2008) and big game species. The inventory plan shall address, but not be limited to the following: species occurrence, migration corridors, winter use, reproductive periods, and habitat value, including the invertebrate community. The plan shall address the time periods to be inventoried by species. The inventory shall be conducted by a qualified individual approved by the AO prior to the commencement of the inventory. The final inventory shall be submitted to the AO within 60 days after completion. A Wildlife Mitigation Plan shall be submitted as part of any mining or exploration plan and will describe actions to be taken to avoid, minimize, or reduce any future impacts to wildlife. The plan shall include but will not be limited to, survey/monitoring of species; the rescue, recovery, reporting and rehabilitation of injured wildlife as practicable; recovery and reporting of wildlife mortalities; and mitigation and adaptive management strategies. The species to be monitored shall include species on the Wildlife Action Plan, developed by the Utah Division of Wildlife Resources, and the Partners in Flight priority species. The lessee shall submit a report annually discussing mortality rates and the effectiveness of any mitigation measures taken. At the discretion of the AO this reporting requirement may be waived. The cost of conducting the inventory, preparing reports and the mitigation plan, and carrying out subsequent mitigation measures and reporting on the effectiveness of such measures, shall be borne by the Lessee. (BLM 2011c)

Per this requirement, various baseline surveys have been completed to support the EIS and permitting efforts. These are discussed below. In addition, per this requirement, an AWMP (CPM 2018k) is currently being prepared.

9.4.6.1 Wildlife

CPM has completed various wildlife field surveys to support the EIS and permitting effort. The results of these survey efforts are presented in the BLM's EIS for the Project and reports, including the *General and Special-Status Wildlife and Plant Species Survey Report* (CH2M 2014) and *Sevier Playa Waterbird Use and Habitat Evaluation Study* (SWCA 2017b). The completed surveys are as follows:

- Avian point counts, 2011 through 2013
- Aerial and terrestrial waterbird surveys, 2017
- Raptor nest surveys, summer 2013 and 2014
- Bat surveys, summer through fall 2013, spring 2014
- Utah prairie dog surveys, June 2013
- Burrow surveys (kit fox and burrowing owls), June through July 2013
- Dark kangaroo mouse surveys, September 2014
- Incidental observations of big game and other wildlife were made during the avian point count survey, 2011 through 2013
- Kit fox surveys:
  - Incidental observations during point count surveys, 2011 through 2013
  - Intensive camera trap surveys, summer through fall 2013, spring 2014

Information from these studies is being used in the Project EIS to describe the potential presence at, or use of lands associated with, the Project by wildlife species and to analyze potential impacts from Project development and operation activities. The AWMP provides a summary of the wildlife resources

regulatory framework, habitats, resources, and resource concerns. This AWMP (CMP 2018k) would be updated through the EIS process.

No habitat value for large mammals exists on the Sevier Playa, although the UDWR heritage database identifies substantial to critical habitat value for pronghorn and mule deer around the perimeter of the playa and in the surrounding area. UDWR has designated crucial, year-round pronghorn habitat on the north, east, and south sides of Sevier Playa. Year-round mule deer habitat is present in off-lease areas in the Cricket Mountains and the House Range. These mountains also provide chukar partridge habitat.

9.4.6.2 Threatened, Endangered, Candidate, or Sensitive Species

Upon review of the USFWS database, there are two species listed under the ESA and their habitats being assessed and evaluated by the BLM within and reasonably near the Project: the Utah prairie dog (threatened, *Cynomys parvidens*) and the California condor (endangered, *Gymnogyps californianus*). A third species listed under the ESA, the yellow-billed cuckoo (threatened, *Coccyzus americanus*) is listed in Millard County, Utah but there is no habitat for this species located in or near the Project. Many BLM special-status species are known to occur near various Project components. Most notable are raptors, migratory birds, and mammals. Other notable wildlife species that can be found within the area are big game, reptiles, and mammals. Potential issues and concerns related to wildlife resources are as follows:

- Wildlife and fish excluding special-status species
  - Loss or degradation of habitats, including loss of habitat suitability
  - Influence of noise, traffic, vehicle collisions, and human activity on movement, foraging, nesting, and breeding of wildlife
- Migratory birds
  - Influence of noise, traffic, vehicle collisions, and human activity on foraging, nesting, roosting, and breeding
  - Attraction of birds to evaporation ponds or other Project facilities, with subsequent injury or mortality
  - Importance of habitats to migrating waterfowl and shorebirds
- Special-status species
  - Utah or BLM sensitive species (e.g., kit fox and burrowing owl)
  - Bats
  - Raptors (e.g., golden eagle and ferruginous hawk)
  - Birds of Conservation Concern
  - Priority Species for Conservation Action
  - Loss of potential (unoccupied) habitat for Utah prairie dog
  - Wildlife and livestock collisions with Project vehicles and subsequent risk of vehicle collisions with scavenging individuals (e.g., the California condor)

Through the EIS process, the BLM is evaluating the potential for the Project to affect these species and, if necessary, would initiate interagency consultation with the USFWS under Section 7 of the Endangered Species Act.

The wildlife surveys completed to support the BLM's preparation of the EIS also assessed the presence of BLM- and State-sensitive plant and animal species in the Sevier Playa area. Burrowing owls (*Athene*

cunicularia) and kit fox (*Vulpes macrotis*) were identified in upland areas adjacent to the Sevier Playa. Through the EIS process, the BLM is evaluating the potential for the Project to affect these species and other BLM- and State-sensitive species.

9.4.6.3 Migratory Birds

Migratory birds include various types of native birds, from songbirds to raptors, such as eagles, hawks, and owls. The Migratory Bird Treaty Act of 1918 made it illegal to "take" migratory birds, their eggs, feathers, or nests. The Bald and Golden Eagle Protection Act affords additional protection to all bald and golden eagles. The Project is within the southeastern corner of the Great Basin Bird Conservation Region 9, which lists 28 species of birds, including ferruginous hawk, golden eagle, peregrine falcon, green-tailed towhee, and brewer's sparrow. Some of these birds are also designated as BLM Sensitive Species.

The habitats in and around the Sevier Playa currently support generally low levels of use by migratory birds, including passerines, waterfowl, other wading and shore birds, and raptors. For construction, maintenance, and decommissioning activities in areas that could be used by nesting birds, CPM would be required to conduct migratory bird nest clearance surveys to determine the locations of nests and nesting habitat around actions the BLM has authorized and by designing those actions to avoid disturbing nesting habitats during the nesting season.

The construction of hypersaline ponds and trenches would potentially attract waterfowl and shorebirds. Birds landing on hypersaline waters can become encrusted with salt and drown, or their ability to fly may become impaired. As a result of preening their feathers or drinking hypersaline water, birds can also become sick or die due salt toxicosis. Therefore, the ponds could present an ongoing hazard to migratory birds throughout the life of the Project. For this reason, Peak has developed a *Brine Pond Stepped Monitoring and Mitigation Plan*, which is included as an appendix of the AWMP (CPM 2018k).

9.4.6.4 Vegetation

No federally listed or candidate plant species are known to occur in the Sevier Playa area, and the area does not contain habitat suitable for any federally protected plant species, based on review of the Utah Conservation Data Center database (UDWR 2013) and field surveys conducted for the Project (CH2M 2014). Potential issues and concerns related to vegetation resources include the loss or degradation of native or desirable vegetation and habitat for wildlife and forage for livestock.

The Utah Noxious Weed Control Act (UAC R68.9) designates the responsibility for the prioritization and implementation of weed control strategies to the Utah Weed Control Association. The BLM Utah State Office does not maintain its own list of weeds. In addition to state-listed noxious and invasive species, Millard County maintains a list of noxious weeds and high-priority invasive species. Vegetation surveys documented the presence of several noxious and invasive plant species in or near the Project. Potential issues and concerns related to noxious and non-native invasive vegetation include the introduction of noxious weeds and the spread of existing and new weed infestations.

Potential impacts to vegetation surrounding the Project would be analyzed in the Project EIS.

9.4.6.5 Wetlands

Peak's federal lease, Special Stipulation 16 states the following:

> Riparian and Wetland Inventory: The operator/lessee shall conduct an inventory for riparian and wetlands. The inventory shall be acceptable to the AO prior to the commencement of any surface disturbing activities. The inventory shall include but not be limited to; (1) maps at a sufficient scale to show the size and location of these areas. This inventory shall include the project area and the Sevier River within Township 20 South, Range 10 West if the AO deems it necessary. (2) Vegetation species shall be addressed along with percent cover, and water quality, temperature and quantity, and soil types. The cost of the inventory shall be borne by the lessee/operator. (BLM 2011c)

Peak's federal lease, Special Stipulation 11 states the following:

> The lessee shall work with the BLM in contacting the Corps of Engineers to comply with Section 404 of the Clean Water Act and, as necessary, in obtaining a 404 Permit. (BLM 2011c)

The USACE issued an approved jurisdictional determination for the Sevier Playa on June 28, 2013 (USACE 2013). This approved jurisdictional determination concluded that the Sevier Playa was "an intrastate isolated feature with no apparent interstate or foreign commerce connection. As such, this feature is not currently regulated by the Corps of Engineers." This approved jurisdictional determination is valid for 5 years. CPM completed a revised delineation of the Sevier Playa and areas potentially impacted by off-lease project features in 2017 and in April 2018 CPM received the Jurisdictional Determination for these features confirming the features are not jurisdictional (USACE 2018).

While it is not anticipated that the wetland areas in the project would be regulated under Section 404 of the Clean Water Act, there are areas that contain wetland vegetation types in the area. These areas were identified in a Wetland and Riparian Baseline Inventory for the Project (SWCA 2016). Based on the results of this inventory, non-native and invasive species are common—and often dominant—throughout the wetland and riparian areas in the study area. The largest wetland and riparian areas and the areas with the most dense and extensive herbaceous wetland vegetation are located along the Sevier River corridor and the inlet of the river to the Sevier Playa. These areas are supported by the Sevier River, the largest water source in the region. However, this is a regulated system for agricultural and industrial use and the amount of water that reaches the playa is substantially reduced and unpredictable.

Riparian vegetation, mostly in the form of invasive salt cedar and salt cedar intermixed with wetland floodplain vegetation, are common along the banks and floodplains of the Sevier River upstream from the Sevier Playa. At the inlet of the Sevier River onto the Sevier Playa, the river corridor dissipates into an alluvial fan of shallow, wandering, braided channels. In this area, vegetation is present in some locations between and around the margins of the channels, as well as in depressions and around the margins left by previous channels. The vegetation is primarily herbaceous wetland and wetland floodplain vegetation intermixed with unvegetated playa areas. Based on a review of aerial imagery, the distribution and extent of vegetated and unvegetated areas at the inlet and on the Sevier Playa has substantial annual variation controlled by inundation and shifting soils, which are related to the volume of water flowing onto the Sevier Playa. In wetter years, such as 2011, the area is largely inundated with water, and vegetation is largely absent.

9.4.6.6 Riparian Areas

Riparian areas in the vicinity of Sevier Playa and upstream of the Sevier Playa along the Sevier River were identified in the *Wetland and Riparian Baseline Inventory for the Sevier Playa Potash Project* (SWCA 2016). Based on the results of this inventory, non-native and invasive species are common—and often dominant—throughout the wetland and riparian areas in the study area. The primary woody riparian species is invasive salt cedar. The largest wetland and riparian areas and the areas with the most dense and extensive herbaceous wetland vegetation are located along the Sevier River corridor and the inlet of the river to the Sevier Playa. These areas are supported by the largest water source in the region, the Sevier River. However, this is a regulated system for agricultural and industrial use and the amount of water that reaches the playa is substantially reduced and unpredictable.

Riparian vegetation, mostly in the form of invasive salt cedar and salt cedar intermixed with wetland floodplain vegetation, are common along the banks and floodplains of the Sevier River upstream from the Sevier Playa. However, no riparian vegetation occupies the Sevier Playa or the playa margins.

9.4.7 Cultural Resources

Peak's federal lease, Special Stipulation 10 states the following:

> Cultural Resources: The Lessee shall contact the AO with sufficient information and request a determination if a cultural inventory and/or tribal consultation is necessary. If it is necessary and prior to BLM approval to initiate potash production, the lessee shall conduct a cultural resource inventory to BLM Utah Class III inventory standards on all lands where they may be surface disturbance within the boundaries of the leased lands. The inventory shall be conducted by a qualified professional cultural resources specialist (i.e., archaeologist, historian, or historical architect, as appropriate), approved by the AO. A report shall be generated of the inventory and recommendation for protecting any cultural resources that are identified. The lessee shall undertake measures, in accordance with instructions from the AO to protect cultural resources on the leased land. The lessee shall not commence the surface disturbing activities until permission to proceed is given by the AO. The cost of conducting the inventory, preparing reports, and carrying out mitigation measures shall be borne by the Lessee. The lessee shall protect all cultural resource properties within the lease area from lease related activities until the cultural resource mitigation measures can be implemented. If cultural resources are discovered during the operations under this lease, the lessee shall immediately bring them to the attention of the AO. The lessee shall not disturb such resources without written authorization from the AO. It may be necessary for the lessee to hire a cultural contractor to assist the BLM in determining the following: 1) whether the materials appear eligible for the National Historic Register of Historic Places; 2) the mitigation measures that the lessee will likely have to undertake before the site can be used (assuming in situ preservation is not necessary); and, 3) a time frame for the AO to complete an expedited review under 36 CFR 800.11 to confirm, through the State Historic Preservation Officer, that the findings of the AO are correct and that mitigation is appropriate. All cultural resources shall remain under the jurisdiction of the United States until ownership is determined under applicable law. (BLM 2011c)

In accordance with this requirement, a series of cultural resources investigations have been completed to support the Project. A programmatic agreement is being developed between the BLM, SHPO, SITLA,

and CPM. Since 2011, SWCA has conducted a series of cultural resources investigations to support the Project. These investigations involved cultural resources surveys and excavation activities monitoring. Pedestrian cultural resources surveys have been conducted within the playa boundary, and a comprehensive Class I study (Beck 2013) has been conducted within the Project APE. Baxter's (2010) review of available data found that considerable cultural resources research had been conducted in and around the area covered by the review. Beck's (2013) search identified 127 previous cultural resources projects, 249 General Land Office features, one historic trail, and 412 known archeological sites located wholly or partially inside the Class I study area.

Additional pedestrian surveys would be conducted as determined in the programmatic agreement once the off-lease facility locations have been confirmed. The Project could have impacts to properties that are eligible for the National Register of Historic Places and traditional cultural properties.

The proposed mine area and all ancillary facilities would be constructed in compliance with the Section 106 process (36 CFR 800.6), as described in the *Cultural Resources Plan* (CPM 2018p).

10 Reclamation Plan

Peak's Potassium Lease, UTU-88387 (BLM 2011c), requires that CPM prepare an interim and final reclamation plan. A *Reclamation Plan* (CPM 2018c) will be prepared in accordance with this stipulation and UDOGM's rules (R647-4-110) including standard reclamation practices (R647-4-111).

Peak's lease includes the following special stipulations (1, 7, and 14) specific to reclamation that will be addressed in the *Reclamation Plan* (CPM 2018c):

> 1) Ditches, Berms, Drill Holes and Other Excavations: The lessee shall fill in pits, ditches, and other excavations within reason, to restore the surface of the leased land and access roads to their former conditions as far as reasonably possible, including removal of structures and removal of all debris. All drill holes shall be filled with cement or other suitable material as approved by the Authorized Officer (AO) prior to abandonment of the wells. This shall take place upon any partial or total lease relinquishment or cancellation or at any other time prior thereto when required and to the extent deemed necessary by the lessor. (BLM 2011c)
>
> 7) Reclamation: The mining plan must include an interim reclamation plan and a final reclamation plan. A seeding and grading plan and schedule will be submitted and approved by the AO prior to finalizing any reclamation. Upon reclamation of disturbed areas surrounding the lakebed where revegetation is planned, plant growth shall be monitored for a minimum of three years or until the reclamation standards of success have been attained. All previously vegetated disturbed areas will attain 75% basal cover, based on similar undisturbed adjacent native vegetative community, and comprised of desired species and/or seeded species within 5 years of initial reclamation action. However, if after three (3) growing seasons there is less than 30% of the basal cover based on similar undisturbed native vegetative community, then the AO may require additional seeding efforts. The reclamation bond/liability will not be released until the AO accepts the reclamation in writing. Concurrent reclamation practices will be used. In the event that this standard cannot be met, the lessee may request a waiver to this stipulation. The waiver must state as a minimum, the reasons for the request and show a history of the reclamation attempts by the lessee. The AO may waive the requirement on his discretion. (BLM 2011c)
>
> 14) Lands and Realty: Existing roads and trails would be used for travel to the maximum extent feasible unless otherwise authorized. During wet road conditions, any ruts deeper than 4 inches remaining on the road from the project would be repaired at the AO discretion. The proposed project would be subject to valid prior existing right-of-way. The Master Title Plat and LR2000 Geo Report show an existing right-of-way within the project area. The proposed project is subject to this existing right-of-way. This Holder shall be contacted and coordinated with if their ROW would be affected by this project. (BLM 2011c)

11 Literature Cited

Avian Power Line Interaction Committee (APLIC). 2006. *Suggested Practices for Avian Protection On Power Lines: The State of the Art in 2006.* Available at: http://www.aplic.org/uploads/files/2643/SuggestedPractices2006%28LR-2%29.pdf. Accessed January 24, 2017.

Alkar. 2015. *Thermal Processing*. Available at: http://middprocessing.com/alkar.html.

Baxter, J. 2010. *Class I Inventory for the Sevier Lake Competitive Potash Leasing Project, Millard County, Utah*. Report Number 10-19. Orem, Utah: Bighorn Archaeological Consultants, LLC.

Beck, K. 2013. *An Overview of Known Cultural Resources Along Proposed Utility Corridors and Facilities for the Sevier Playa Project in Millard County, Utah*. Salt Lake City, Utah: SWCA Environmental Consultants.

Case, R. W., and K. L. Cook. 1979. A Gravity Survey of the Sevier Lake Area, Millard County, Utah. *Utah Geology* 6(1):55–76.

Carlton, S. M. 1985. Fish Springs multi-basin flow system. Unpublished M.S. thesis, Mackay School of Mines, University of Nevada, Reno.

CH2M. 2012. *CONFIDENTIAL - Results of Clean Water Test Hole.* Memorandum to Rick Dye, Crystal Peak Minerals. Salt Lake City, Utah. July 3.

———. 2013a. *CONFIDENTIAL - Preliminary Draft - Sevier Playa Basin Conceptual Model Report.* December.

———. 2013b. *CONFIDENTIAL - Preliminary Feasibility Study of the Sevier Lake Playa Sulphate of Potash Project*. NI 43-101 Technical Report, Millard County, Utah. November 18.

———. 2013c. *Soil Assessment for the Sevier Playa Project.* October.

———. 2013d. *CONFIDENTIAL - Documentation of a Probabilistic Reservoir Model for the Sevier Playa Project.* Technical Memorandum. October 10.

———. 2014. *General and Special-Status Wildlife and Plant Species Survey Report for the Sevier Playa Project*. September.

———. 2016a. *CONFIDENTIAL - Sevier Playa SOP Feasibility Study, Re: CPM Sevier Playa SOP FS – Site Conditions*. Technical Memorandum. December 15.

———. 2016b. *CONFIDENTIAL - Crystal Peak Minerals Freshwater Production Well Effects Analysis.* Memorandum to Mike Gates, Clara Stevens, Paul Summers, Tom Gibbons, Todd Leeds, and Cindy Ledbetter, Bureau of Land Management. Salt Lake City, Utah. December 22.

———. 2017a. *CONFIDENTIAL - Draft Engineering Design Report E2 Sever River Diversion Canal and Structures.* July.

———. 2017b. *CONFIDENTIAL - Sevier Playa Potash Project Feasibility Study – Water Balance Model Report*. Prepared for Crystal Peak Minerals Inc. August 2017.

Coastal Engineering Research Center. 1984. *Shore Protection Manual*. Available at: https://ia802604.us.archive.org/34/items/shoreprotectionm01unit/shoreprotectionm01unit.pdf

Crystal Peak Minerals Inc. (CPM). 2018a. *NI 43-101 Technical Report – Sevier Playa Sulfate of Potash Project*. Salt Lake City, Utah: Crystal Peak Minerals Inc. February 21.

———. 2018b. *Stormwater Pollution Prevention Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018c. *Reclamation Plan.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018d. Groundwater Discharge Permit Application. Salt Lake City, Utah: Crystal Peak Minerals Inc. *(In Process).*

———. 2018e. *DRAFT Plan of Development for Off-Lease Facilities for the Sevier Playa Potash Project.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018f. *Fugitive Dust Control Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018g. *CONFIDENTIAL* - CPM SPP Project – Groundwater Model. Technical Memorandum. Salt Lake City, Utah: Crystal Peak Minerals Inc. January 2018.

———. 2018h. *Noxious Weed Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018i. *Gravel Pits Mining Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018j. *Environmental Compliance and Inspection Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018k. *Adaptive Wildlife Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018l. *Spill Prevention, Control, and Countermeasures Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018m. *Solid and Hazardous Waste Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018n. *Transportation and Traffic Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018o. *Blasting Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018p. *Cultural Resources Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018q. *Site Safety Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018r. *Water Monitoring Plan.* Salt Lake City, Utah: Crystal Peak Minerals Inc. (*In Process*).

———. 2018s. *Fresh Water Baseline Study.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018t. *Combined Sampling and Analysis Plan and Quality Assurance Project Plan for the Sevier Playa Project.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

DSB International. 2013. *CONFIDENTIAL* - Solar Pond Balance Rev3-2013.xls. Excel spreadsheet.

Fortier, S., and F. C. Scobey. 1926. Permissible Canal Velocities. *Transactions of the American Society of Civil Engineers*, 89:940–956, Paper No. 1588.

Gilbert, G. K. 1890. Lake Bonneville. U.S. Geological Survey. Washington – Government Printing Office.

Gwynn, J. W. 2006. *History and Mineral Resources Characterization of Sevier Lake, Millard County, Utah*. Miscellaneous Publication 06-6. Utah Geological Survey.

Harrill, J. R., and D. E. Prudic. 1998. *Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States – Summary Report.* Prepared for U.S. Geological Survey. Professional Paper 1409-A. Washington, D.C.

Heilweil, V. M., and L. E. Brooks. 2011. *Conceptual Model of the Great Basin Carbonate and Alluvial Aquifer System.* Prepared for U.S. Geological Survey. Scientific Investigations Report 2010-5193. Washington, D.C.

Intermountain GeoEnvironmental Services, Inc. (IGES). 2013. *CONFIDENTIAL - SDRI Summary Report*. July 18.

Lane, E. W. 1955. The Importance of Fluvial Morphology in Hydraulic Engineering. *Proceedings of American Society of Civil Engineers* 81(745):1–17.

Lenntech. 2017. Water Analysis Accuracy Tester. Available at: https://www.lenntech.com/calculators/accuracy/accuracy-water-analysis.htm.

March Consulting Associates Inc. 2012. *Preliminary Economic Assessment, Sevier Dry Lake, Utah, United States*. Technical Report NI 43-101. Prepared for EPM Mining Ventures Inc. Saskatoon, Saskatchewan: March Consulting Associates Inc., in cooperation with Norwest Corporation.

Millard County. 2013. *Millard County General Plan*. Available at: https://www.millardcounty.org/wp-content/uploads/departments/planning-zoning/general-plan/GENERAL-PLAN.pdf.

Natural Resources Conservation Service (NRCS). 2013 *Soil Survey of West Millard/Juab Area, Utah – Parts of Millard and Juab Counties* (Unpublished). Access via telephone and email communication with Mr. Burke Davenport, Natural Resources Conservation Service, Fillmore, Utah. July 22, 2013.

———. 2018. Web Soil Survey. Available at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. January 11, 2018.

Novopro Projects Inc. 2016. *CONFIDENTIAL - Flotation Reagents Screening & Performance Testing Campaign – Summary of Results*. November 25.

Oregon State University. 2012. *Parameter-elevation Regressions on Independent Slopes Model* (PRISM). Available at: http://www.prism.oregonstate.edu/index.phtml.

Rasmussen, J. D. 1997. *Geology and Evaporite Mineral Resources, Sevier Lake Project, Millard County, Utah*. Prepared for Salada Minerals LLC. Salt Lake City, Utah.

Soil Conservation Service (SCS). 1970. *Soil Survey of the Beaver-Cove Fort Area, Utah – Part of Beaver and Millard Counties*.

———. 1971. *Soil Survey of Delta Area, Utah – Part of Millard County*.

SWCA Environmental Consultants (SWCA). 2016. *Wetland and Riparian Baseline Inventory for the Sevier Playa Potash Project.* Prepared for Crystal Peak Minerals Inc.

———. 2017a. *CONFIDENTIAL - Response to BLM Questions Regarding Sevier Playa Potash Project Sevier River Water Delivery.* September 15, 2017. Memorandum to Clara Stevens, Bureau of Land Management. Salt Lake City, Utah.

———. 2017b. Sevier Playa Waterbird Use and Habitat Evaluation Study. Prepared for Crystal Peak Minerals Inc. (*In Process*).

U.S. Army Corps of Engineers (USACE). 2003. *Slope Stability – Engineer Manual*. Available at: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1902.pdf.

———. 2013. Approved Jurisdictional Determination for the Peak Minerals, Sevier Lake Project. SPK-2013-00295. Bountiful, Utah: Utah Regulatory Office.

———. 2018. Approved Jurisdictional Determination for the Peak Minerals, Sevier Lake Project. April 25, 2018. SPK-2013-00295. Bountiful, Utah: Utah Regulatory Office.

U.S. Bureau of Land Management (BLM). 1987. *Warm Springs Resource Area, The Resource Management Plan, Record of Decision Rangeland Program Summary*. U.S. Department of the Interior, U.S. Bureau of Land Management, Richfield District Office. April.

———. 2011a. *Sevier Lake Competitive Potash Leasing Proposal, Millard County, Utah, Environmental Assessment DOI-BLM-UT-W020-2010-014-EA*. U.S. Department of the Interior, U.S. Bureau of Land Management, Fillmore Field Office. February.

———. 2011b. *Sevier Dry Lake Exploratory Testing, Millard County, Utah, Environmental Assessment DOI-BLM-UT-W020-2011-0015-EA*. U.S. Department of the Interior, U.S. Bureau of Land Management, Fillmore Field Office. October.

———. 2011c. Peak's Potassium Lease, UTU-88387

U.S. Environmental Protection Agency (EPA). 2005. Appendix W of 40 CFR Part 51—Guideline on Air Quality Models (Revised), Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. November.

U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. 2010. *Federal Land Managers' Air Quality Related Values Work Group (FLAG).* Phase I Report—Revised (2010). Natural Resource Report NPS/NRPC/NRR—2010/232. Denver, Colorado: National Park Service.

U.S. Geological Survey (USGS). 2014. Fetch- and Depth-Limited Wave Calculations. https://woodshole.er.usgs.gov/staffpages/csherwood/sedx_equations/ RunSPMWave.html. November 24.

Utah Automated Geographic Reference Center. 2012. Ten-meter-grid resolution DEM data. Available at: https://gis.utah.gov/#data. Accessed 2012.

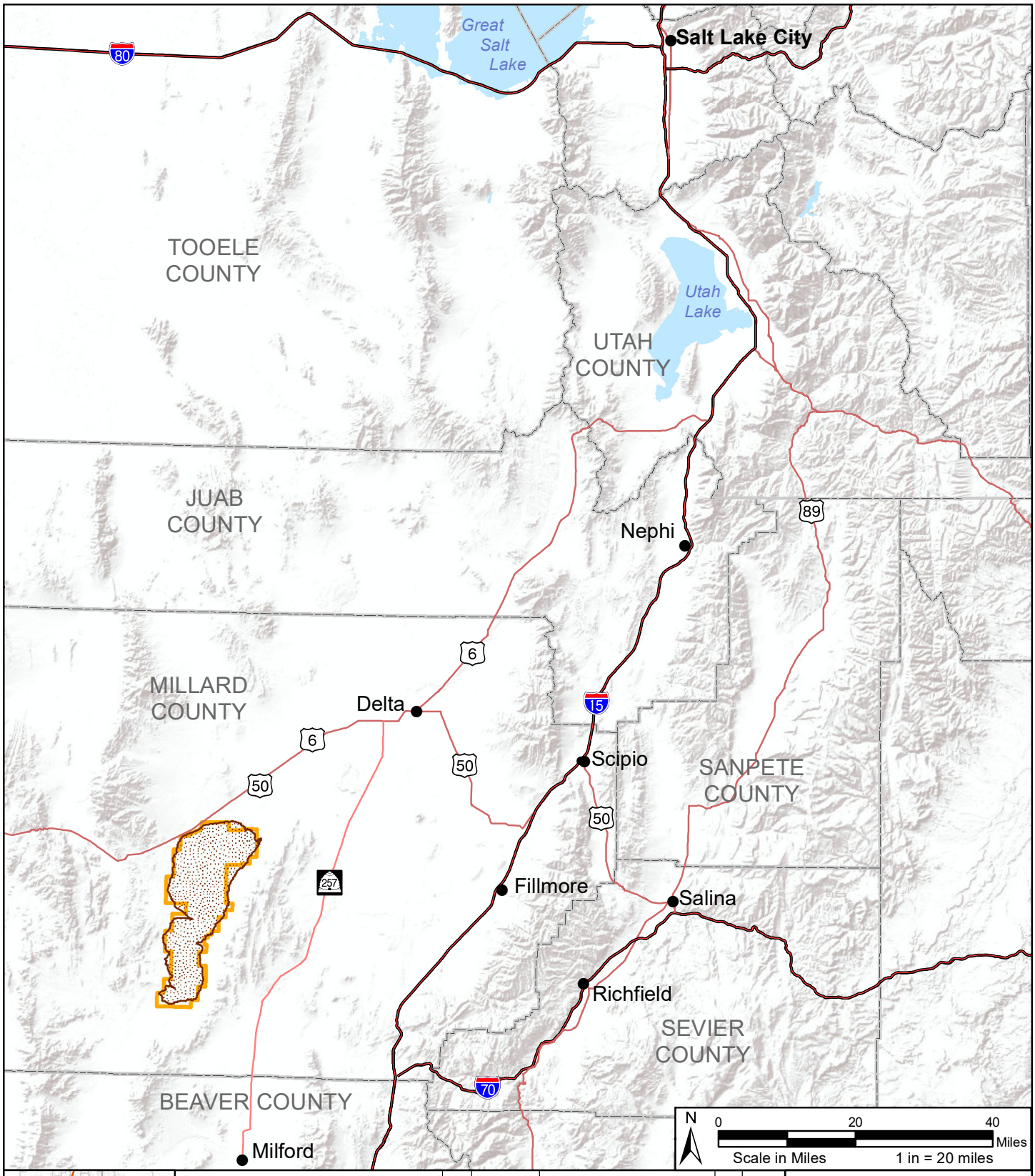
Utah Division of Air Quality (UDAQ). 2013. *Emissions Impact Assessment Guidelines*. Available at: http:// www.deq.utah.gov/Permits/air/docs/2013/03Mar/EmissionsImpactAssessmentGuideline.pdf.

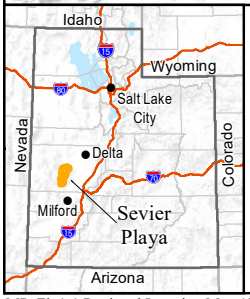
Utah Division of Wildlife Resources (UDWR). 2013. Utah Conservation Data Center. Database search for the Sevier Project including a 1-mile buffer around the gas lines and a 0.5-mile buffer around other Project components. Available at: http://dwrcdc.nr.utah.gov/ucdc.

Western Regional Climate Center. 2013. Average annual precipitation of Milford and Delta, Utah. Available at: http://www.wrcc.dri.edu/.

Whetstone Associates, Inc. 2017. *Draft Baseline Water Resources Technical Report for the Sevier Playa Potash Project.* October.

Figures





Sevier Playa Boundary

BLM and SITLA Lease Boundary

NO.	DATE	REVISION	BY	APVD
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

FIGURE 1-1

Sevier Playa Potash Project
Regional Vicinity

MINING PLAN

DATE: 12/15/2017 | SCALE: 1:1,267,200

CRYSTAL PEAK MINERALS INC.

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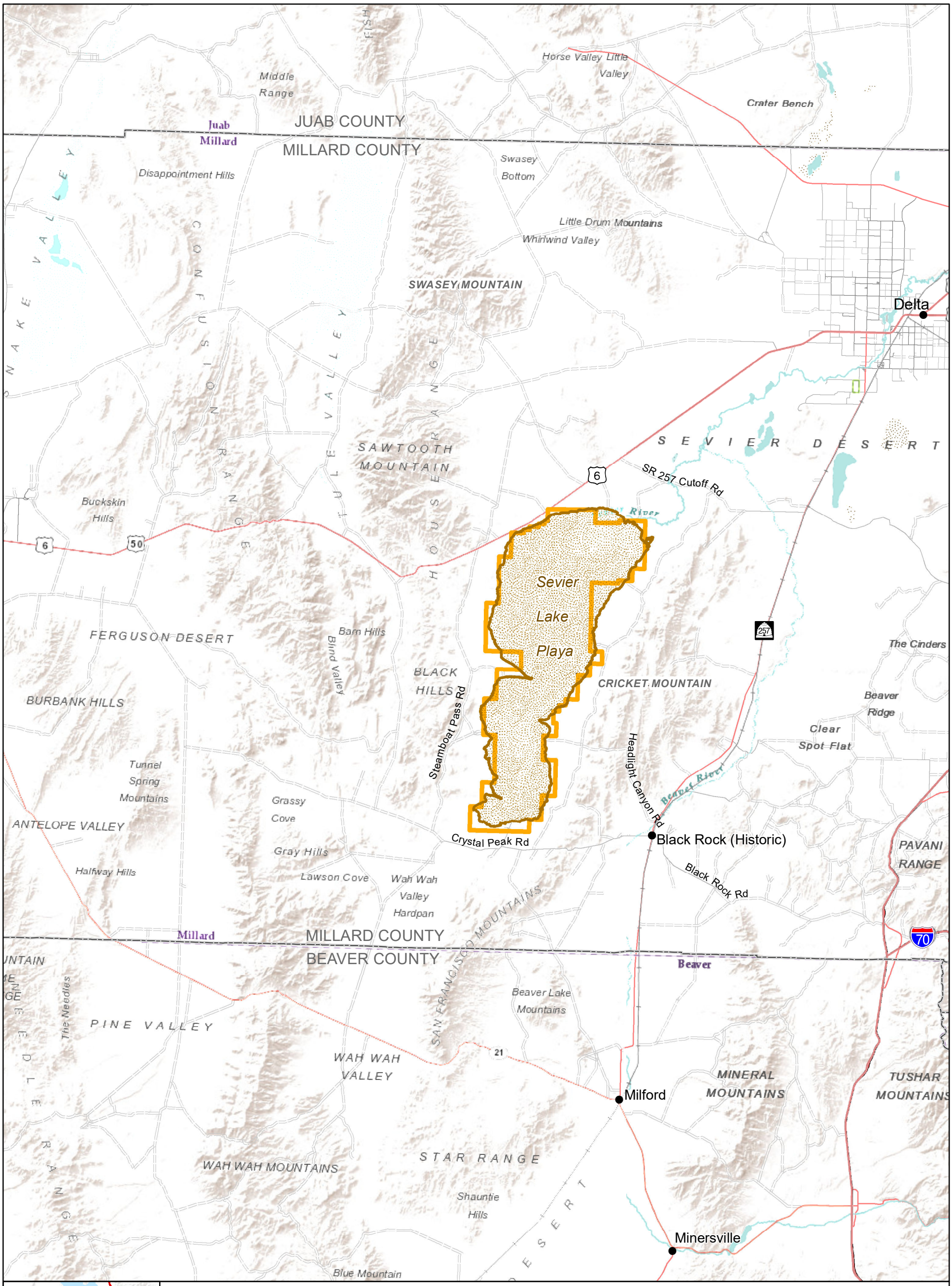

NO.	DATE	REVISION	BY	APVD
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

FIGURE 1-2

Sevier Playa Potash Project
Project Area

MINING PLAN

DATE: 12/15/2017 | SCALE: 1:500,000

CRYSTAL PEAK MINERALS INC.

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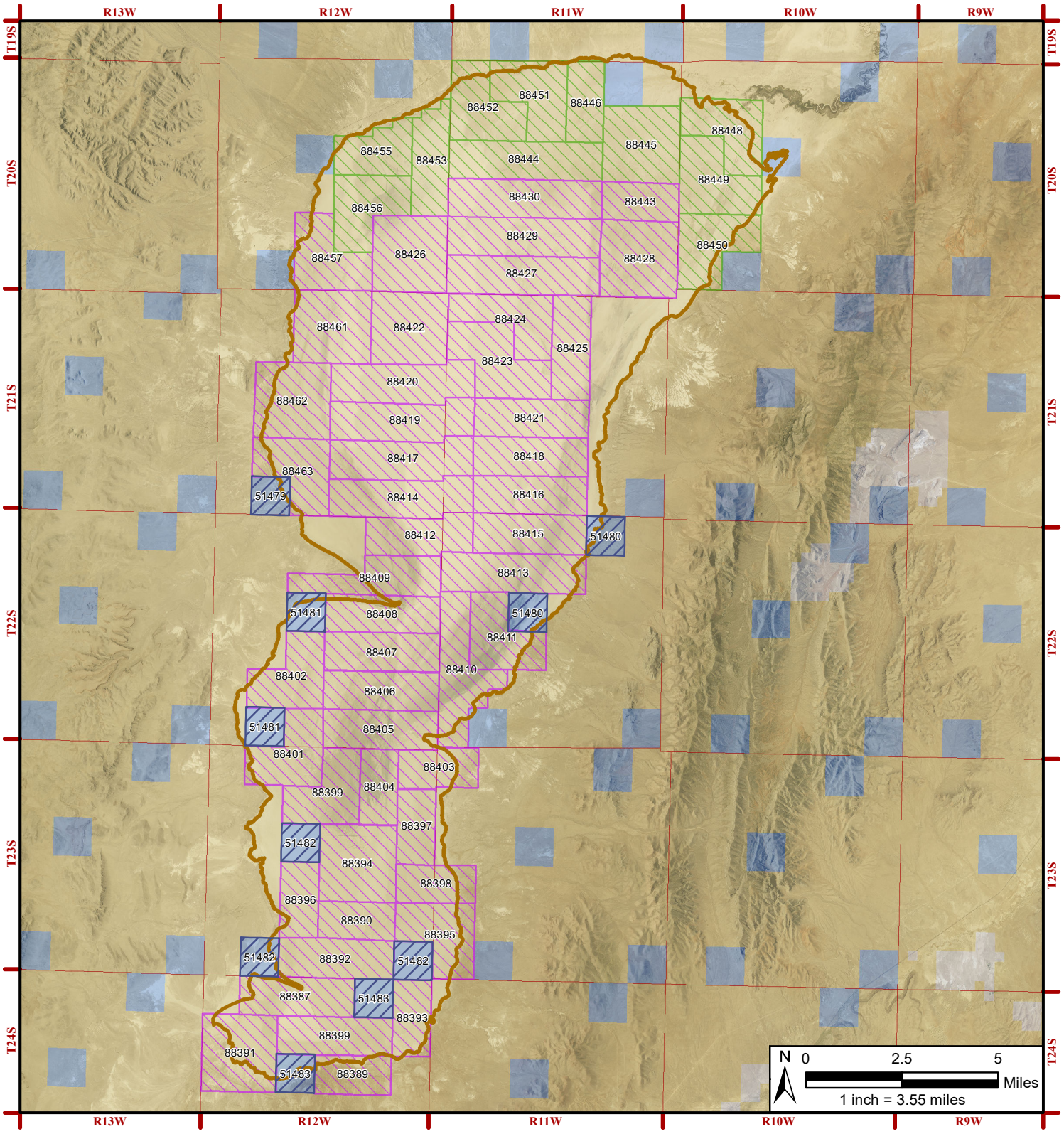


Project Features

- LUMA Lease
- Peak Lease
- EPM Lease - SITLA

Land Ownership

- BLM
- State Lands
- Private
- Sevier Playa Boundary

Notes:

- The project facilities not drawn to exact scale to improve legibility of figure.
- The project facilities shown on this map are draft and may be revised and/or refined throughout the development of the project.

NO.	DATE	REVISION	BY	APVD
1	1/5/2018	Revised based on comments	BD	
0	10/25/2017	Initial Submission	BD	

DSGN	DR	CHK	APVD

FIGURE 2-1

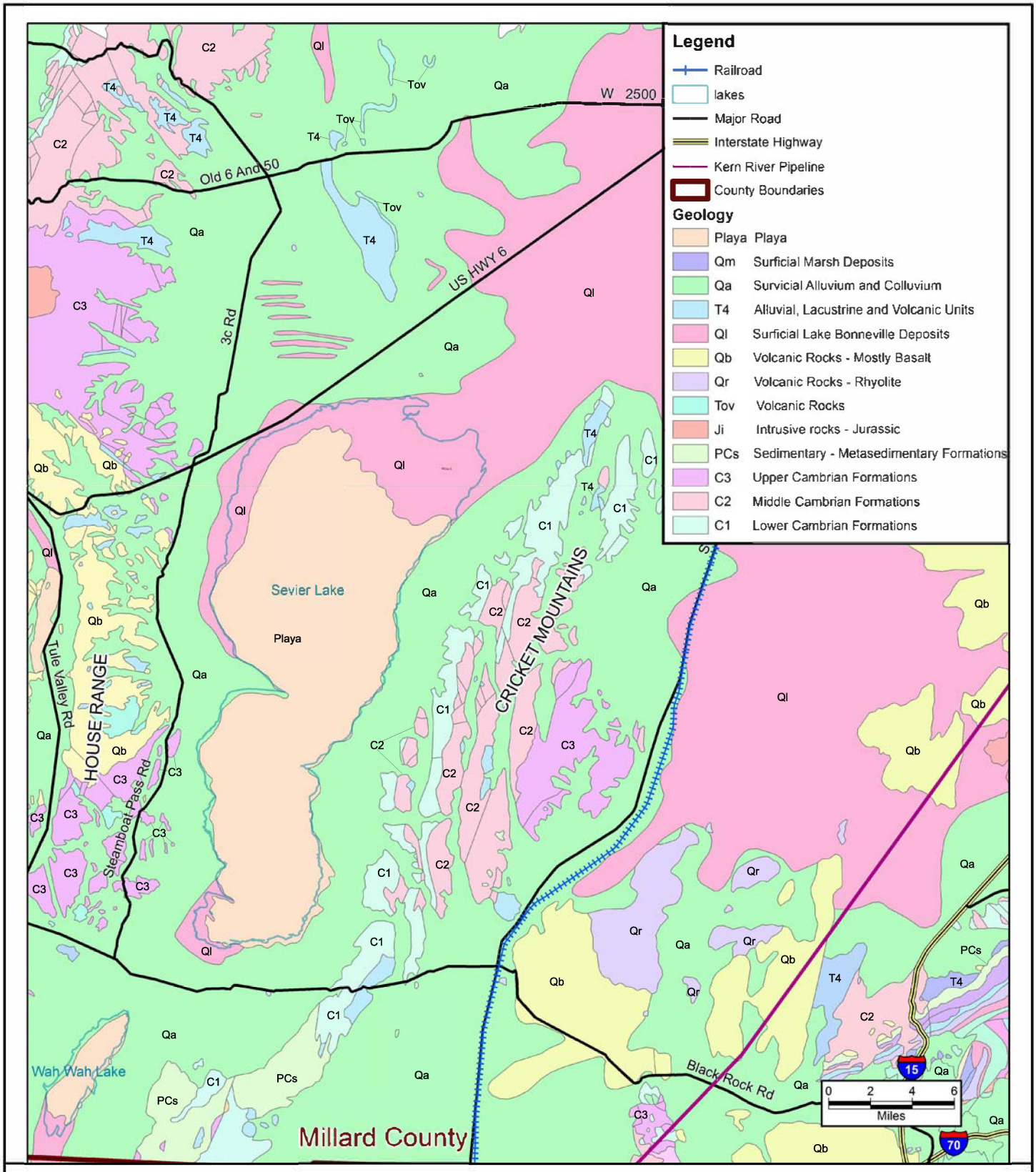
Sevier Playa Potash Project
Sevier Playa Leaseholds

MINING PLAN

DATE: 1/11/2018 | SCALE: 1:225,000

CRYSTAL PEAK MINERALS INC.

MP Fig 2-1_Leaseholds 180111 1/11/2018 2:53:52 PM



CRYSTAL PEAK MINERALS INC.

Source:
Digital Geologic Map of Utah,
Lehi F. Hintze, Grant C. Willis, Denise Y. M. Laes,
Douglas A. Sprinkel, and Kent D. Brown,
Utah Geological Survey
2000

0 2 4 6
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Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	DL	AB

DSGN	DR	CHK	APVD
DL	DL	AB	AB

FIGURE 3-1

Sevier Playa Potash Project
Mining Plan
Surface Geology

DATE: 10/03/2017
FILE: Figure 3.1 Surface Geology Mine Permit App.
SCALE: As Shown
NORWEST CORPORATION

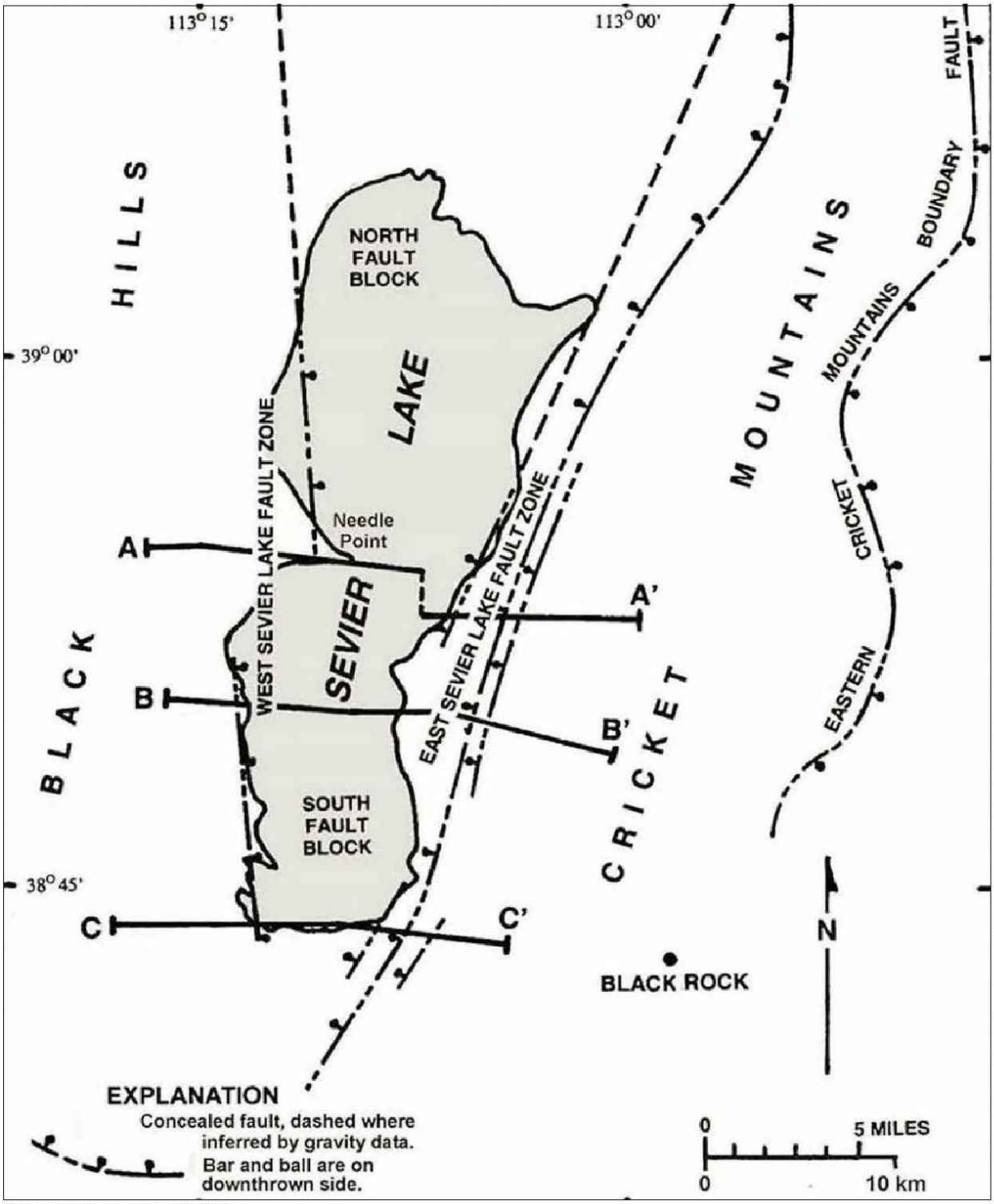


Figure from Case and Cook, 1979

CRYSTAL PEAK MINERALS INC.

FIGURE 3-2

Sevier Playa Potash Project
Fault Zones
Case and Cook (1979)

0	-25-	ITI-L SUB ITTAL	DL	AB
	DAT=		BY	-PVD

DSGN	DR	CHK	APVD
DL	DL	AB	AB

10/03/2017

NORWEST CORPORATION

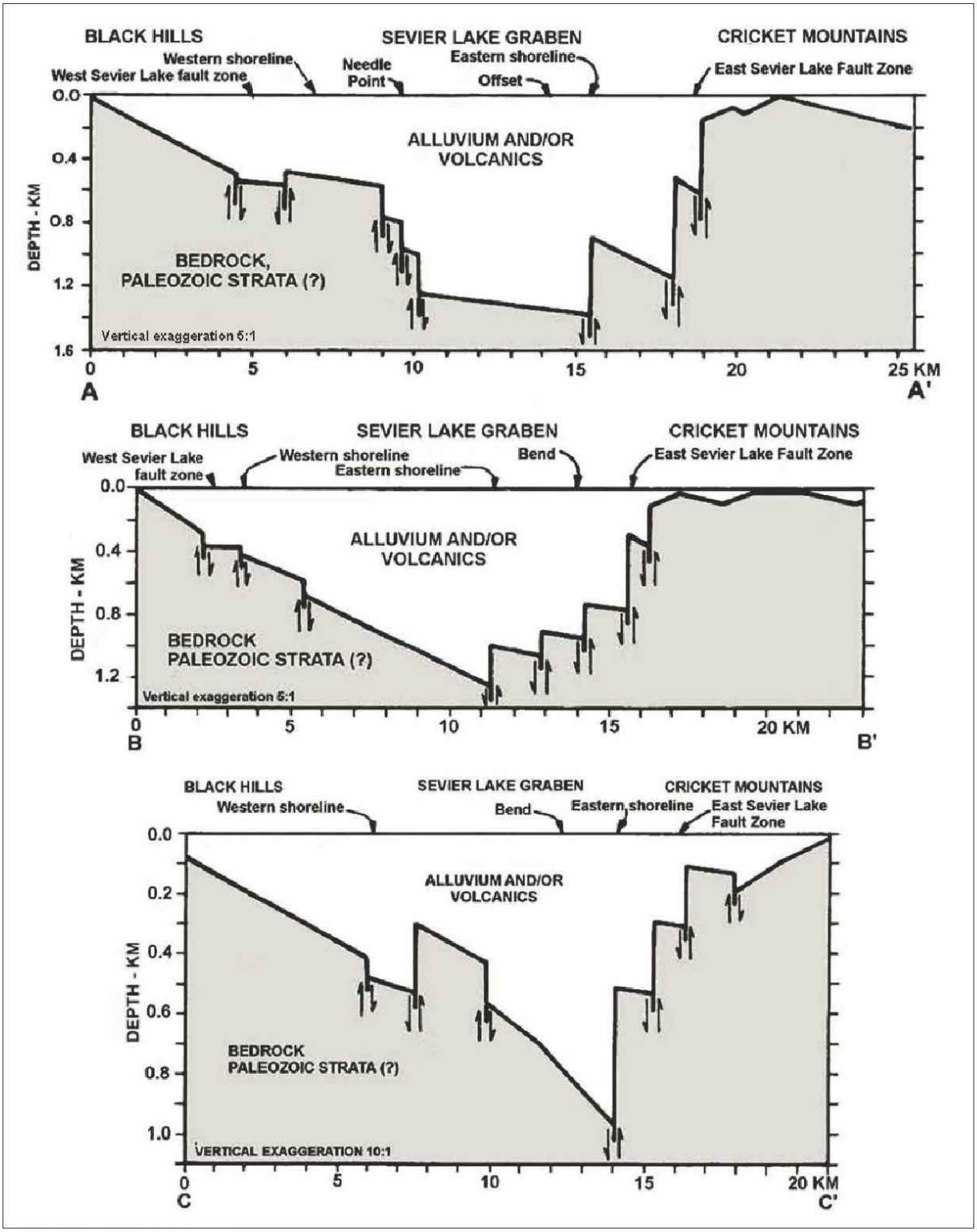


Figure from Case and Cook, 1979

CRYSTAL PEAK MINERALS INC.

N

0	-25-	ITI-L SUB ITTAL	DL	AB
D.	DAT:		BY	-PVD

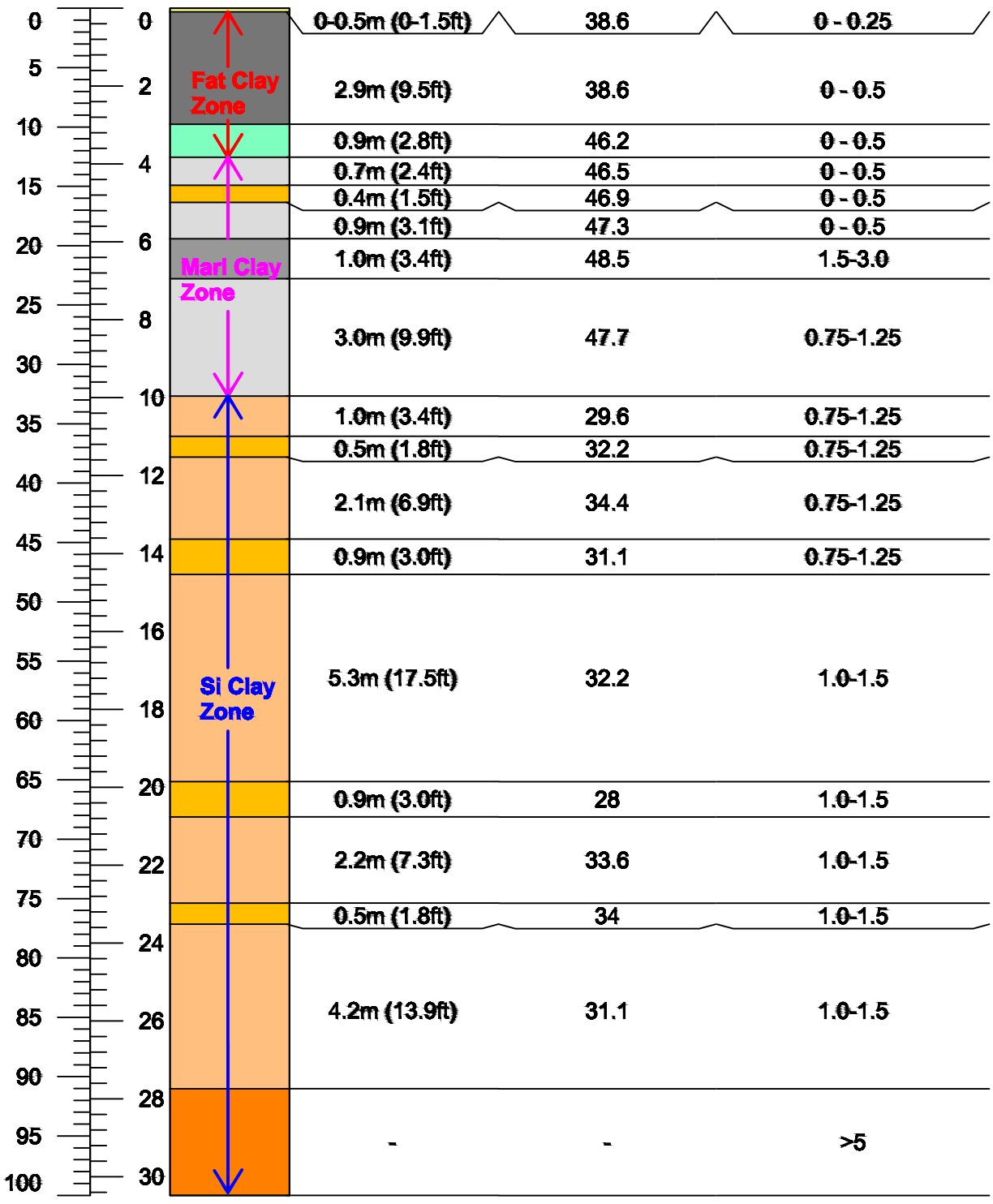
DSGN	DR	CHK	APVD
DL	DL	AB	AB

FIGURE 3-3

Sevier Playa Potash Project
Gravity Survey Sections
Case and Cook (1979)

10/03/2017 .dwg

NORWEST CORPORATION



CRYSTAL PEAK MINERALS INC.

LEGEND

- Salt Crust
- Fat Clay with organics
- Fat (plastic) Clay
- Stiff Marl Clay
- Marl Clay
- Sand and Gravel
- Siliceous Clay
- Hard Dry Clay

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	JDS	AB
0	10-25-17	INITIAL SUBMITTAL	DL	AB

DSGN	DR	CHK	APVD
DL	DL	AB	AB

FIGURE 3-4

Sevier Playa Potash Project

Mining Plan

Brine Aquifer

Typical Stratigraphy

DATE: 09/20/2017
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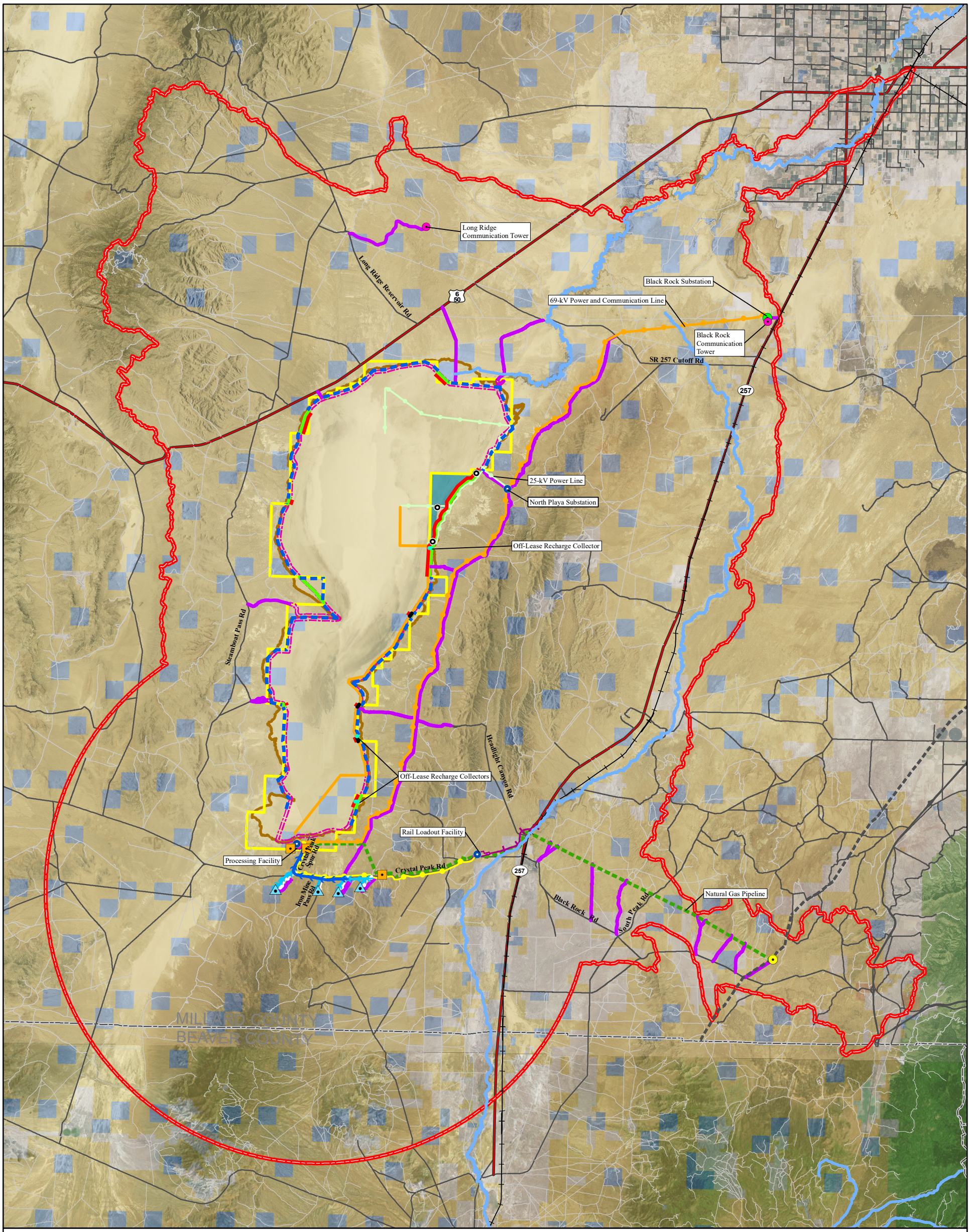
SCALE: NTS

NORWEST CORPORATION



Proposed Project Features

- 69-kV Power and Communication Line
- 25-kV Power Line
- 12.47-kV Power and Communication Line
- 12.47-kV Power Line Spur
- Recharge Canal - On-Lease
- Recharge Canal - Off-Lease
- Access Road - Off-Lease
- Perimeter Road and Spurs - On-Lease
- Perimeter Road Segment - Off-Lease
- Brine Transfer Canal/Pipeline - On-Lease
- Brine Transfer Canal - Off-Lease
- Recharge Collector - Off-Lease
- Rail Spur and Access Corridor
- Rail Loadout Facility
- Natural Gas Pipeline
- Gravel Pit
- Water Supply Pipeline
- Water Supply Pipeline Spur
- Water Supply Well
- Communication Tower
- Substation
- Preconcentration Ponds - Off-Lease

General Reference

- Water Resources Analysis Area
- BLM and SITLA Lease Boundary
- Sevier Playa Boundary
- Kern River Natural Gas Pipeline
- Kern River Valve Station
- Black Rock Substation
- US Highway, State Highway
- Class B Road
- Dirt Track Road
- Railroad

Land Ownership

- BLM
- State Lands
- Private

N

0 2.5 5 Miles

1 in = 5 miles 1:336,000

Sources:
Project features, Crystal Peak Minerals, 2015, 2016, 2017;
Water resources study area, Whetstone Associates, 2016;
Public land survey system, BLM 2013;
Sevier Playa Boundary, SWCA 2015;
Land jurisdiction, BLM 2013;
Roads, Millard County 2013;
Railroads, ESRI 2000;
Kern River gas pipeline, BLM 2011;
Aerial Imagy, USDA/APFO 2016

Note:
- The rail facility and utility siting areas shown on this map are draft and may be revised and/or refined throughout the development of the project.

NO.	DATE	REVISION	BY	APVD
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

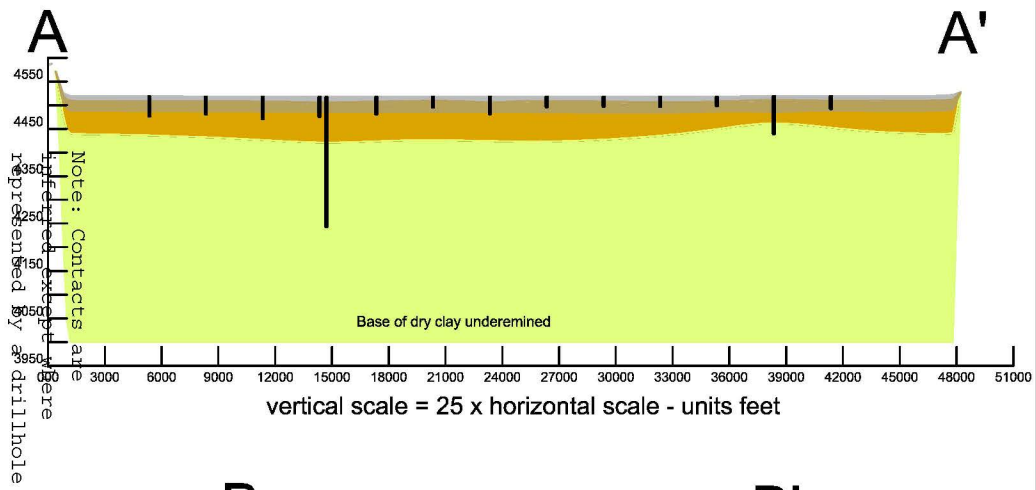
FIGURE 3-5

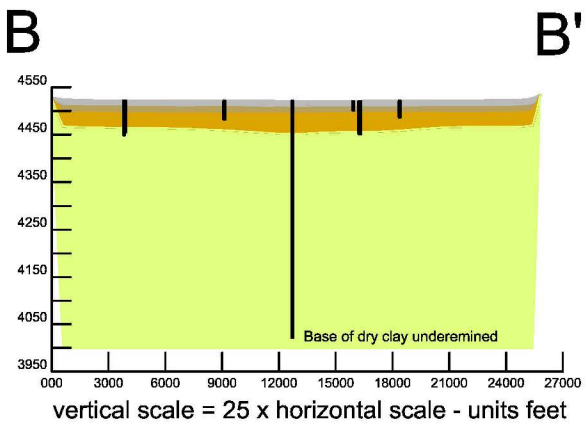
Sevier Playa Potash Project
Baseline Water Resources Analysis Area

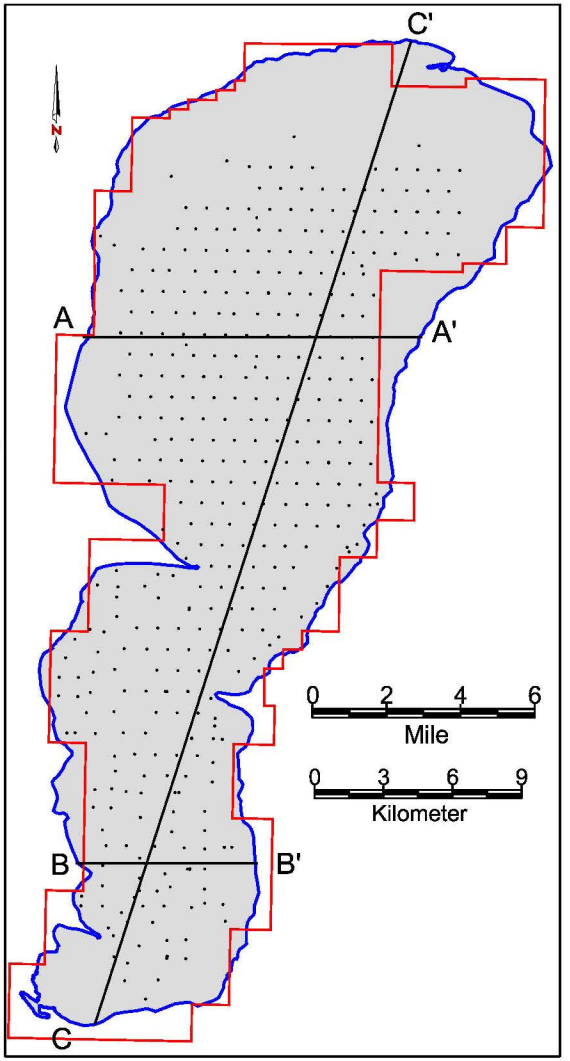
MINING PLAN

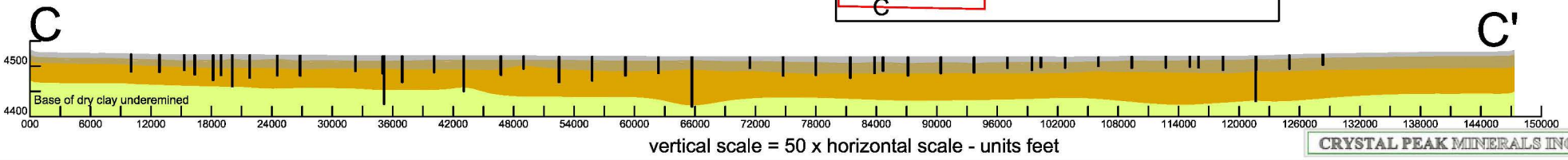
DATE: 1/19/2018 SCALE: 1:336,000

CRYSTAL PEAK MINERALS INC.









CRYSTAL PEAK MINERALS INC.

LEGEND

Lease Control
Playa Boundary*
Drillholes
Fat Clay
Marl Clay
Siliceous Clay
Dry Clay

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

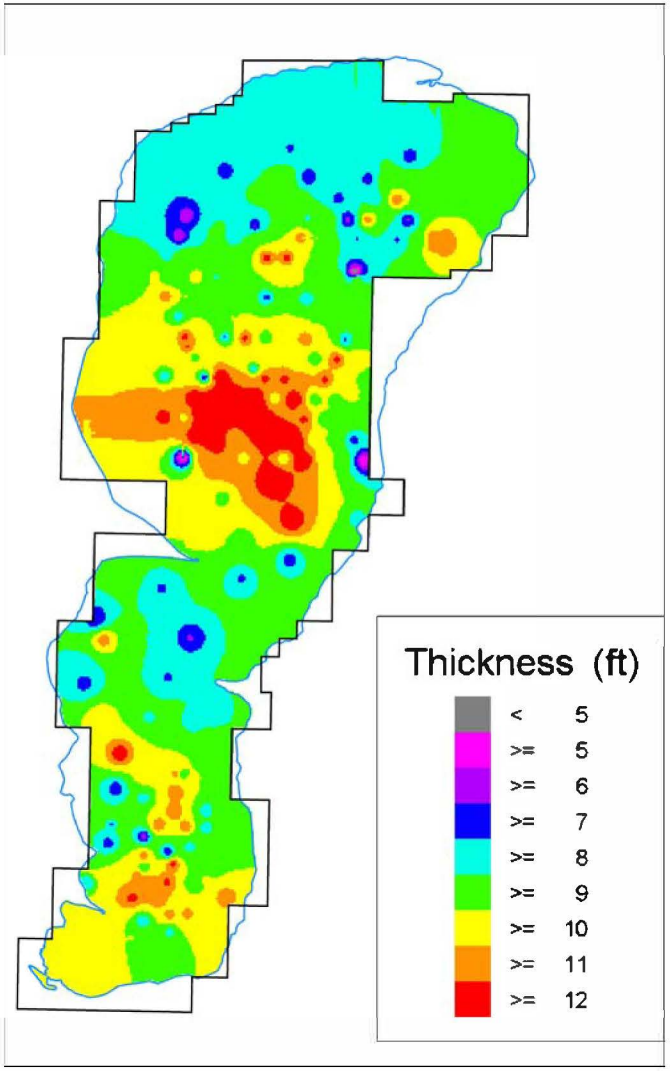
FIGURE 5-3

Sevier Playa Potash Project
Mining Plan
Playa Cross Sections
A-A' B-B' C-C'

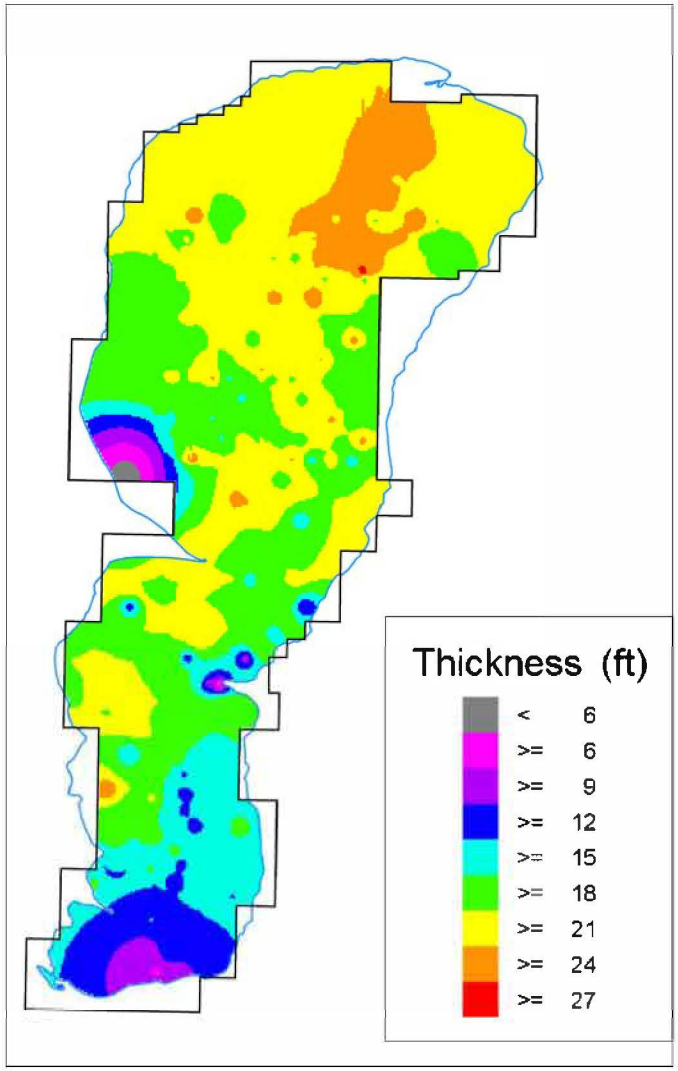
DATE: 09/22/2017
FILE: 89-11 Fig 5.2
SCALE: As Shown

NORWEST CORPORATION

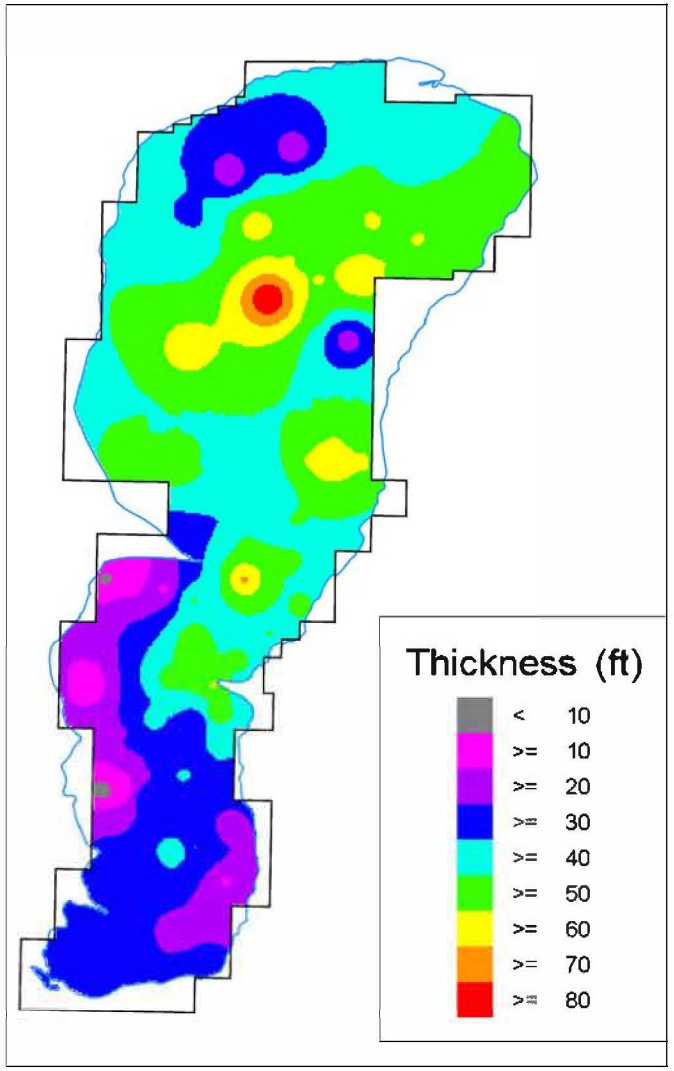
Fat Clay



Marl Clay



Siliceous Clay



CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

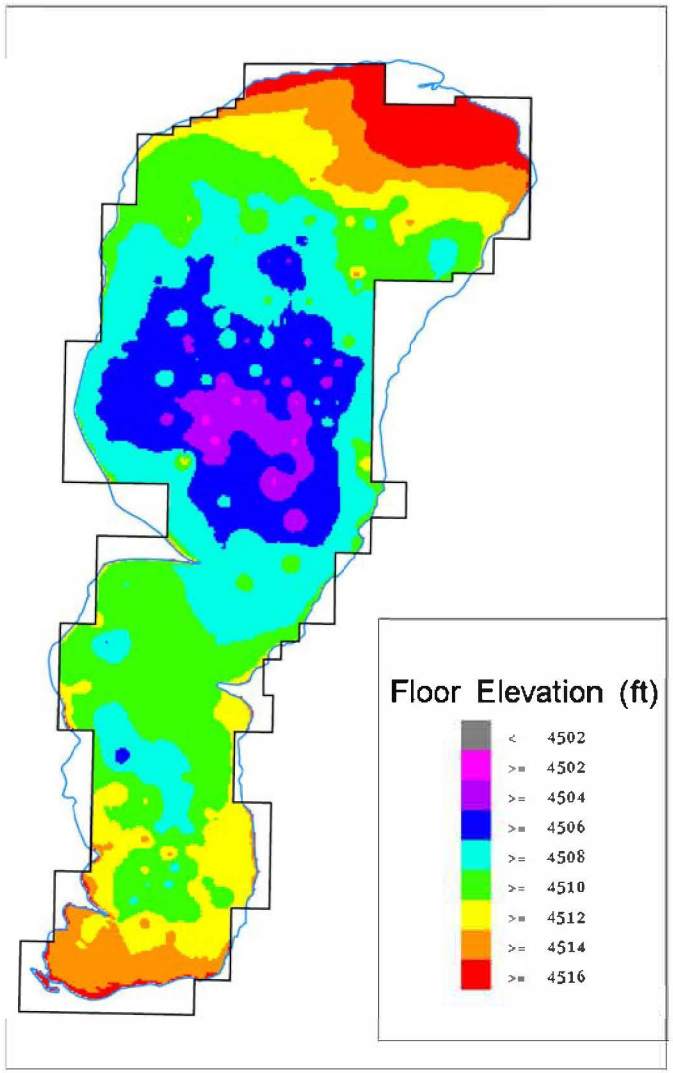
FIGURE 5-4

Sevier Playa Potash Project
Mining Plan
Brine Horizon
Thickness (feet)

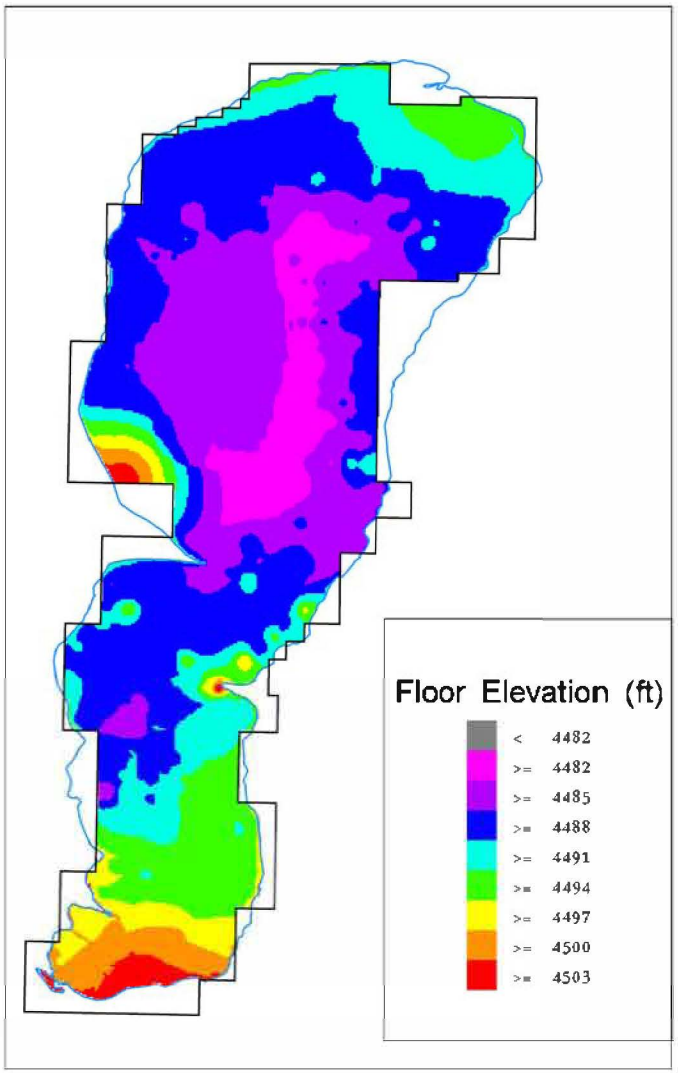
DATE: 09/22/2017
FILE: 89-11 Fig 5.3
SCALE: As Shown

NORWEST CORPORATION

Fat Clay



Marl Clay



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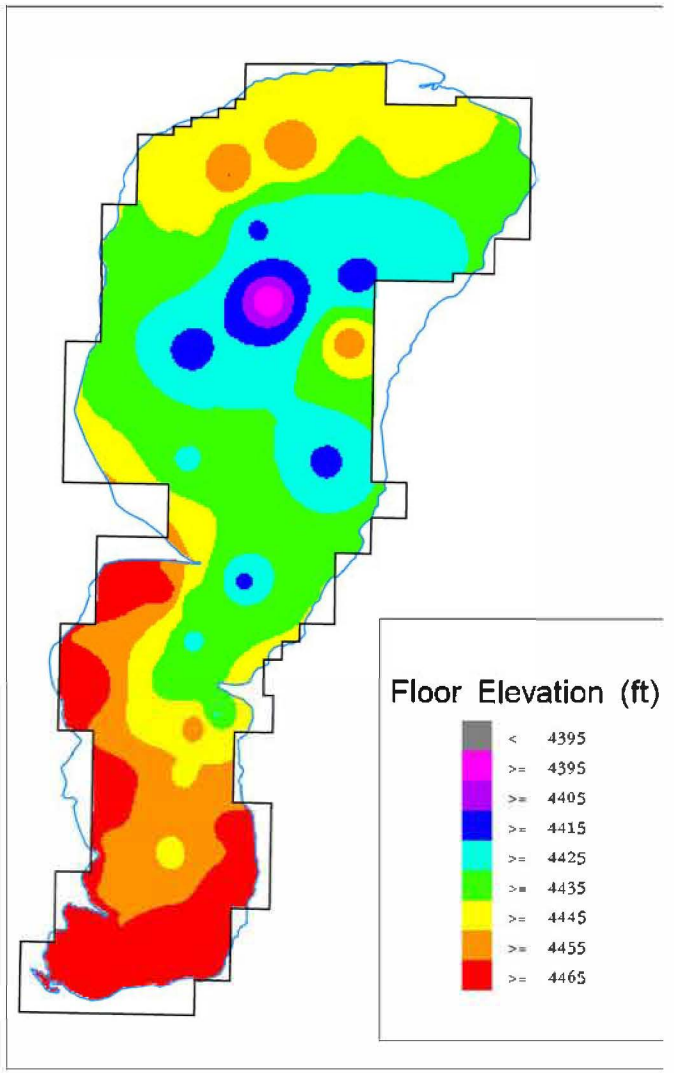


CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

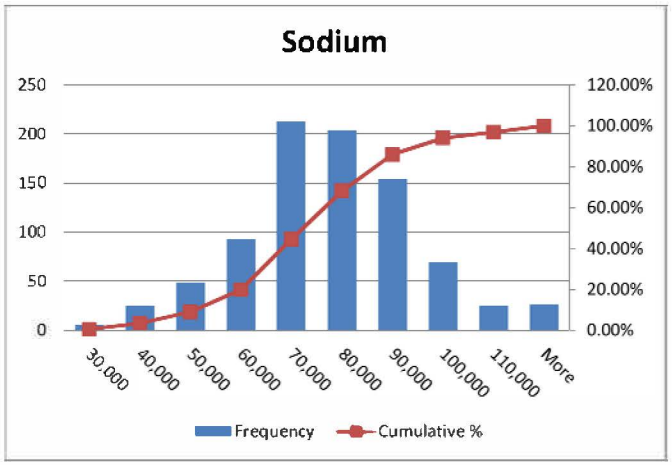
DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

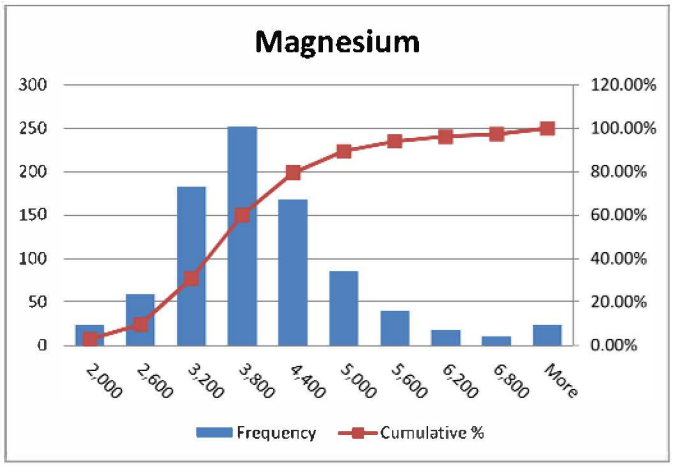
FIGURE 5-5

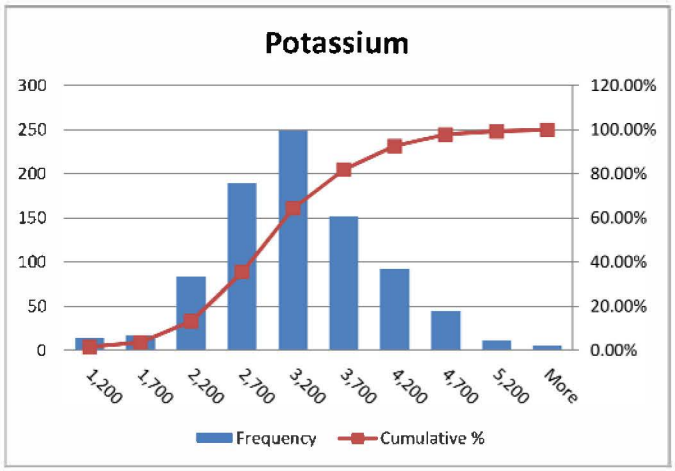
Sevier Playa Potash Project
Mining Plan
Brine Horizon
Floor Elevation (feet)

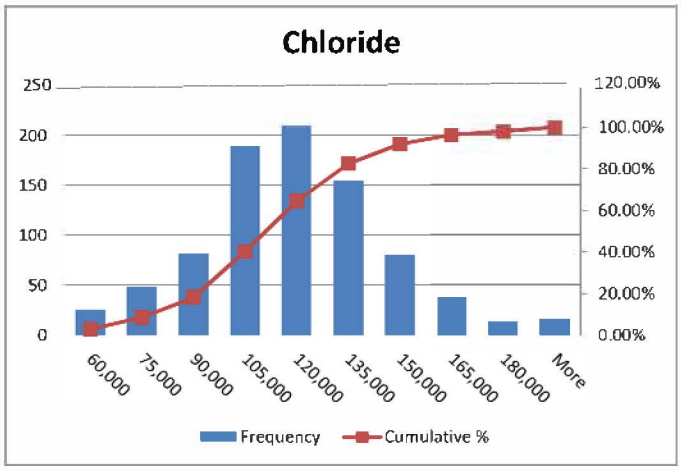
DATE: 09/22/2017
FILE: 89-11 Fig 5.4
SCALE: As Shown

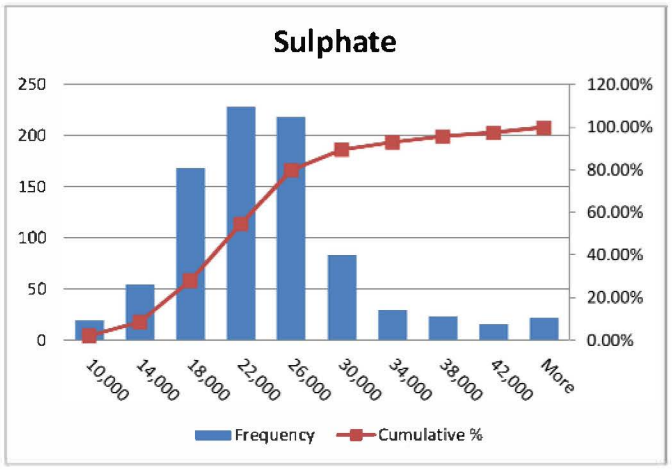
NORWES CORPORATIO

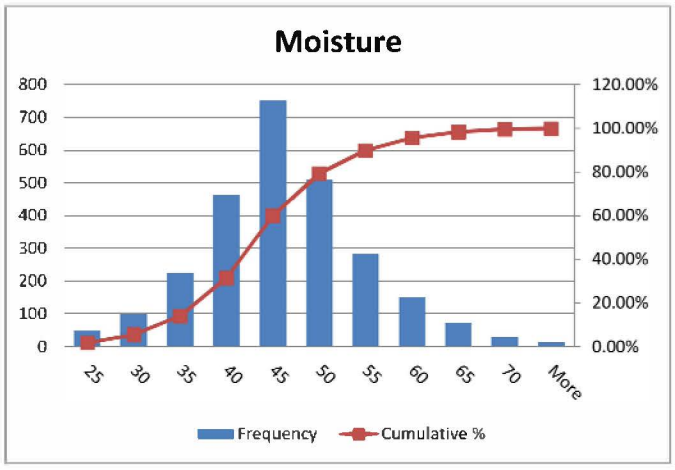












CRYSTAL PEAK MINERALS INC.

Left Axis - Frequency (n)

Right Axis - Cumulative Percent (%)

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

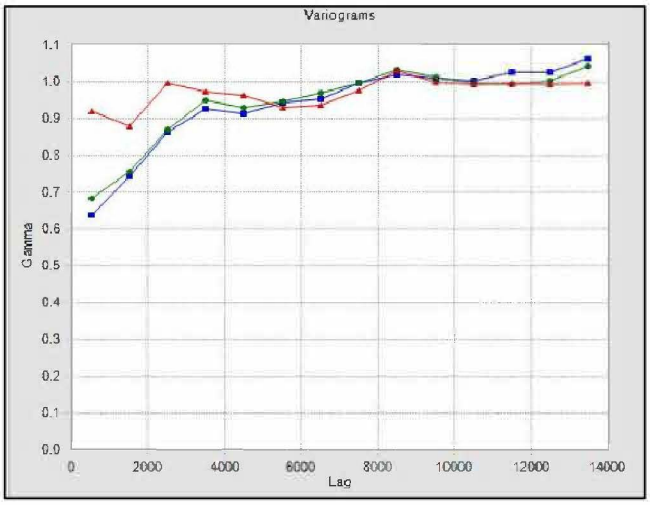
FIGURE 5-6

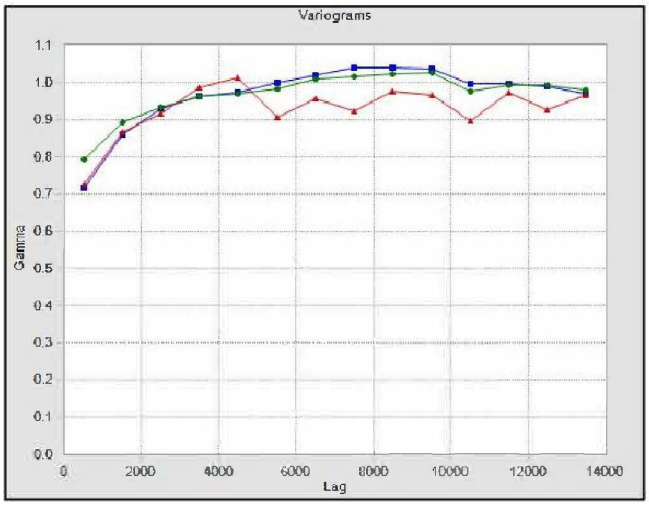
Sevier Playa Potash Project
Mining Plan

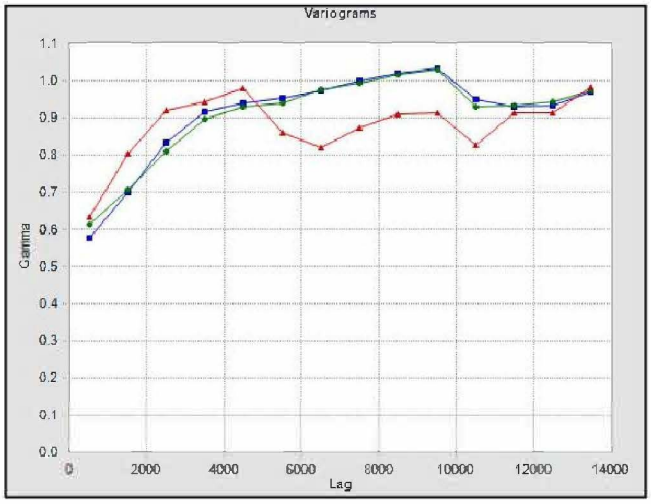
Data Distribution
Major Ions and Moisture

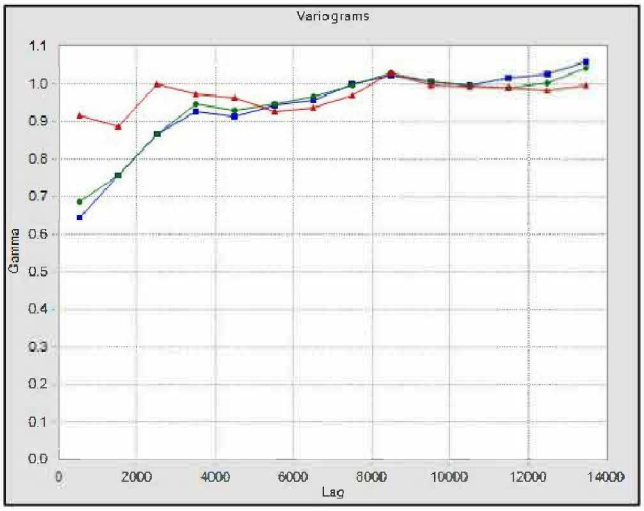
DATE: 09/22/2017
FILE: 89-11 Fig 5.5
SCALE: As Shown

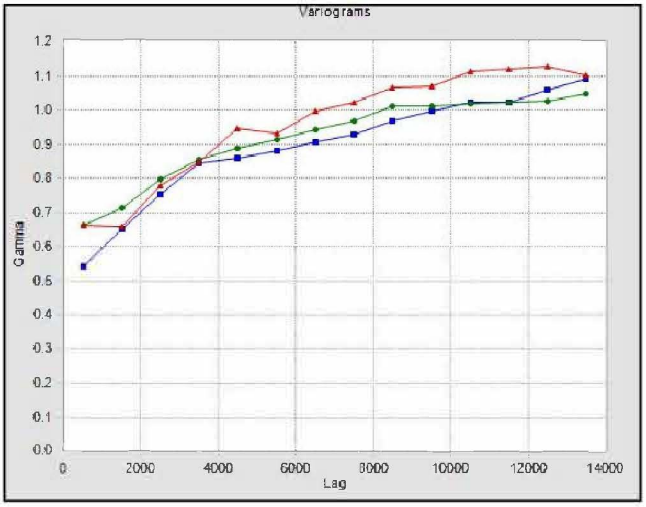
NORWEST CORPORATION

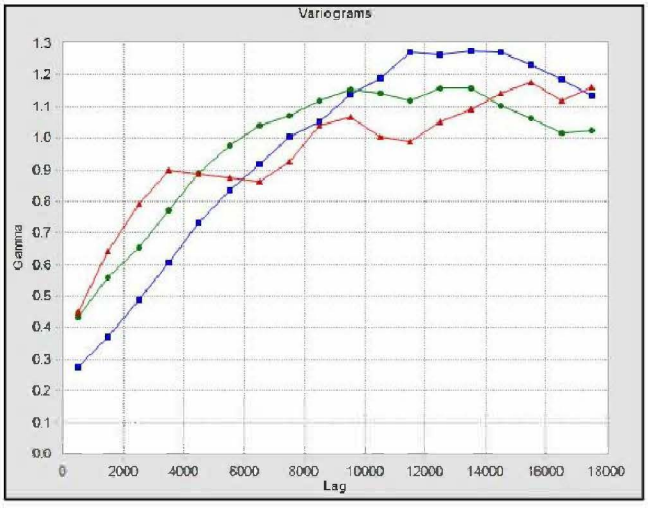












CRYSTAL PEAK MINERALS INC.

LEGEND

Fat Cl
Marl Clay
Siliceous Clay

Y-axis gamma = semi-variance
X-axis lag = range in meters

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

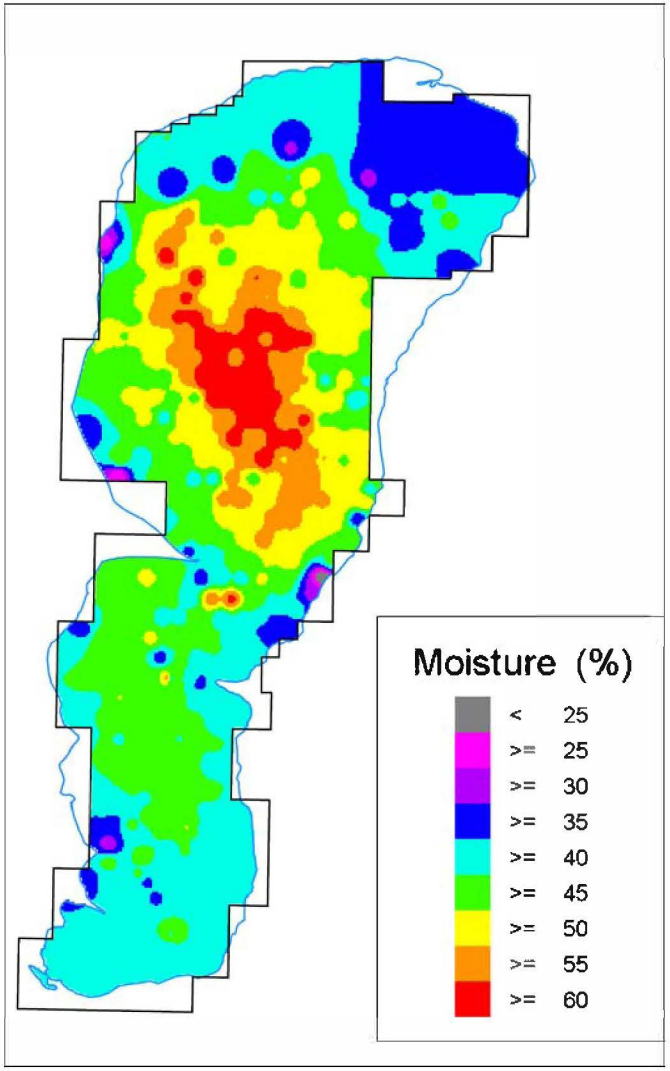
FIGURE 5-7

Sevier Playa Potash Project
Mining Plan
Semi-Variograms

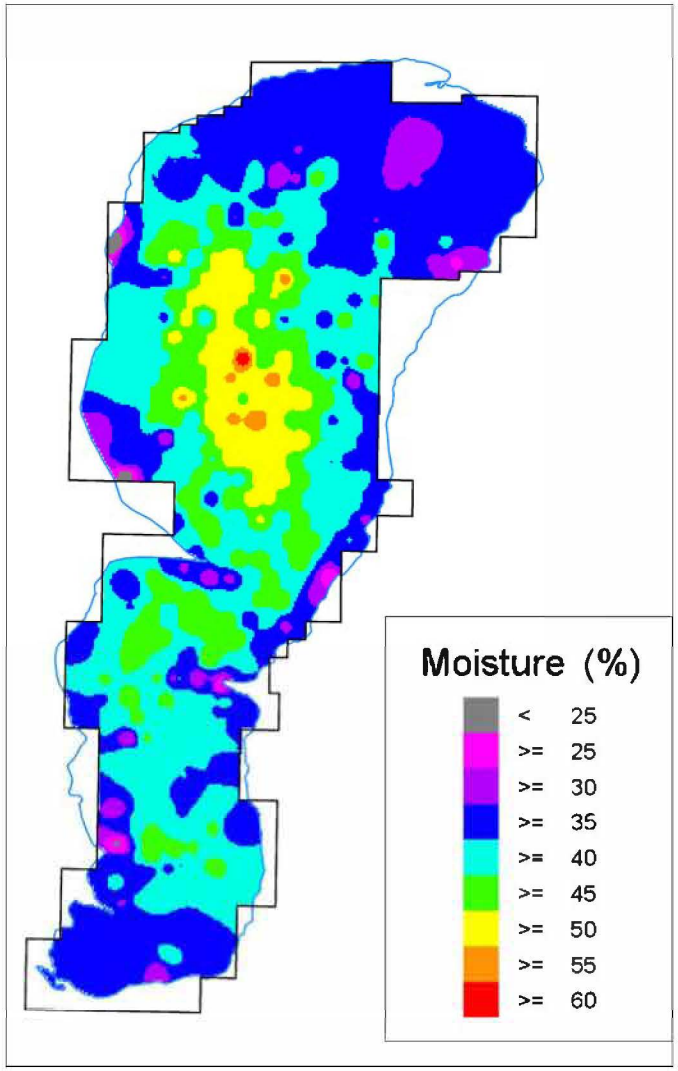
DATE: 10/03/2017
FILE: 89-11 Fig 5.6
SCALE: As Shown

NORWEST CORPORATION

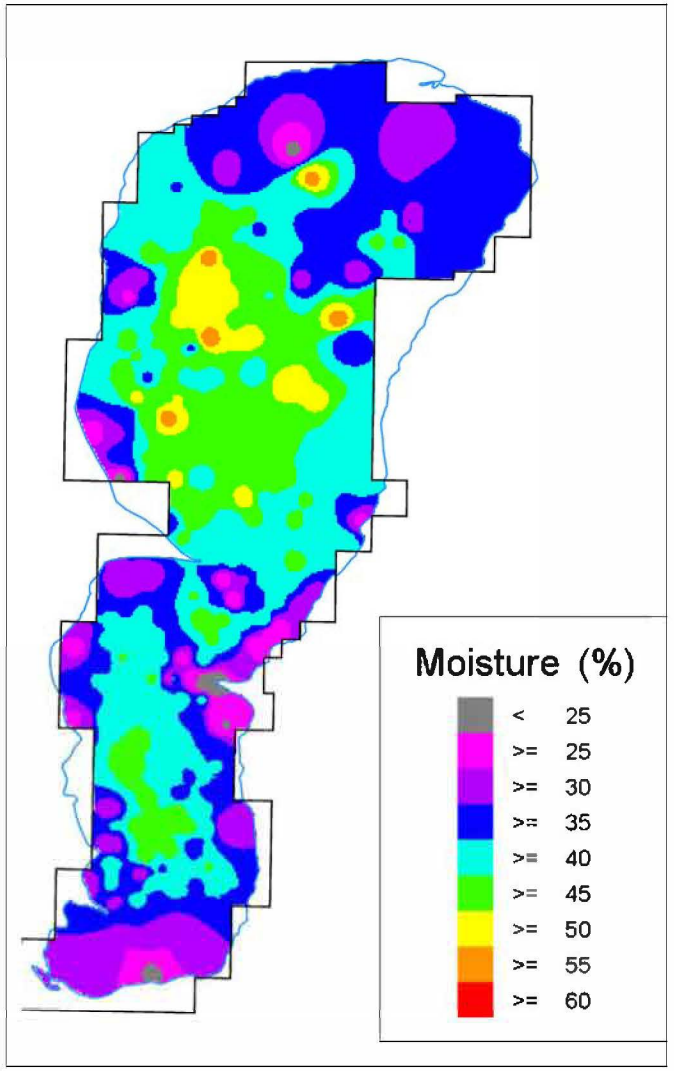
Fat Clay



Marl Clay



Siliceous Clay



CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

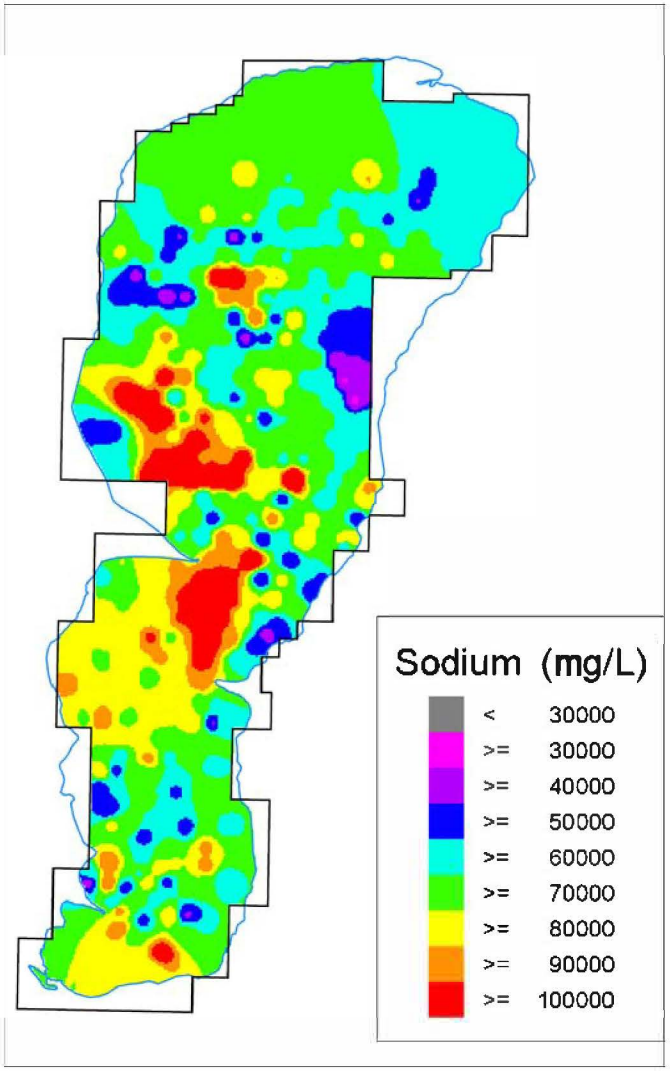
FIGURE 5-8

Sevier Playa Potash Project
Mining Plan
Brine Aquifer
Gravimetric Moisture (%)

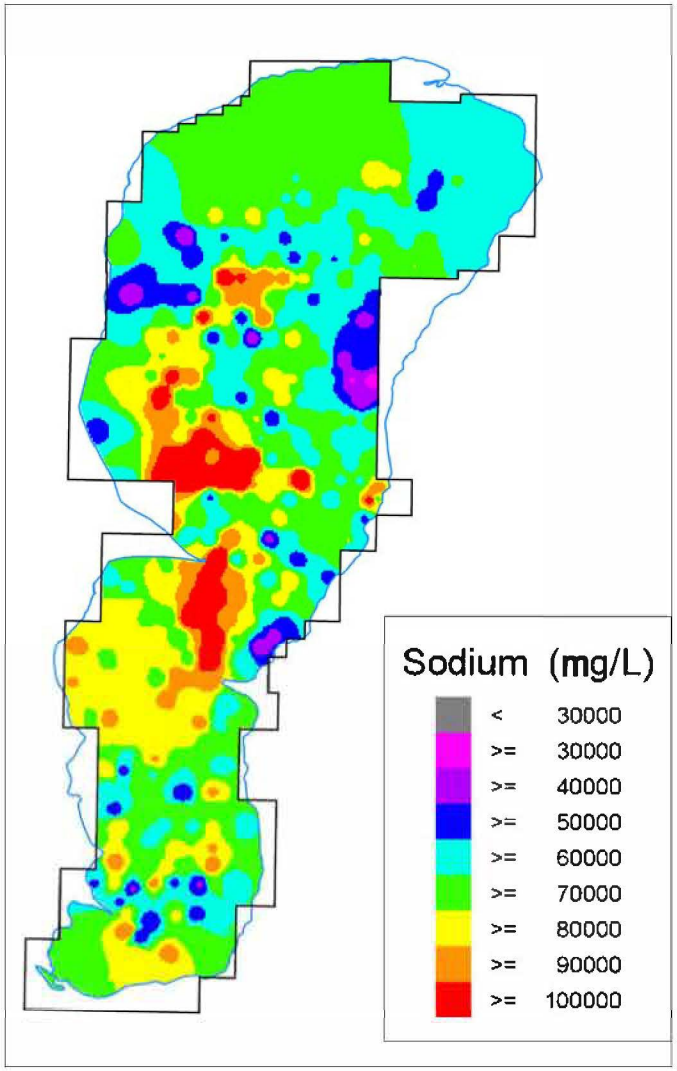
DATE: 09/22/2017
FILE: 89-11 Fig 5.7
SCALE: As Shown

NORWEST CORPORATION

Fat Clay



Marl Clay



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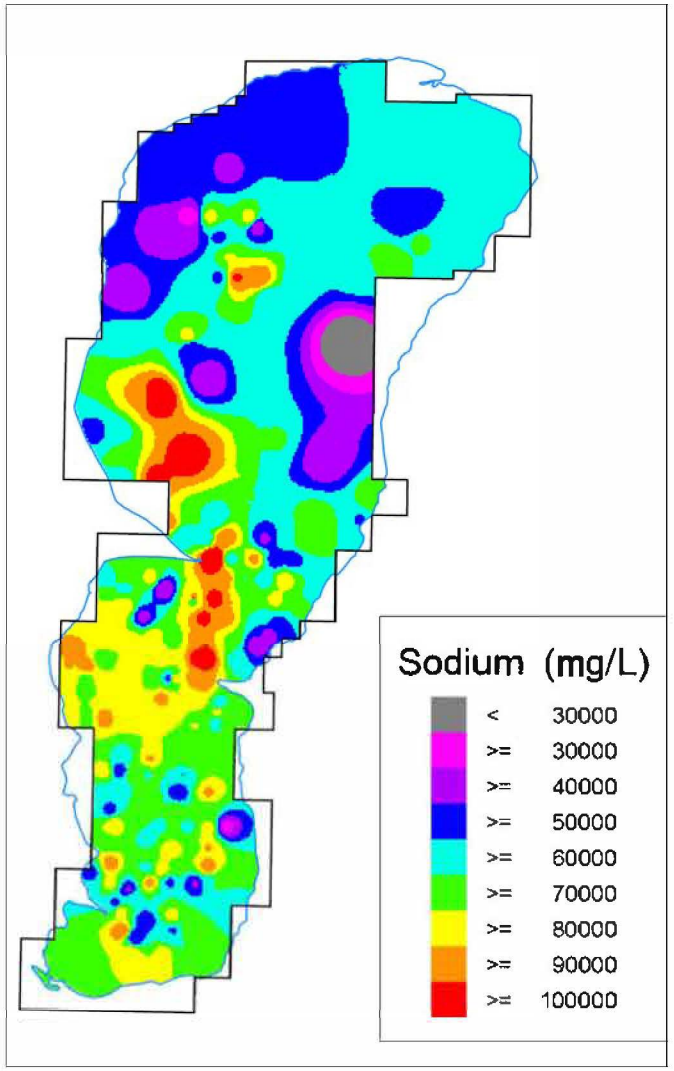


CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

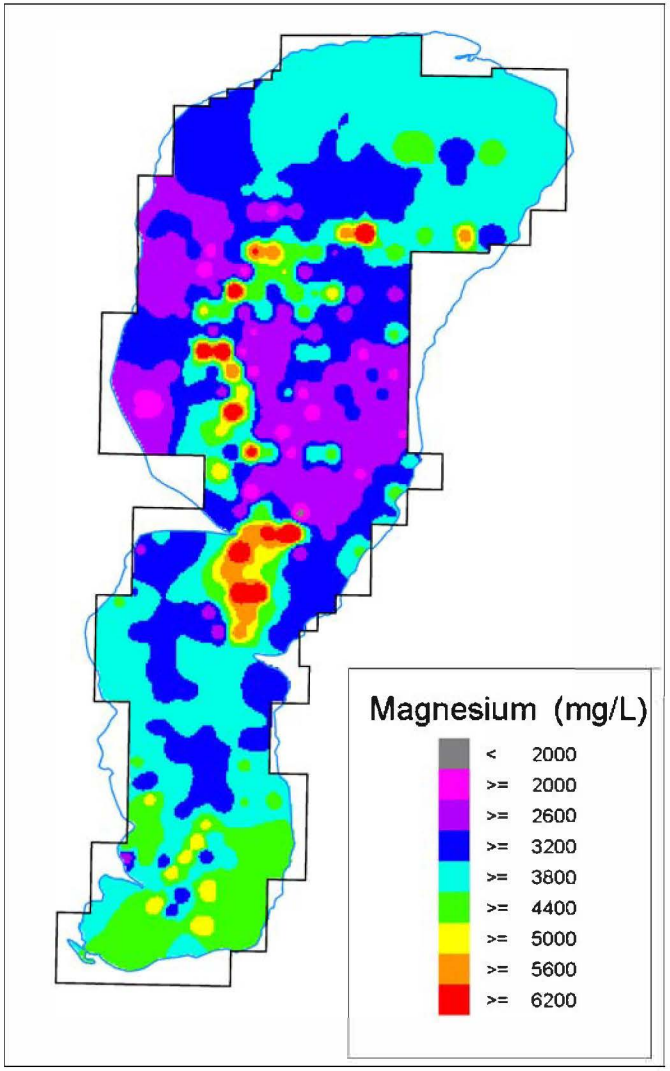
FIGURE 5-9

Sevier Playa Potash Project
Mining Plan
Major Brine Cations
Sodium (mg/L)

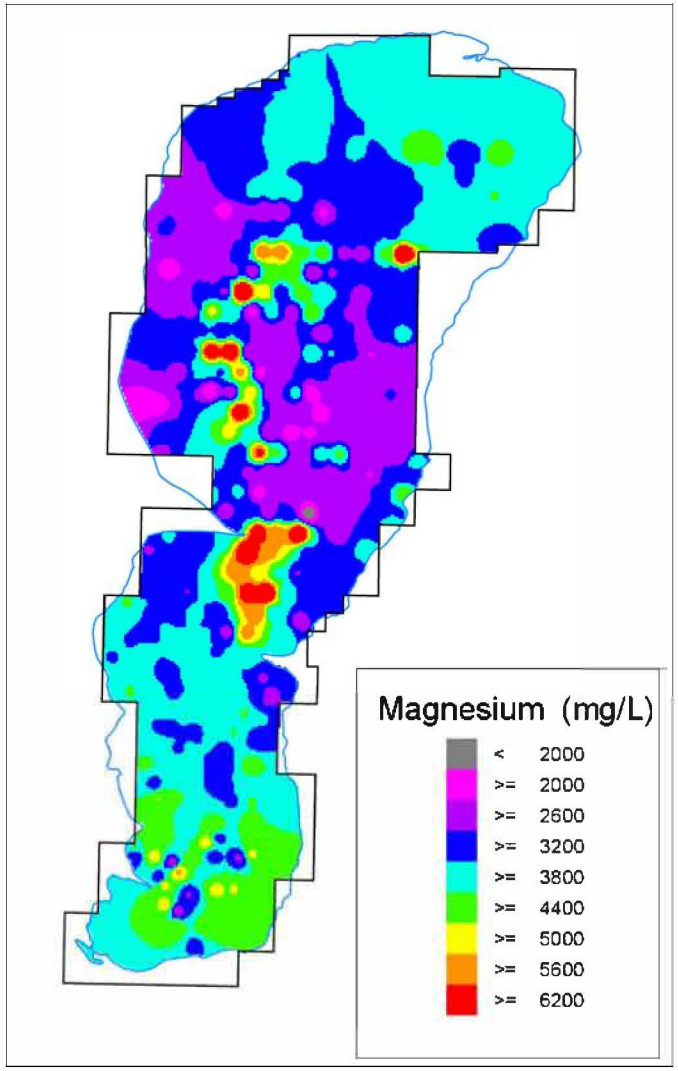
DATE: 09/22/2017
FILE: 89-11 Fig 5.8
SCALE: As Shown

NORWEST CORPORATION

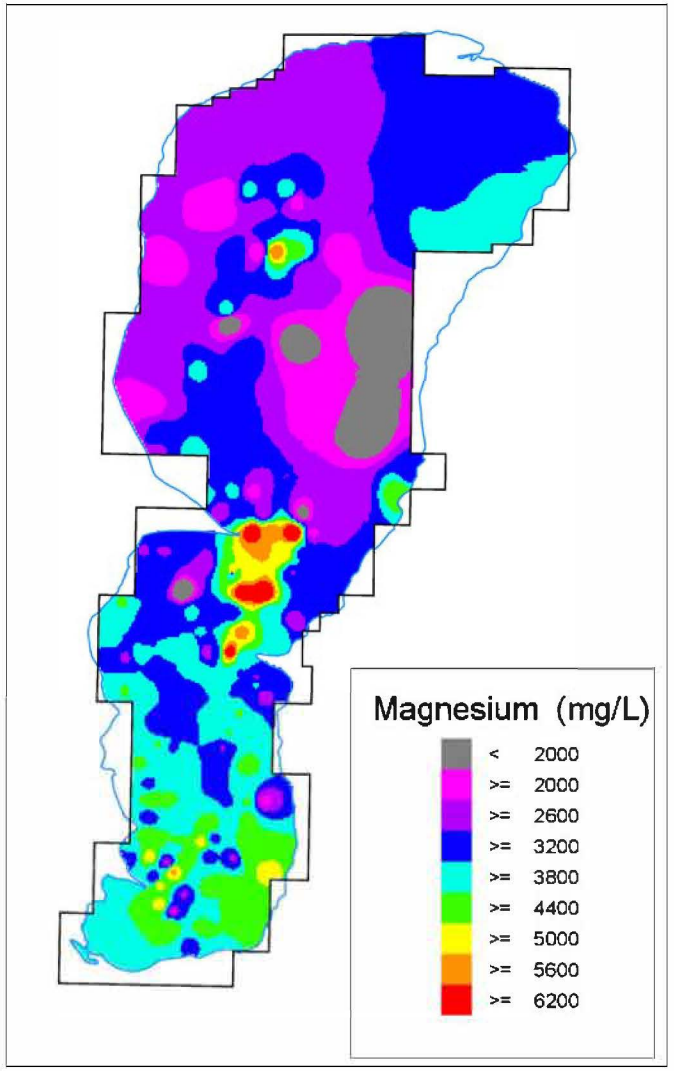
Fat Clay



Marl Clay



Siliceous Clay



CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

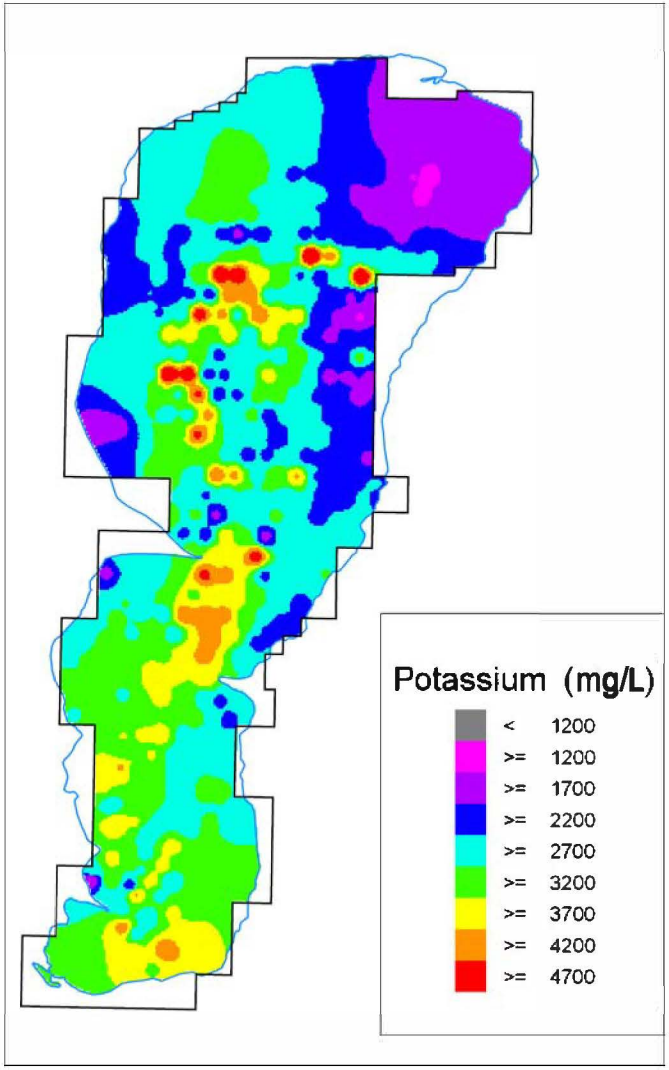
FIGURE 5-10

Sevier Playa Potash Project
Mining Plan
Major Brine Cations
Magnesium (mg/L)

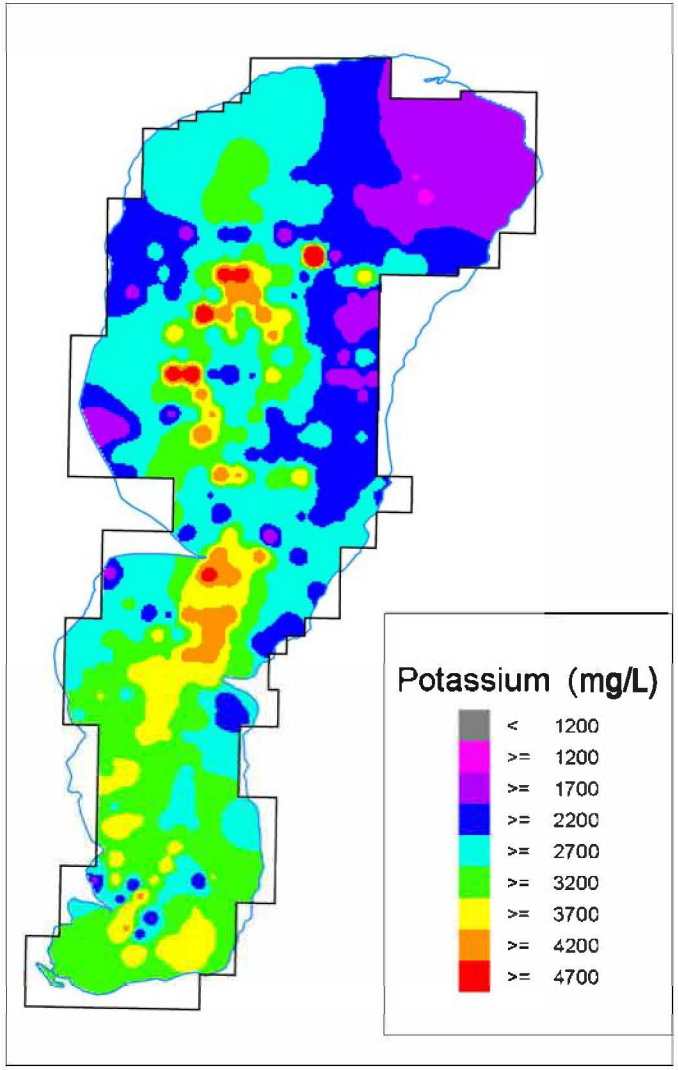
DATE: 09/22/2017
FILE: 89-11 Fig 5.9
SCALE: As Shown

NORWEST CORPORATION

Fat Clay



Marl Clay



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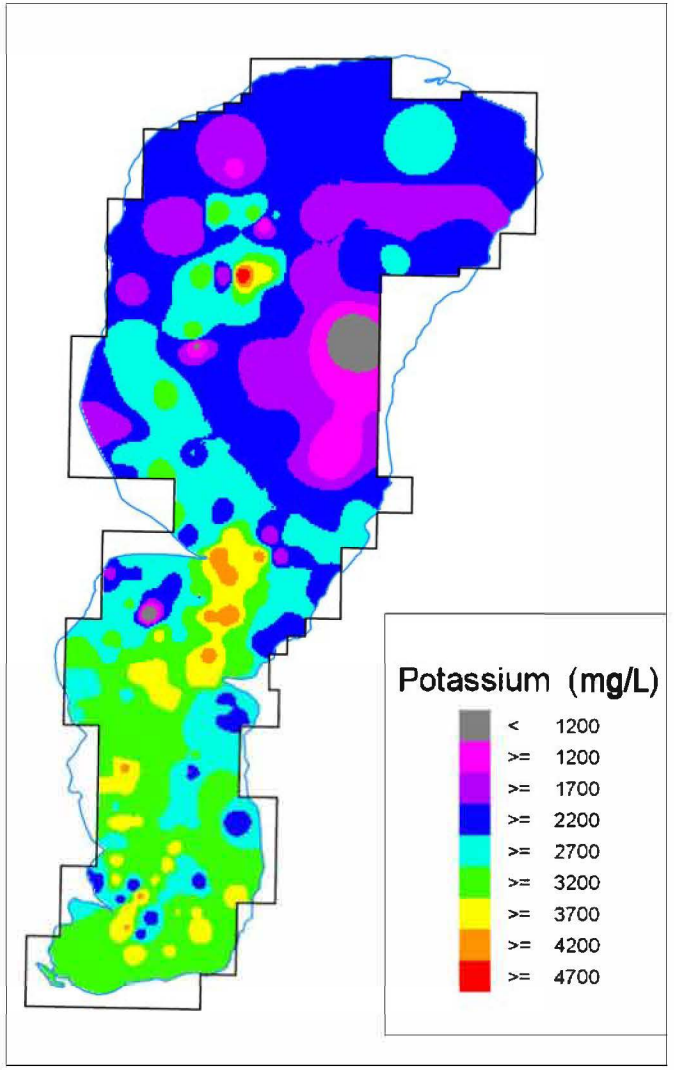


CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

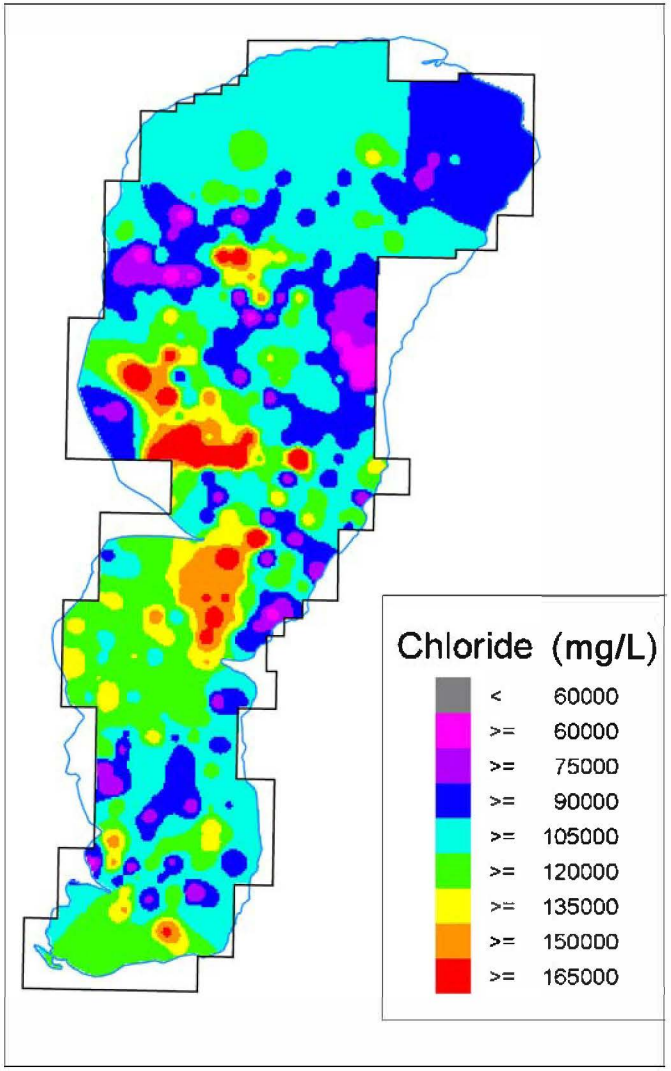
FIGURE 5-11

Sevier Playa Potash Project
Mining Plan
Major Brine Cations
Potassium (mg/L)

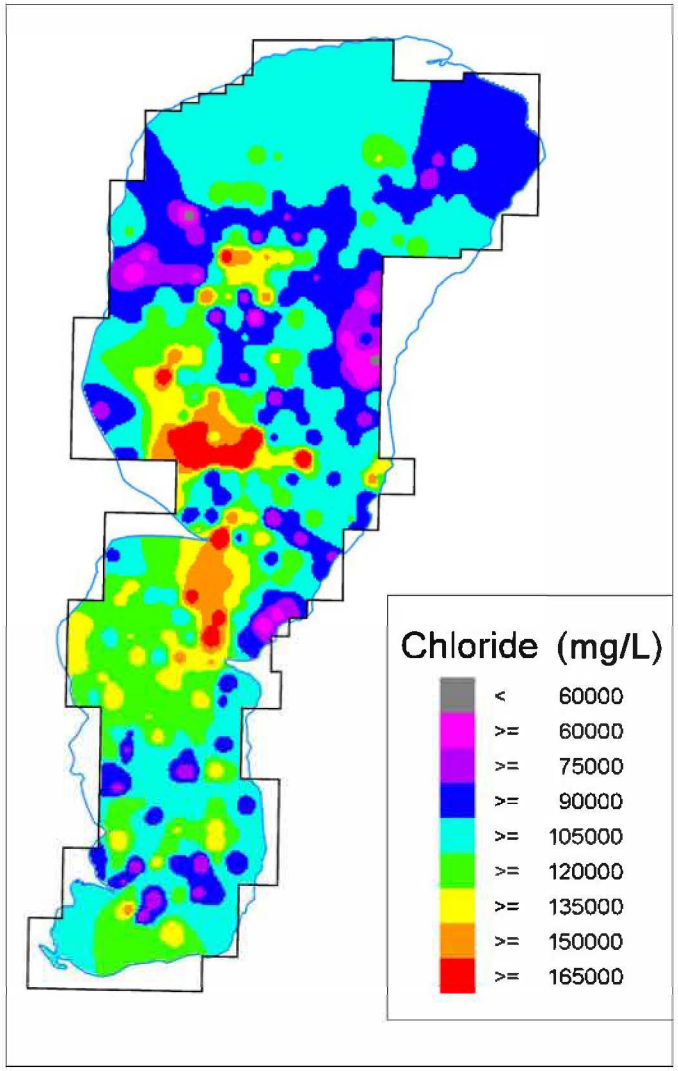
DATE: 09/22/2017
FILE: 89-11 Fig 5.10
SCALE: As Shown

NORWEST CORPORATION

Fat Clay



Marl Clay



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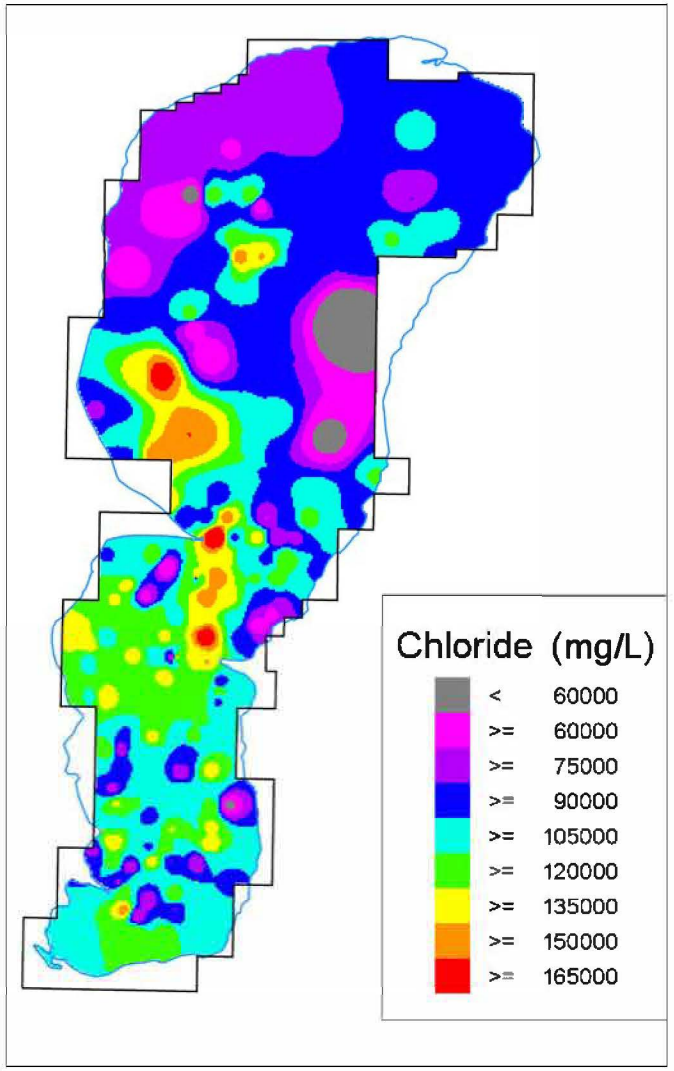


CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

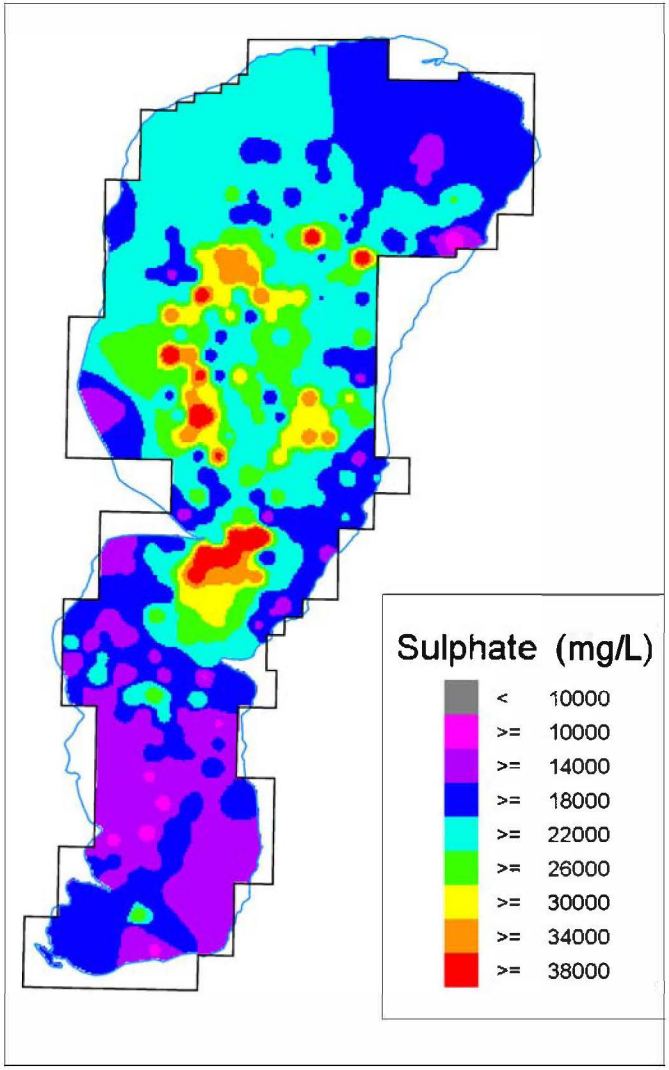
FIGURE 5-12

Sevier Playa Potash Project
Mining Plan
Major Brine Cations
Chloride (mg/L)

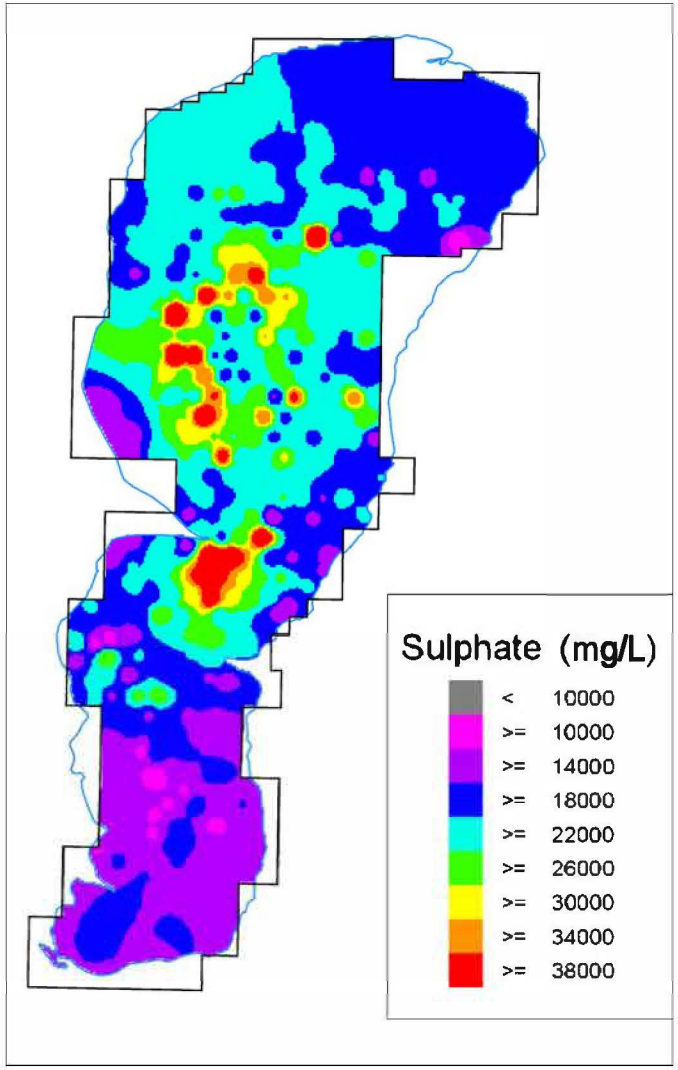
DATE: 09/22/2017
FILE: 89-11 Fig 5.11
SCALE: As Shown

NORWEST CORPORATION

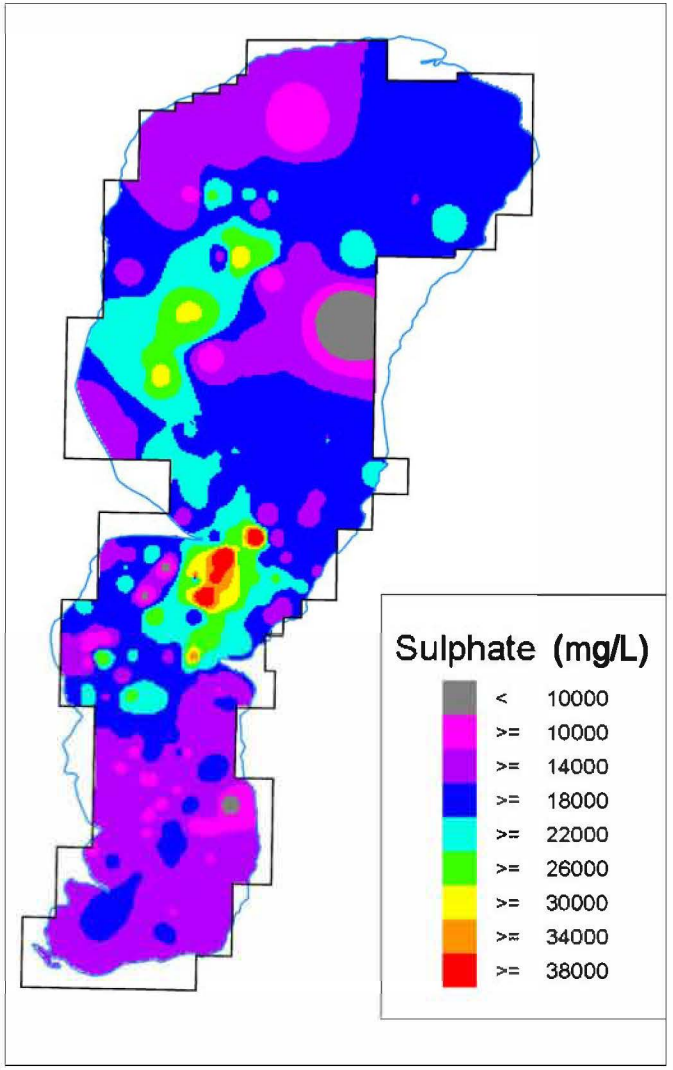
Fat Clay



Marl Clay



Siliceous Clay



CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

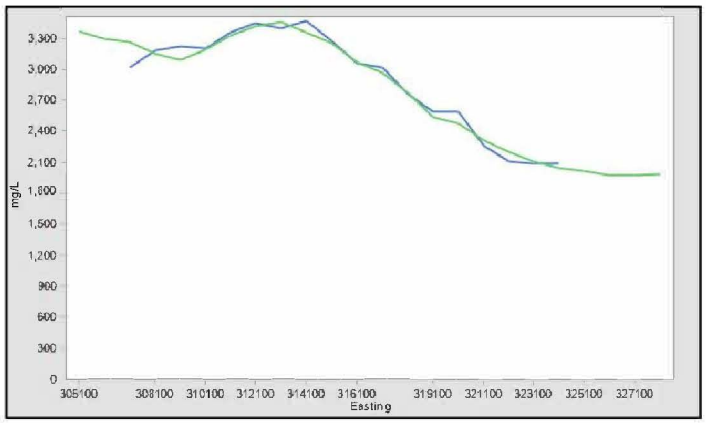
FIGURE 5-13

Sevier Playa Potash Project
Mining Plan
Major Brine Cations
Sulphate (mg/L)

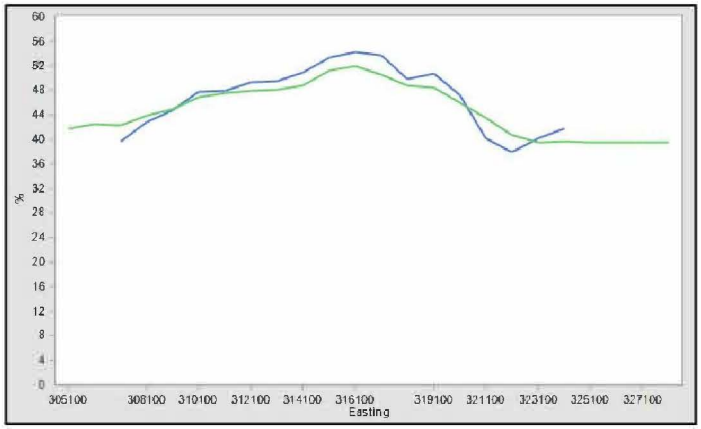
DATE: 09/22/2017
FILE: 89-11 Fig 14-12
SCALE: As Shown

NORWEST CORPORATION

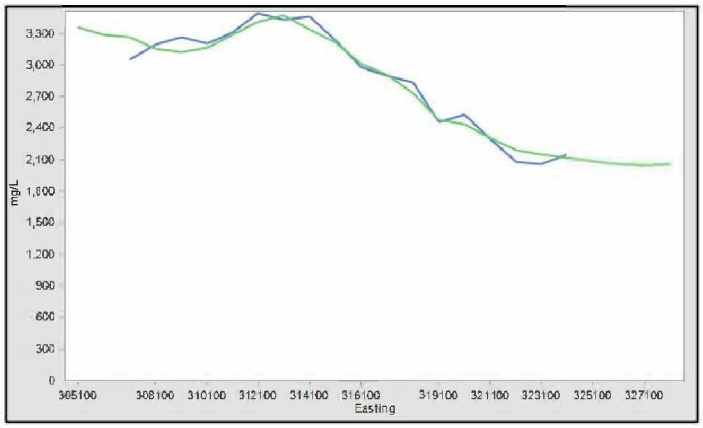
Fat Clay Brine Potassium (mg/L)



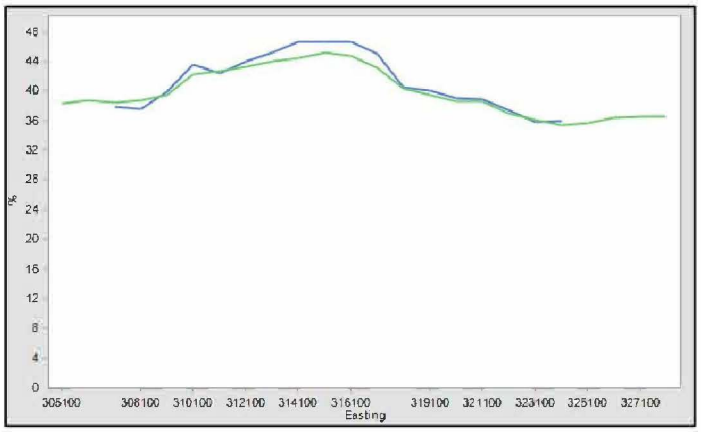
Fat Clay Moisture Content (%)



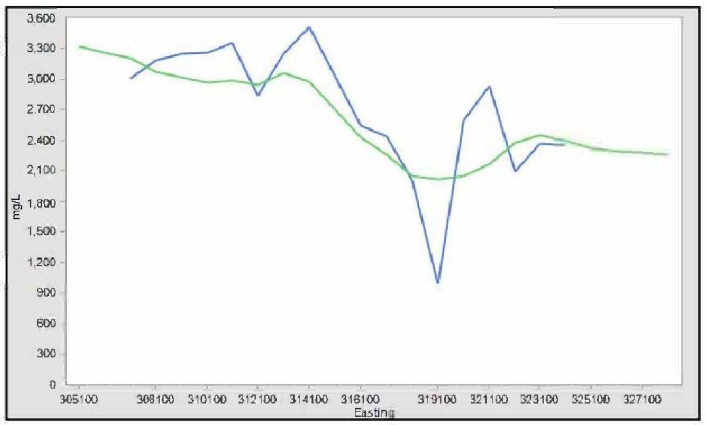
Marl Clay Brine Potassium (mg/L)



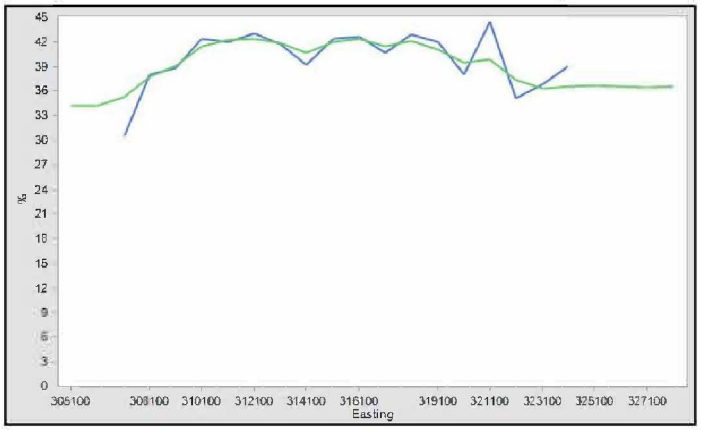
Marl Clay Moisture Content (%)



Siliceous Clay Brine Potassium (mg/L)



Siliceous Clay Moisture Content (%)



CRYSTAL PEAK MINERALS INC.

LEGEND
Drillhole Data
Model Data

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

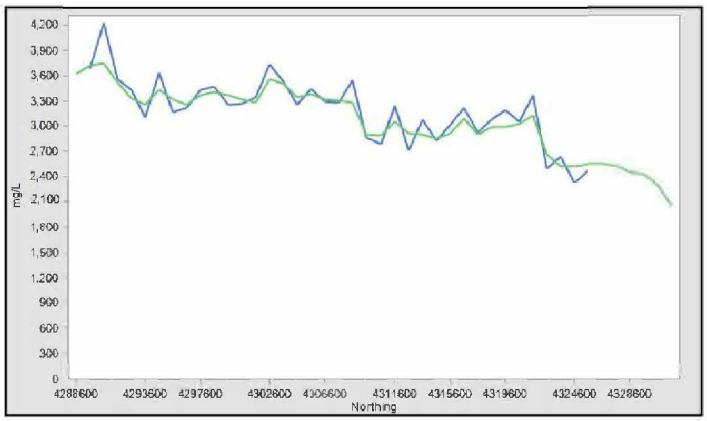
FIGURE 5-14

Sevier Playa Potash Project
Mining Plan
Model Swath Plots
W-E 1,000m interval

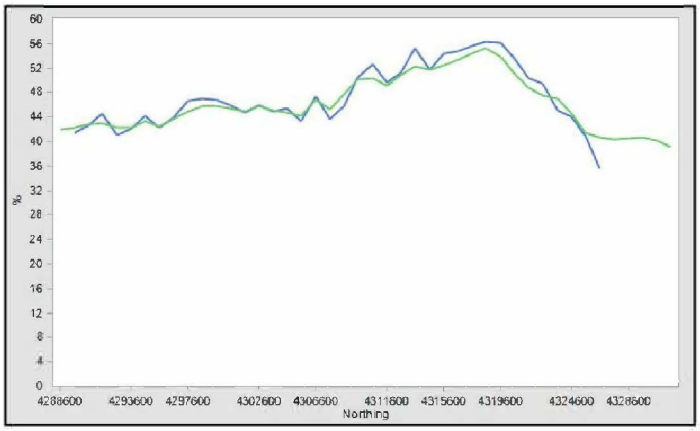
DATE: 09/22/2017
FILE: 89-11 Fig 5.13
SCALE: As Shown

NORWEST CORPORATION

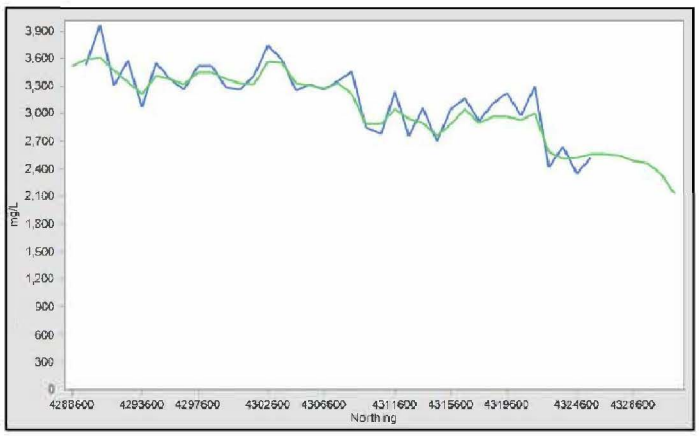
Fat Clay Brine Potassium (mg/L)



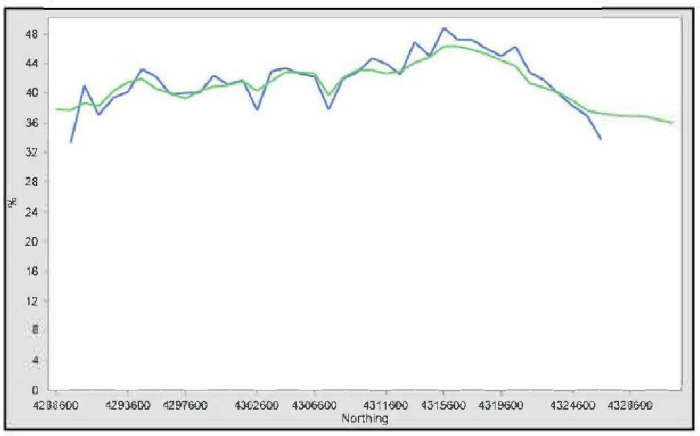
Fat Clay Moisture Content (%)



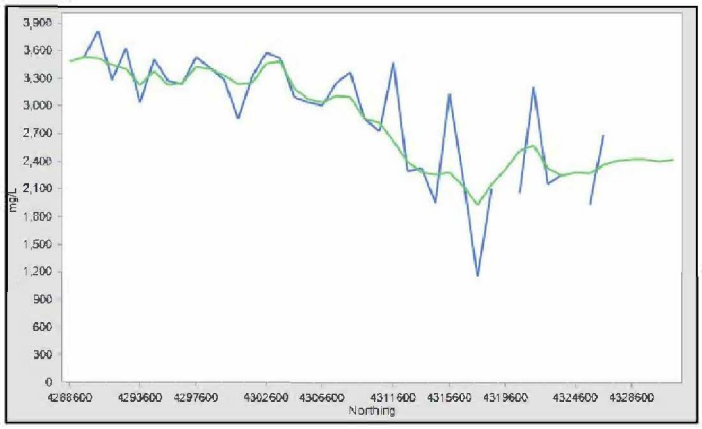
Marl Clay Brine Potassium (mg/L)



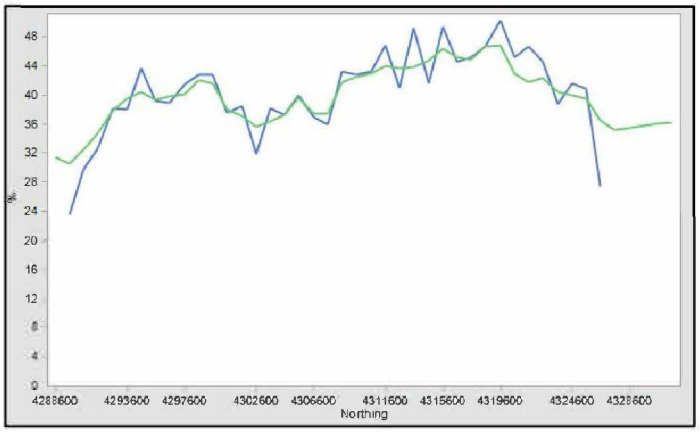
Marl Clay Moisture Content (%)



Siliceous Clay Brine Potassium (mg/L)



Siliceous Clay Moisture Content (%)



CRYSTAL PEAK MINERALS INC.

LEGEND
Drillhole Data
Model Data

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

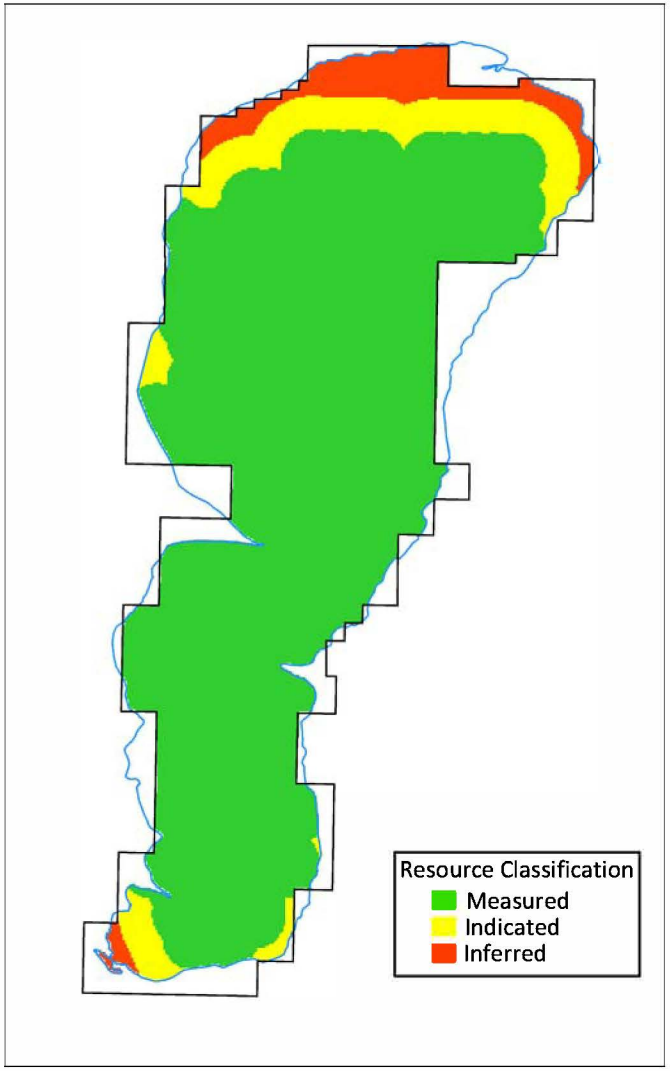
FIGURE 5-15

Sevier Playa Potash Project
Mining Plan
Model Swath Plots
S-N 1,000m interval

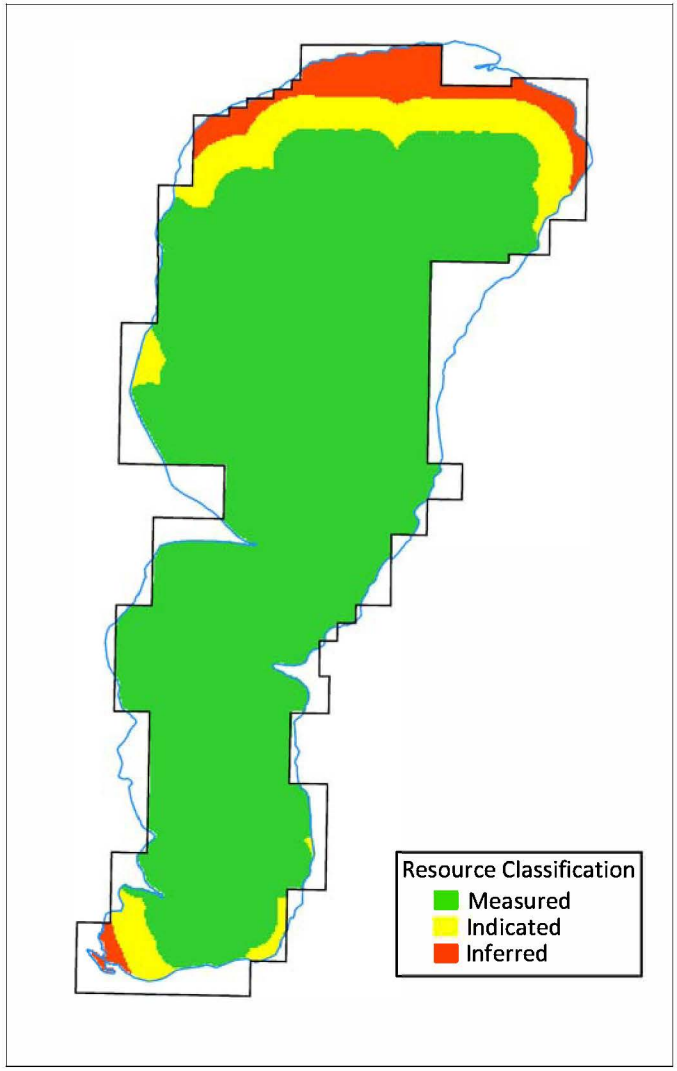
DATE: 09/22/2017
FILE: 89-11 Fig 5.14
SCALE: As Shown

NORWEST CORPORATION

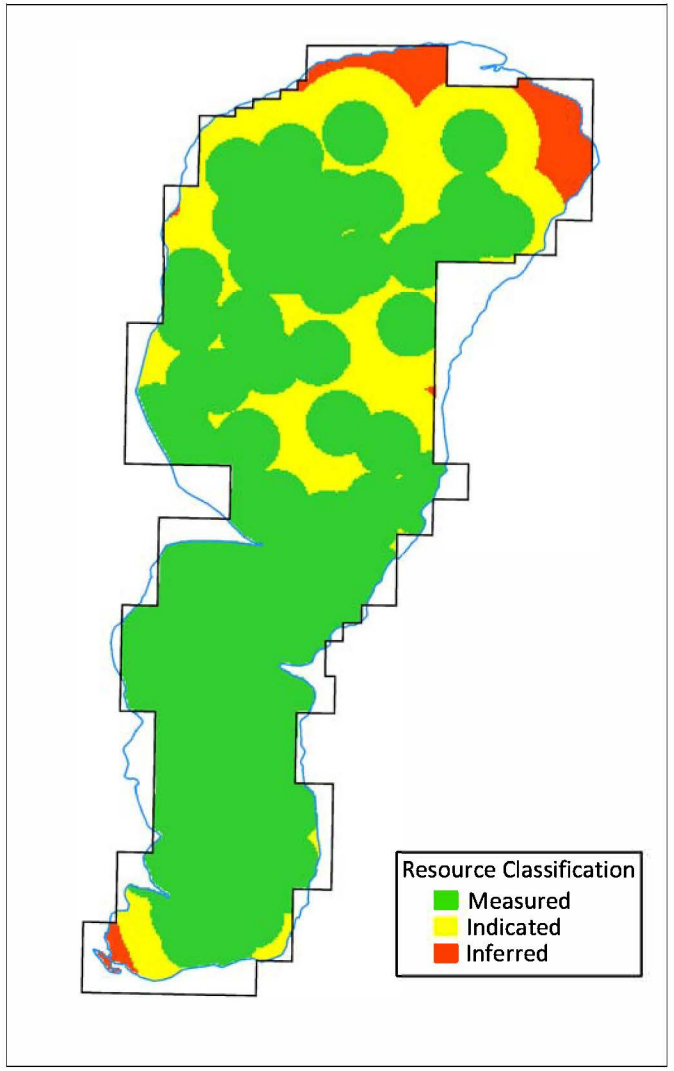
Fat Clay



Marl Clay



Siliceous Clay



CRYSTAL PEAK MINERALS INC.

LEGEND
Lease Control
Playa Boundary*

*Sunrise Engineering Survey (2011), Aerographics LiDAR (2015)

0 2 4 6
Mile
0 3 6 9
Kilometer

N

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

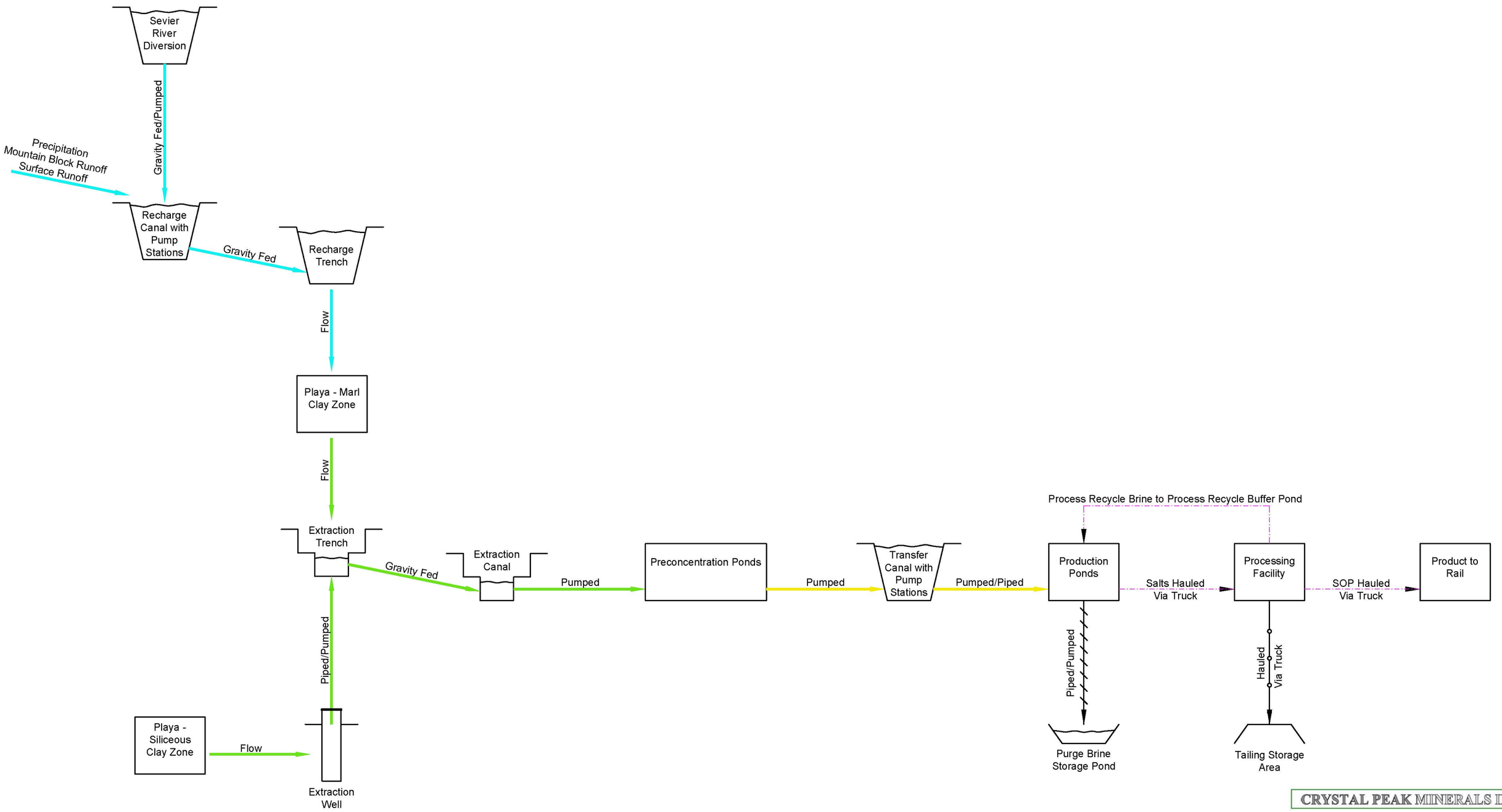
FIGURE 5-16

Sevier Playa Potash Project
Mining Plan
Brine Resource
Classification

DATE: 09/22/2017
FILE: 89-11 Fig 5.15

SCALE: As Shown

NORWEST CORPORATION



CRYSTAL PEAK MINERALS INC.

Recharge Water

Brine

Preconcentrated Brine

Purge Brine

Filter Cake Tailings

N

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-1

Sevier Playa Potash Project
General Overview of Project

DATE: 09/25/2017

FILE: Figure 6-1 Flow Diagrame.dwg

SCALE: NONE

NORWEST CORPORATION

R13W R12W R11W R10W R9W

T19S T20S T21S T22S T23S T24S

6
50

BMU14
BMU15
BMU01
BMU02
BMU03
BMU17
BMU04
BMU05
BMU19
BMU16
BMU18
BMU21
BMU22
BMU20
BMU07
BMU 06
BMU08
BMU09
BMU 10
BMU11
BMU13

P-1
P-2
P-3
P-4
P-10
P-9
P-8
P-7
P-6
P-5
HB

Steamboat Pass Rd
Lake Point Road
Purge Brine Storage Pond
Tailings Storage Area
Process Recycle Buffer Pond
Process Recycle Brine Pipeline
Processing Facility
Tailings Leach Pipeline
Crystal Peak Spur Rd
Crystal Peak Rd
Headlight Canyon Rd
257
257
Black Rock

R13W R12W R11W R10W R9W

Proposed Project Features

- Recharge Trench
- Recharge Collector
- Extraction Trench
- Recharge Canal
- Extraction Canal
- Brine Transfer Canal / Pipeline
- Purge Brine Pipeline
- Process Recycle Brine Pipeline and Tailings Leach Pipeline
- Preconcentration and Production Ponds
- Preconcentration Pond Weir
- Pump Station - On Lease
- Pump Station - Off Lease
- Sevier River Diversion
- Brine Mining Unit Boundary
- Perimeter Road
- Haul Roads

General Reference

- BLM and SITLA Lease Boundary
- Sevier Playa Boundary
- Township/Range Boundary
- US Highway, State Highway
- Class B Road
- Dirt Track Road
- Railroad

Land Ownership

- BLM
- State Lands
- Private

N 0 1 2 4 Miles

1 in = 2 miles

Sources:
Project features, Crystal Peak Minerals, 2015, 2016, 2017;
Public land survey system, BLM 2013;
Land jurisdiction, BLM 2013;
Roads, Millard County 2013;
Railroads, ESRI 2000;
Kern River gas pipeline, BLM 2011;
Aerial Imagy, USDA/APFO 2016

Notes:
- The utility siting areas shown on this map are draft and may be revised and/or refined throughout the development of the project.
- Some features have been graphically offset to improve map legibility.

NO.	DATE	REVISION	BY	APVD
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

FIGURE 6-2

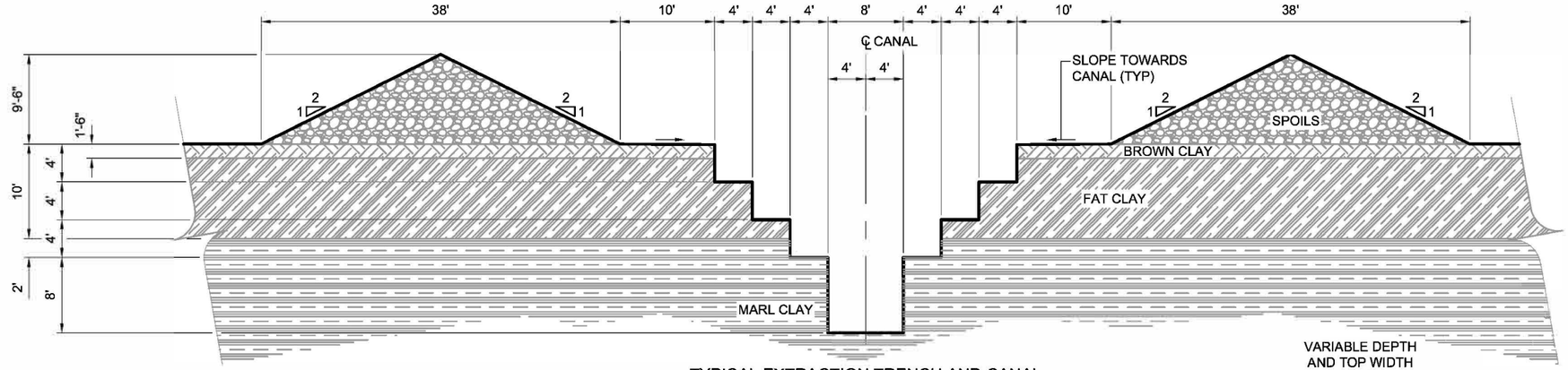
Sevier Playa Potash Project
Mine Plan Trench Layout

MINING PLAN

DATE: 5/24/2018 SCALE: 1:150,000

CRYSTAL PEAK MINERALS INC.

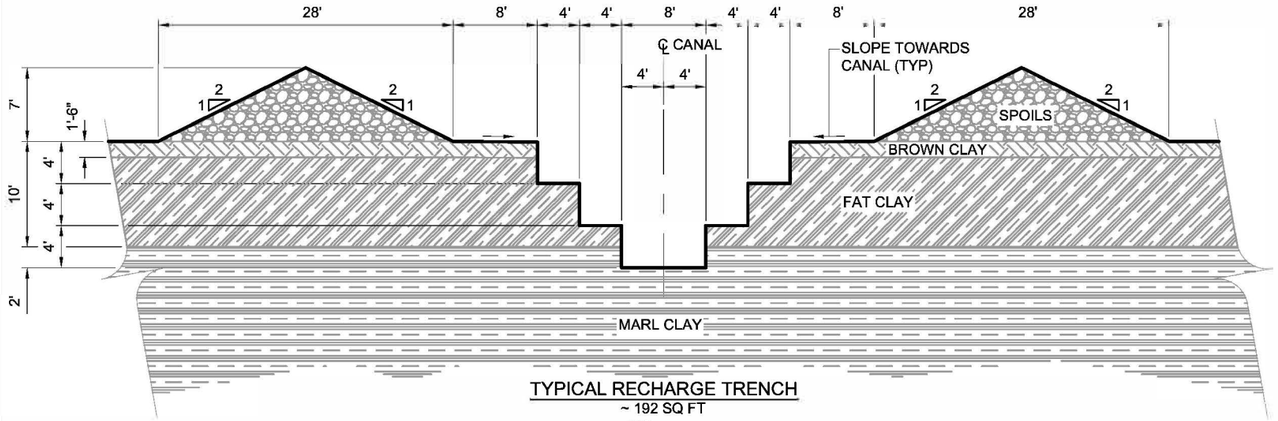
MP_Fig 6-2 - Trench Layout 180509 5/24/2018 5:52:06 PM
CPM Edit Lake Point Road Label by BU 5/31/18



TYPICAL EXTRACTION TRENCH AND CANAL

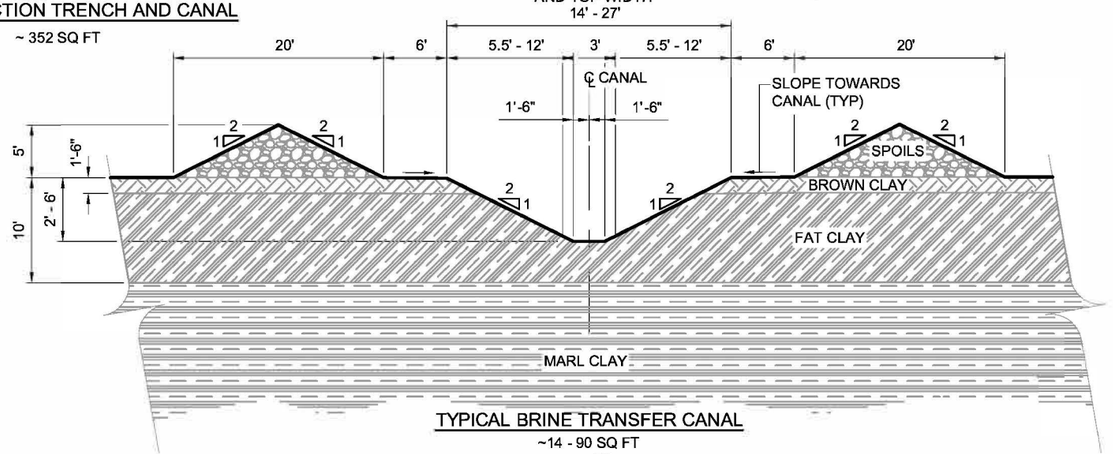
~ 352 SQ FT

NOTE
- SPOILS NOT TO SCALE
- TRENCH/CANAL CONFIGURATION SHOWN AT THE TIME OF CONSTRUCTION



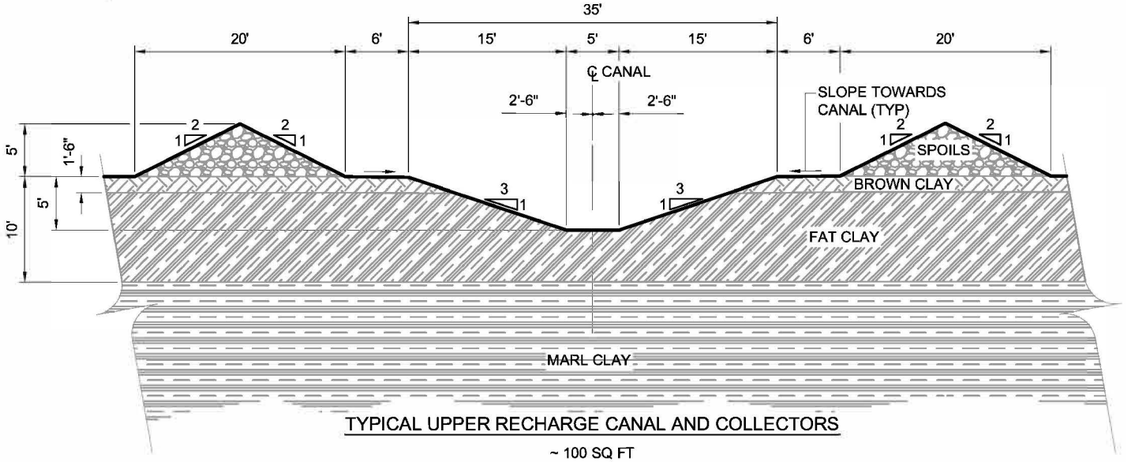
TYPICAL RECHARGE TRENCH

~ 192 SQ FT



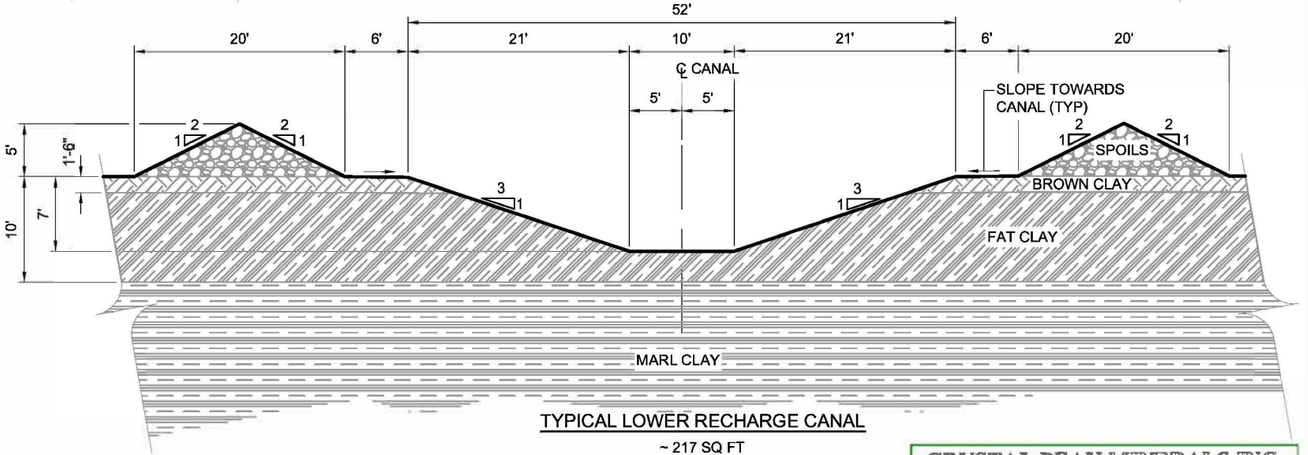
TYPICAL BRINE TRANSFER CANAL

~14 - 90 SQ FT



TYPICAL UPPER RECHARGE CANAL AND COLLECTORS

~ 100 SQ FT



TYPICAL LOWER RECHARGE CANAL

~ 217 SQ FT

CRYSTAL PEAK MINERALS INC.

15 0 15 30

FEET

NO.	DATE	REVISION	BY	APVD
1	01-05-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-3

Sevier Playa Potash Project

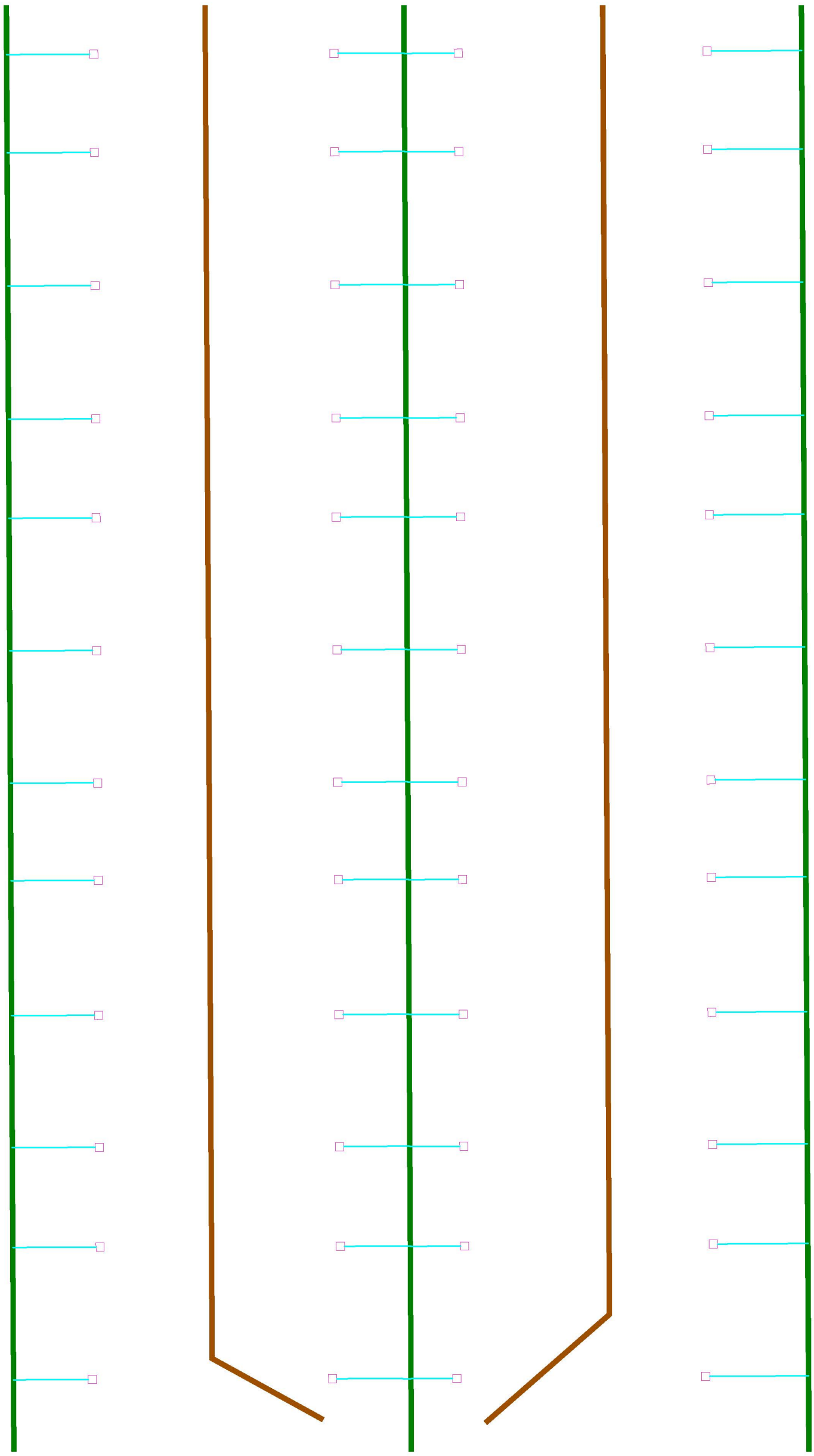
Typical Constructed Extraction Trench/Collector/Canal

DATE: 09/21/2017

FILE: Figure 6-3 Typical Trench-Collector-Canal Rev0

SCALE: As Shown

NORWEST CORPORATION



CRYSTAL PEAK MINERALS INC.

LEGEND

- Extraction Trench
- Recharge Trench
- Extraction Well
- Piping

N

1200 0 600 1200 2400

FEET

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-4

Sevier Playa Potash Project

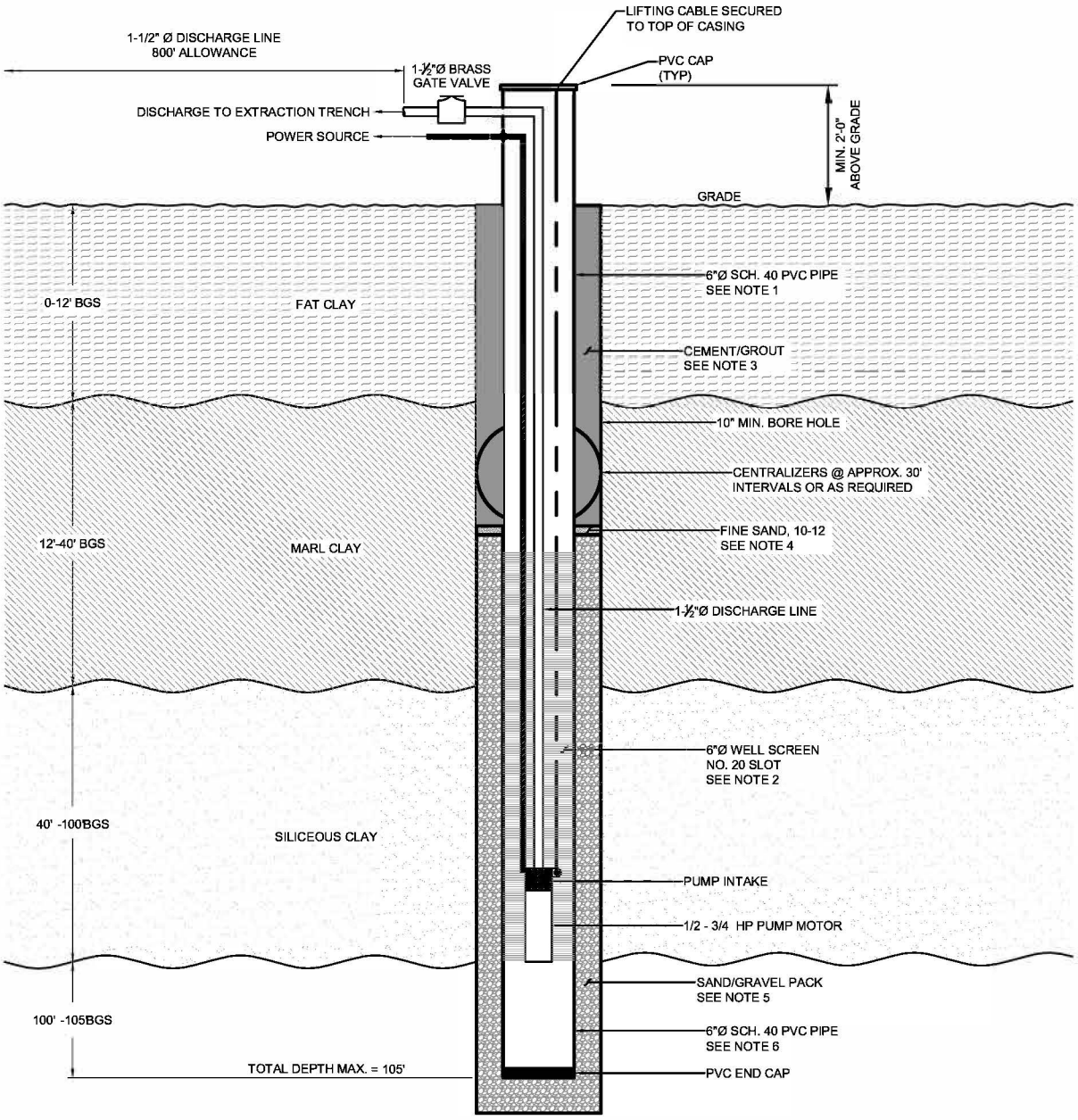
Typical Trenches and Wells Layout

DATE: 09/14/2017

FILE: Figure 6-4 Typical Trenches and Wells Layout

SCALE: As Shown

NORWEST CORPORATION



EXTRACTION WELL TYPICAL SECTION

WELL TOTAL DEPTH VARIES BY LOCATION
MINIMUM DEPTH = 61 FEET
MAXIMUM DEPTH = 111 FEET
AVERAGE DEPTH = 77 FEET

ABBREVIATIONS:

AGS - ABOVE GRADE SURFACE
BGS - BELOW GRADE SURFACE
TD - TOTAL DEPTH

NOTES:

1) 2' AGS TO 33' BGS
2) 33' BGS TO TD
3) GRADE TO 30' BGS
4) 30' BGS TO 31' BGS
5) 31' BGS TO 100' BGS
6) 100' BGS TO 105' BGS

CRYSTAL PEAK MINERALS INC.

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

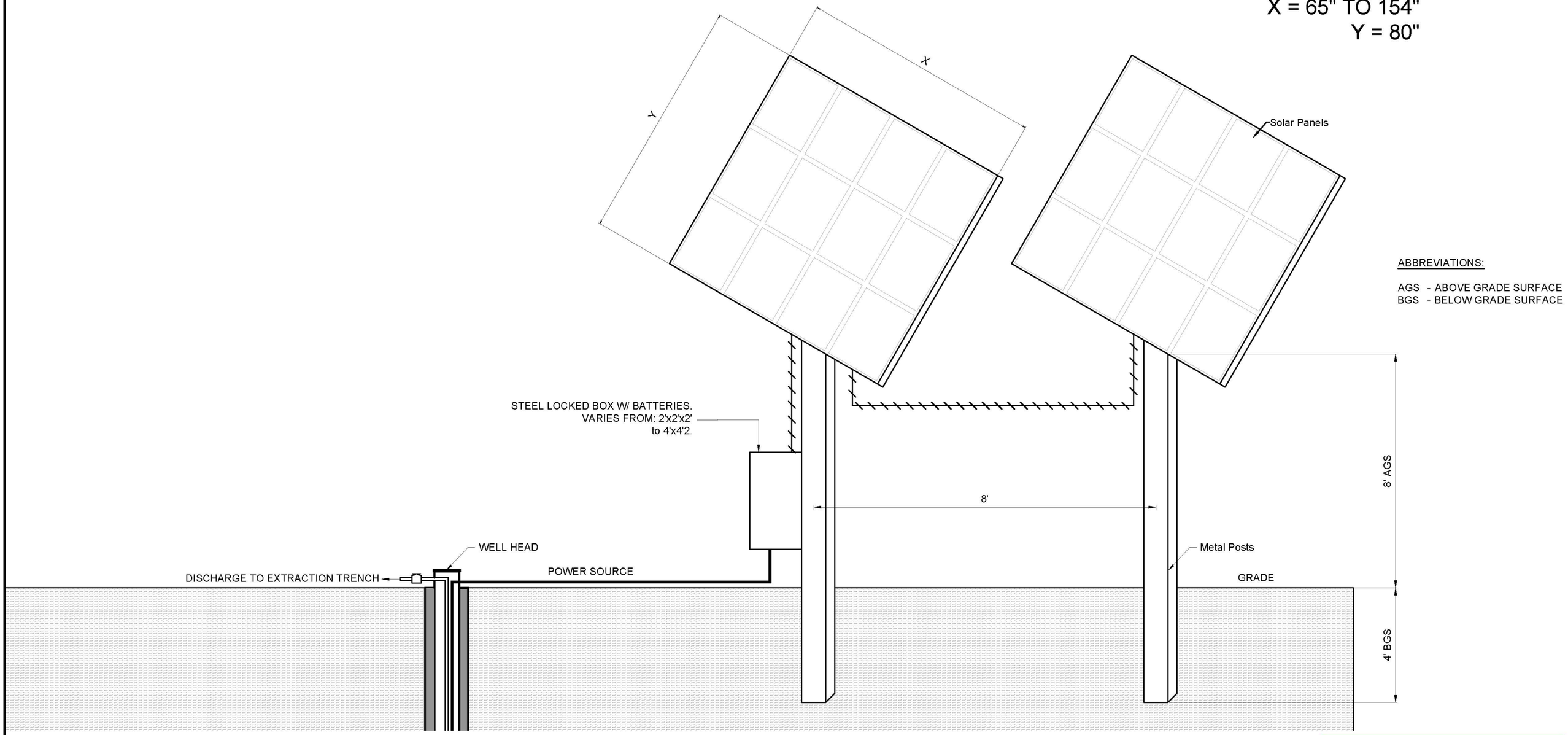
FIGURE 6-5

Sevier Playa Potash Project
Extraction Well
Typical Section

DATE: 09/14/2017
FILE: Figure 6-5 Typical Extraction Well Typical S
SCALE: NTS

NORWEST CORPORATION

SOLAR PANEL SIZES WILL
VARY FROM
X = 65" TO 154"
Y = 80"



ABBREVIATIONS:

AGS - ABOVE GRADE SURFACE
BGS - BELOW GRADE SURFACE

CRYSTAL PEAK MINERALS INC.

Wiring

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-6

Sevier Playa Potash Project
Extraction Well Power Schematic

DATE: 09/25/2017
FILE: Figure 6-6 Extraction Well Power.dwg
SCALE: NONE

NORWEST CORPORATION

R10W

T20S

Drop Structure

Perimeter Road Spur 1A

Perimeter Road Spur 1

Diversion Berm

A

Figure 6-8

B

Diversion Canal

Diversion Canal Spoils Pile

Figure 6-9

C

Figure 6-9

Diversion Sump

Perimeter Road Culvert
Crossing Location
Culvert is 16 feet long

Map Extent

R10W

T20S

Proposed Project Features

- Drop Structure
- Diversion Canal
- Recharge Canal
- Diversion Canal Spoils Pile
- Access Road – Off lease
- Perimeter Road and Spurs - On-Lease
- Diversion Sump
- Culvert Crossing

General Reference

- Sevier Playa Boundary
- BLM and SITLA Lease Boundary

N 0 100 200 400 Feet
1 in = 400 feet 1:4,800

Sources:
Project features, Crystal Peak Minerals, 2015, 2016, 2017, 2018;
Sevier Playa Boundary, SWCA 2015;
Land jurisdiction, BLM 2013;
Roads, Millard County 2013;
Aerial Imagy, USDA/APFO 2016

Note:
• The project features shown on this map are draft and may be revised and/or refined throughout the development of the project.

NO.	DATE	REVISION	BY	APVD
2	2/13/2018	Updated Drop Structure		
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

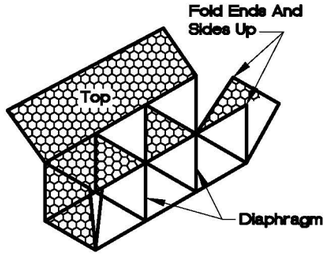
FIGURE 6-7

Sevier Playa Potash Project
Plan View Sevier River Diversion Canal and Berm

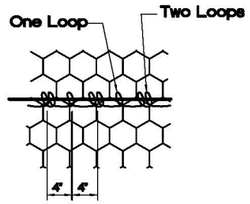
MINING PLAN

DATE: 2/13/2018 SCALE:1:4,800

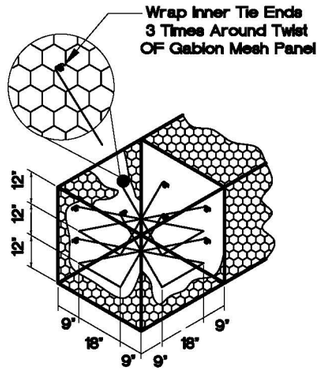
CRYSTAL PEAK MINERALS INC.



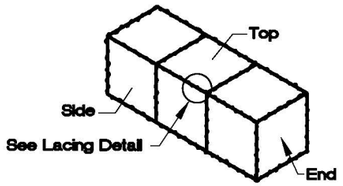
ASSEMBLY DETAIL



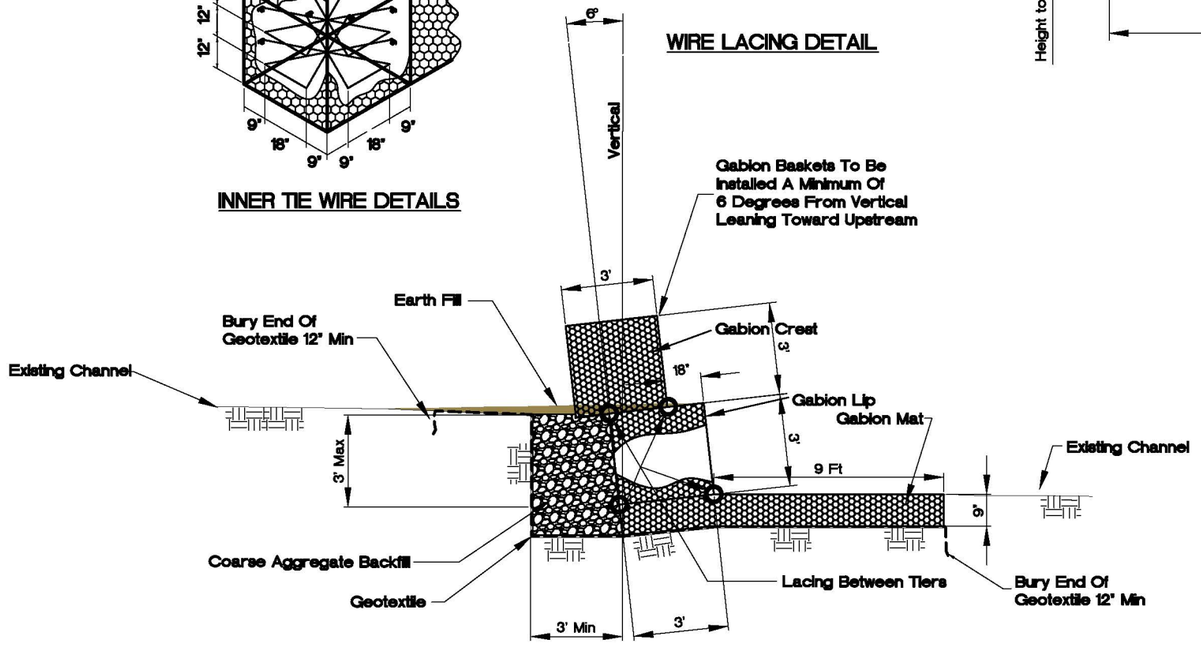
LACING DETAIL



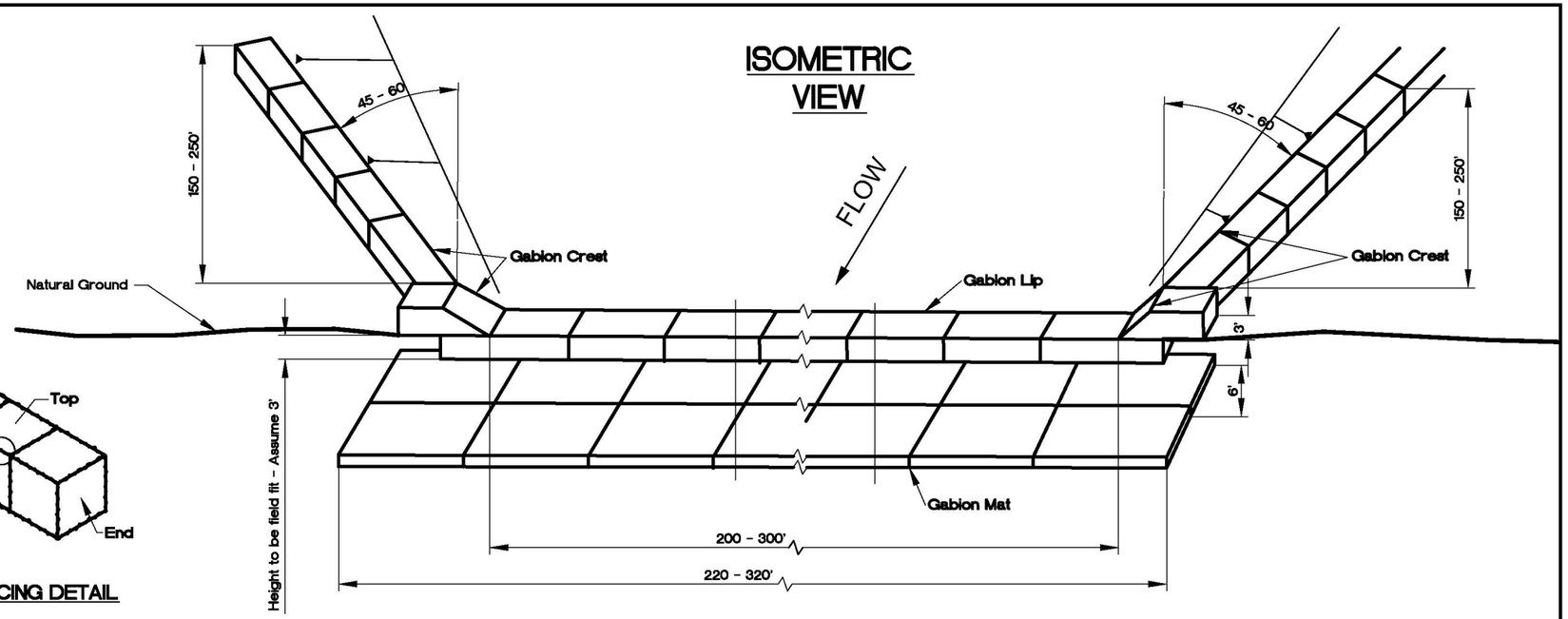
INNER TIE WIRE DETAILS



WIRE LACING DETAIL



SECTION



LACING NOTES:

1. The ends of a lacing wire will be secured by looping it thru the mesh and twisting. Proceed to lace with alternate two loops and one loop at approximately 4 inch intervals.
2. Other lacing methods may be used if recommended by the manfuacturer and approved by the engineer/inspector.
3. The "X" shaped inner tie may be twisted at the "X" to tighten, if placed too loosely.

GABION NOTES:

1. The coarse aggregate backfill shall meet the gradation of 3" minus to $\frac{1}{4}$" plus.
2. The Gabions shall be installed according to construction specification 64 WIRE MESH GABIONS.
3. Baskets which are stacked in tiers shall have vertical seams staggered for each row and tier.
4. The coarse aggregate backfill shall be placed level with the top of the lower basket before the upper basket is installed.
5. Geotextile (non-woven, needle punched) min. criteria:
   - Grab Tensile strength (lb) ASTM D 4632 ____ 202
   - Elongation at failure (%) ASTM D 4632 ____ ≥50
   - Trapezoidal tear strength (lb) ASTM D 4533 ____ 79
   - Puncture strength (lb) ASTM D 6241 ____ 433
   - Ultraviolet light (% retained strength) ASTM 4355 ____ min 50
   - Apparent opening size (AOS) ASTM D 4751 ____ max 0.22 mm (US sieve size 70)
   - Permittivity sec^{-1}/ ASTM D 4491 ____ min 0.70
6. Any geotextile splices shall overlap a minimum of 18 inches, with upstream or upslope geotextile overlapping the abutting downslope geotextile.

CRYSTAL PEAK MINERALS INC.

NO.	DATE	REVISION	BY	APVD
0	12/18/17	INITIAL SUBMISSION	TJS	GG

DSGN	DR	CHK	APVD
TJS	TJS	GG	GG

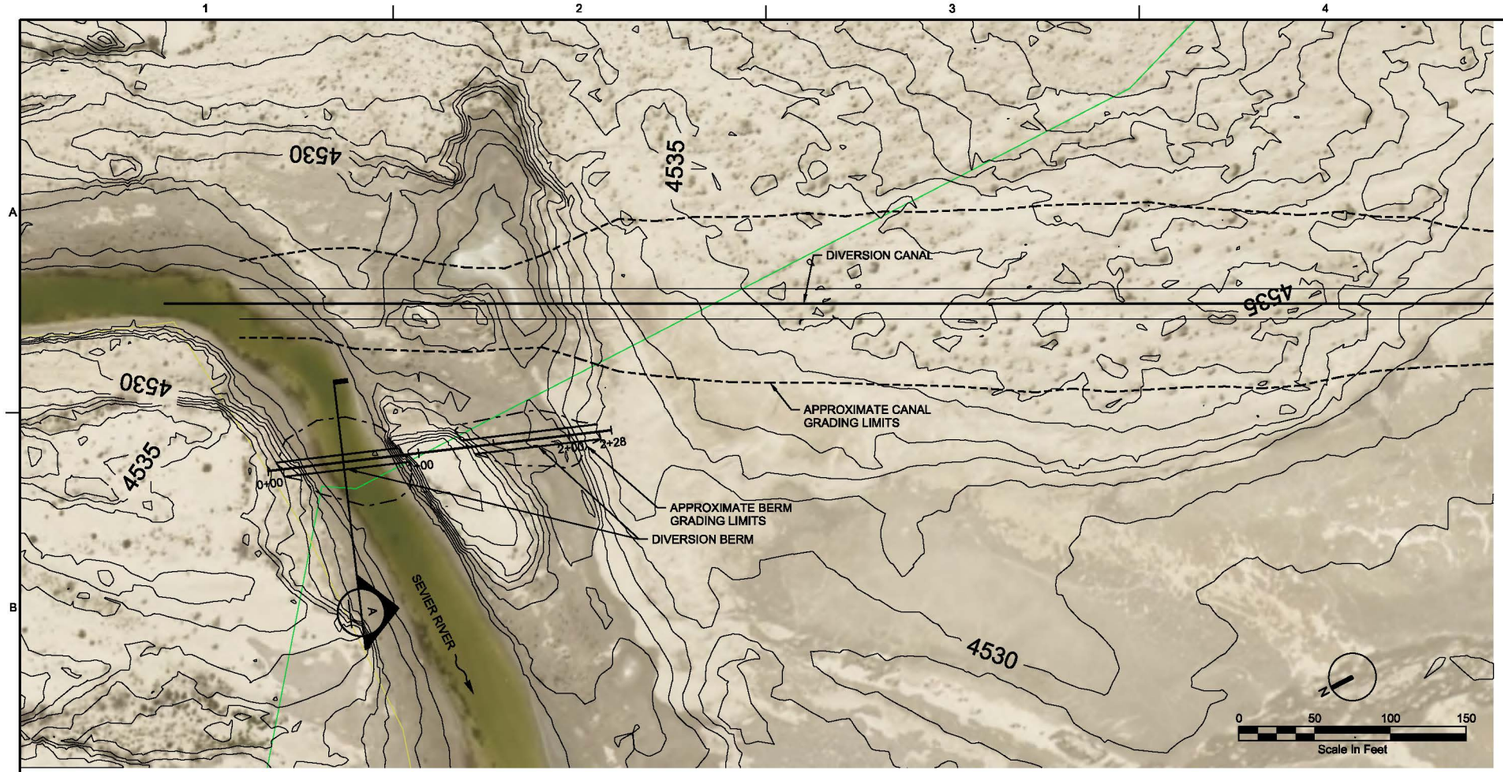
FIGURE 6-8

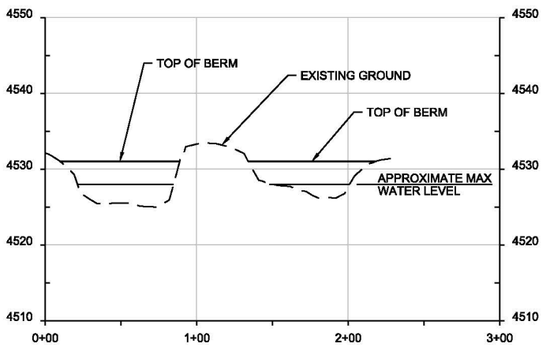
Sevier Playa Potash Project
Sevier River Drop Structure
Typical Details

DATE: 12/18/2017
FILE: Figure6-8 Headcut Typical Details

SCALE: 1" = 4'

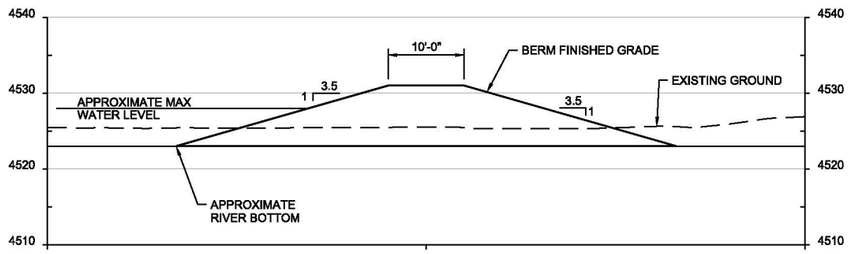
NORWEST CORPORATION





DIVERSION BERM PROFILE

H: 1"=50'-0"



A DIVERSION BERM SECTION

H: 1"=10'-0"
V: 1"=10'-0"

Figure 6-9

MINING PLAN

SEVIER PLAYA POTASH PROJECT

1/9/17 CPM REV

NO.	DATE	REVISION	CHK	APVD
1	1/5/18	Update Figure Number		
0	10/25/17	Initial Submittal		
DSGN		DR		APVD

CRYSTAL PEAK MINERALS INC.

SEVIER PLAYA SOP FS PROJECT
CRYSTAL PEAK MINERALS, INC
MILLARD COUNTY, UTAH

ch2m:

CIVIL
DIVERSION BERM
PLAN, PROFILE AND SECTIONS

VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	
PROJ	679114
DWG	
SHEET	of

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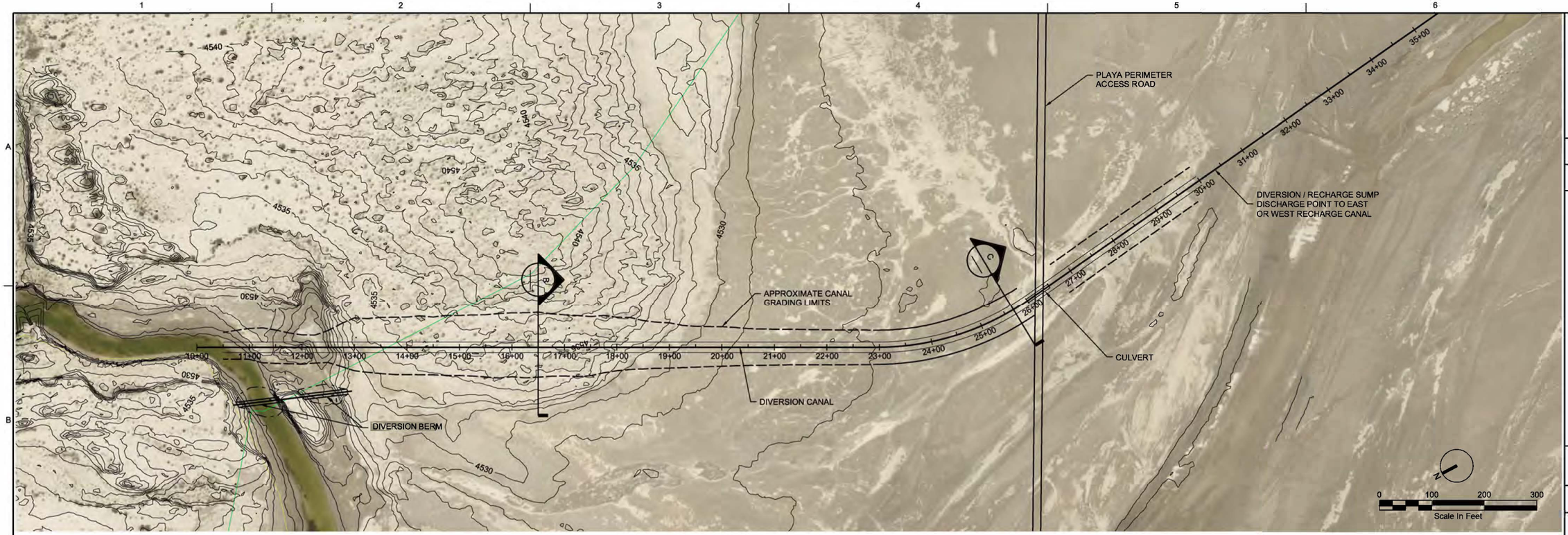
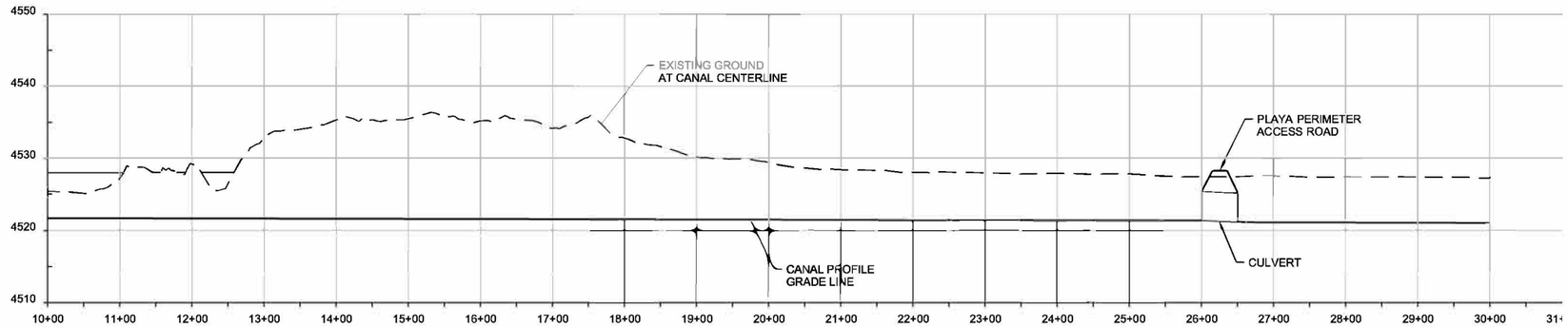
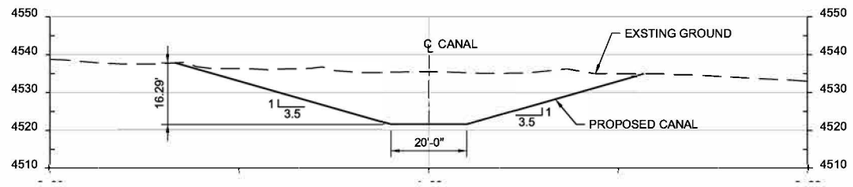




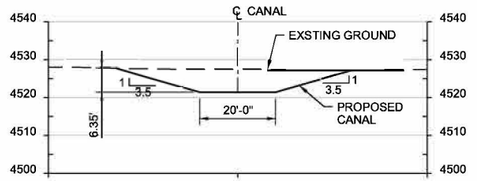
DIVERSION CANAL PROFILE

H: 1"=100'-0"
V: 1"=10'-0"



B DIVERSION CANAL SECTION

H: 1"=20'-0"
V: 1"=20'-0"



C DIVERSION CANAL SECTION

H: 1"=20'-0"
V: 1"=20'-0"

Figure 6-10

MINING PLAN

SEVIER PLAYA POTASH PROJECT

1/9/2017 CPM REV

NO.	DATE	REVISION	CHK	APVD	BY	APVD
1	1/5/18	Revised Figure Number				
0	10/25/17	Initial Submittal				

DSGN DR

CRYSTAL PEAK MINERALS INC.

SEVIER PLAYA SOP FS PROJECT
CRYSTAL PEAK MINERALS, INC
MILLARD COUNTY, UTAH

ch2m:

CIVIL
DIVERSION CANAL
PLAN, PROFILE AND SECTIONS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE
PROJ 679114
DWG
SHEET of

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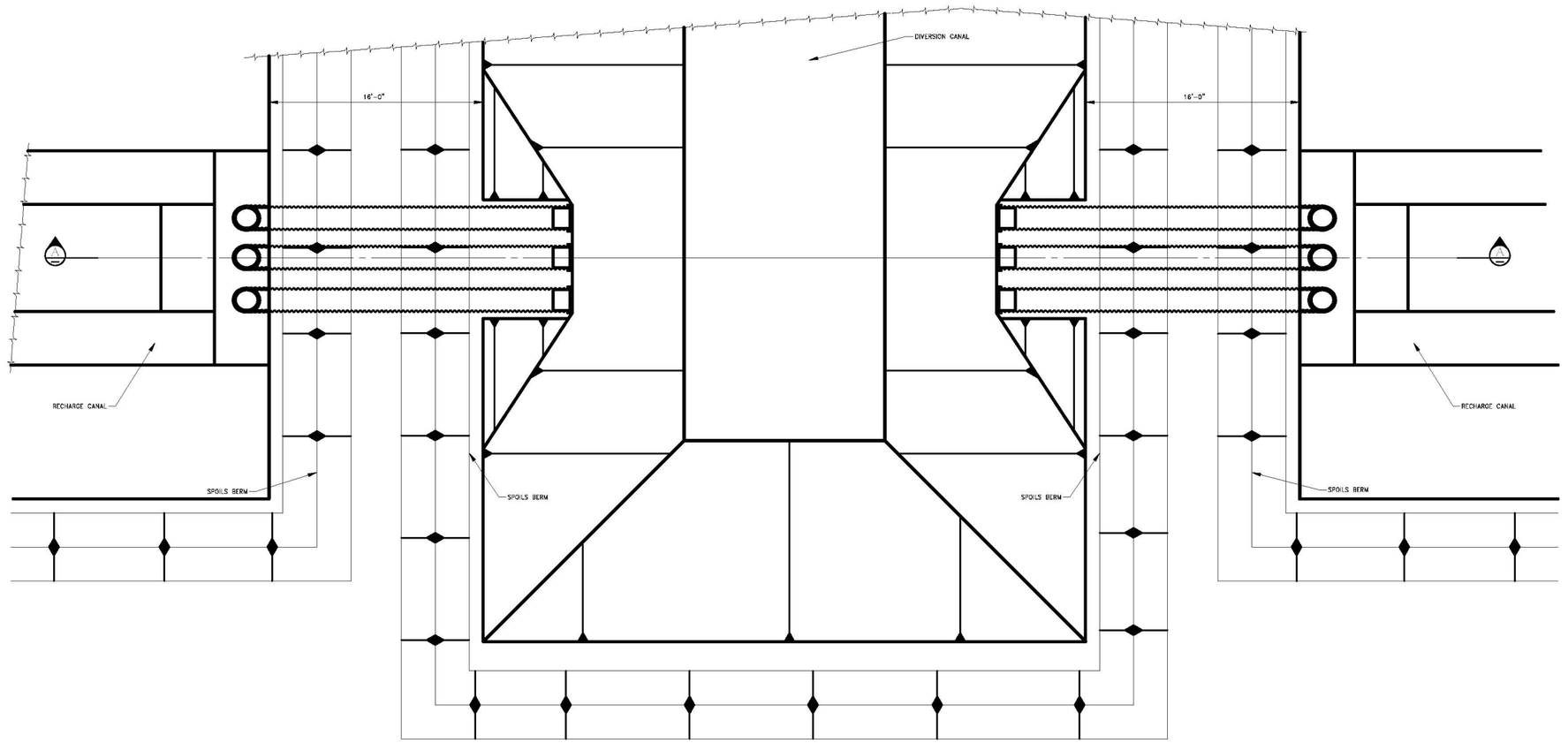
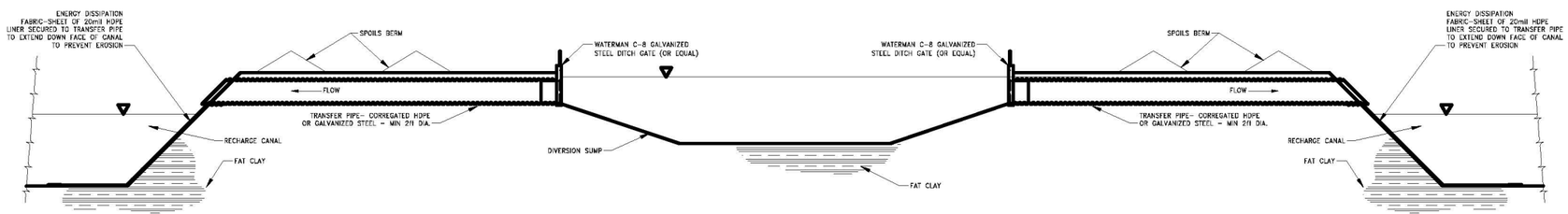


PLAN



SECTION A

ELEVATION

CRYSTAL PEAK MINERALS INC.

10 0 10 20

1"=10'

NO.	DATE	REVISION	BY	APVD
0	12/18/17	INITIAL SUBMISSION	TJS	GG

DSGN	DR	CHK	APVD
TJS	TJS	GG	GG

FIGURE 6-11

Sevier Playa Potash Project

Proposed Diversion

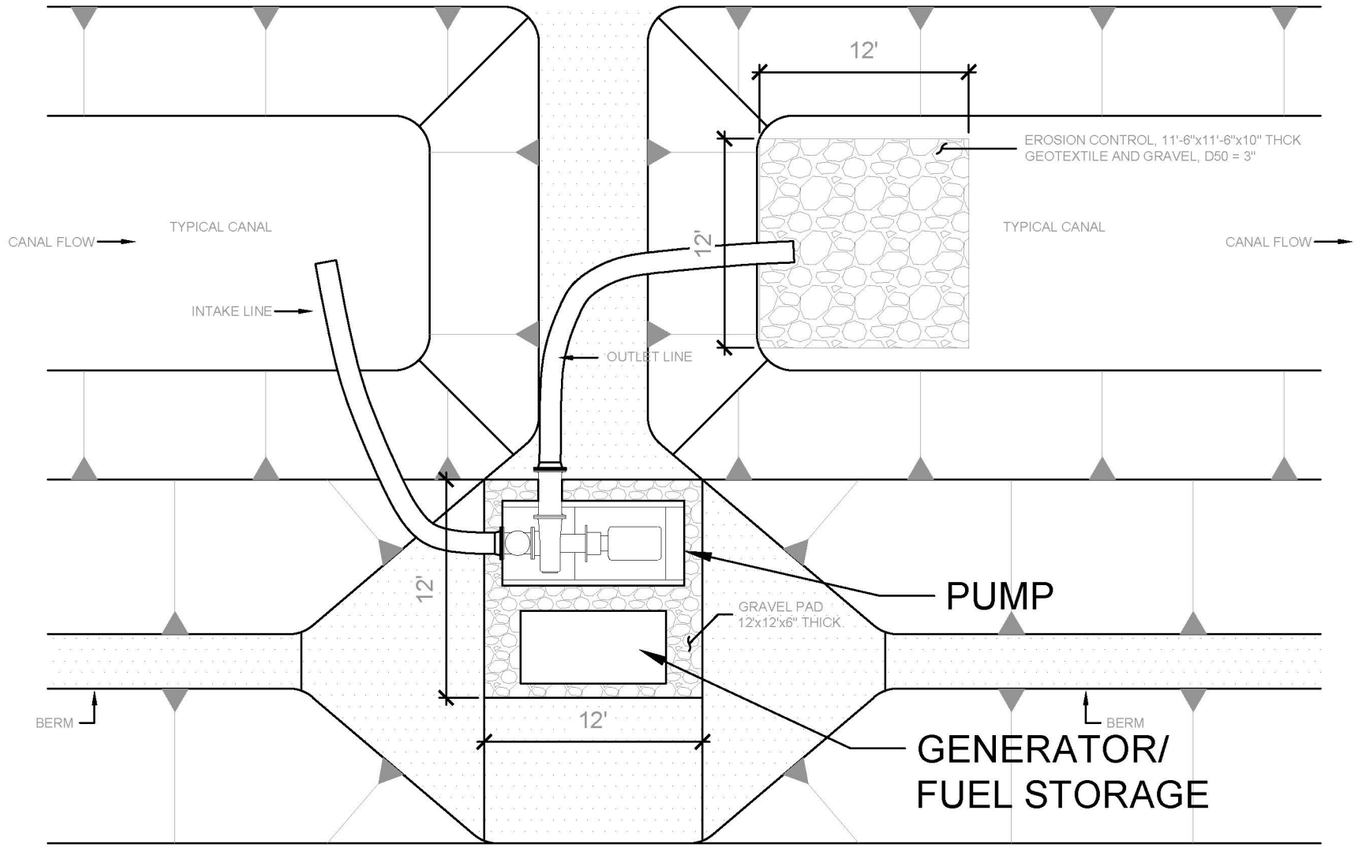
Sump Typical Detail

DATE: 12/18/2017

FILE: Figure 6-11 Proposed Diversion Sump

SCALE: 1" = 10'

NORWEST CORPORATION



NOTES:

1. PUMP PACKAGE: PIONEER PP1212S17L2-H0-20-6.
2. 50' ALLOWANCE FOR INTAKE AND DISCHARGE LINES.

CRYSTAL PEAK MINERALS INC.

10 0 10 20

1"=10'

NO.	DATE	REVISION	BY	APVD
1	12/8/17	ADDED GENERATOR, FLOW ARROWS, FIXED SCALE	TJS	GG
0	9/21/17	INITIAL SUBMISSION	TJS	GG

DSGN	DR	CHK	APVD
TJS	TJS	GG	GG

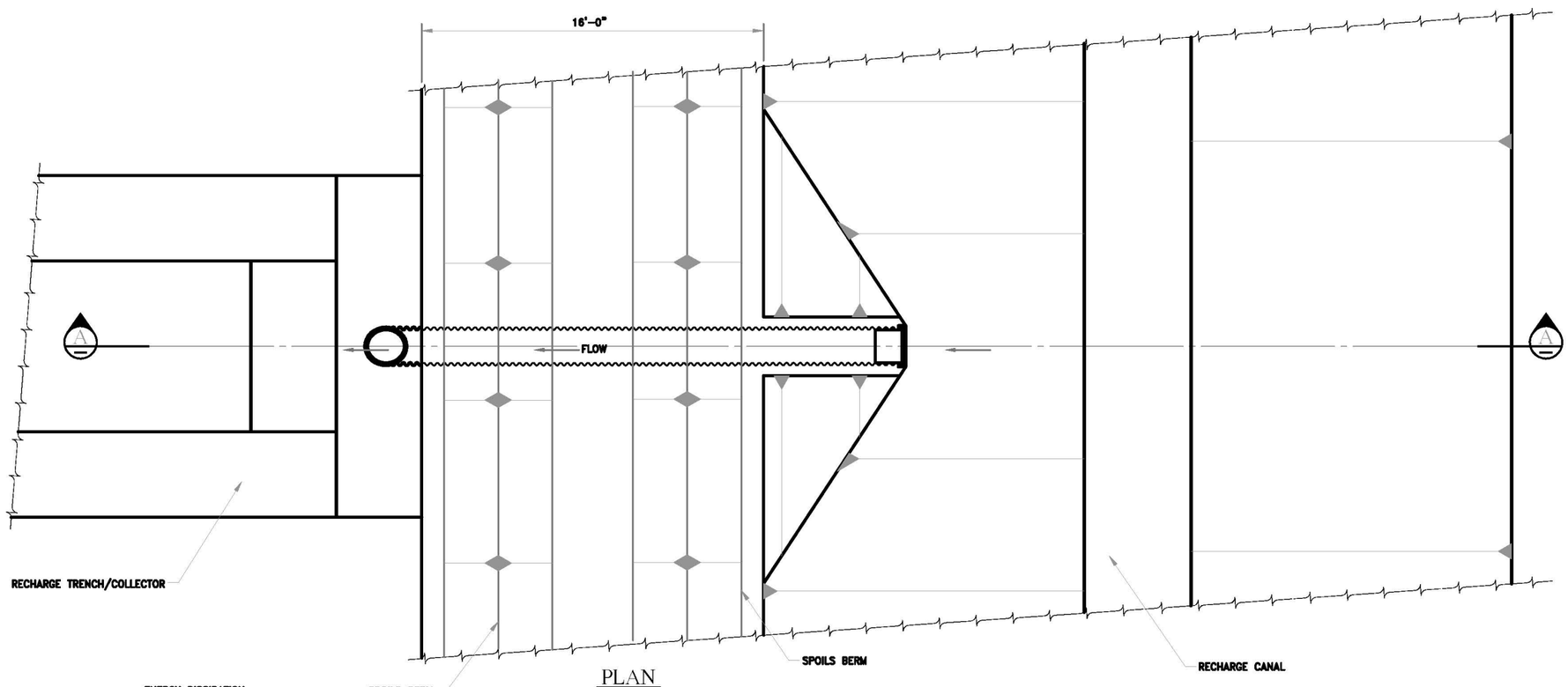
FIGURE 6-12

Sevier Playa Potash Project
General Arrangement
Typical Pump Station

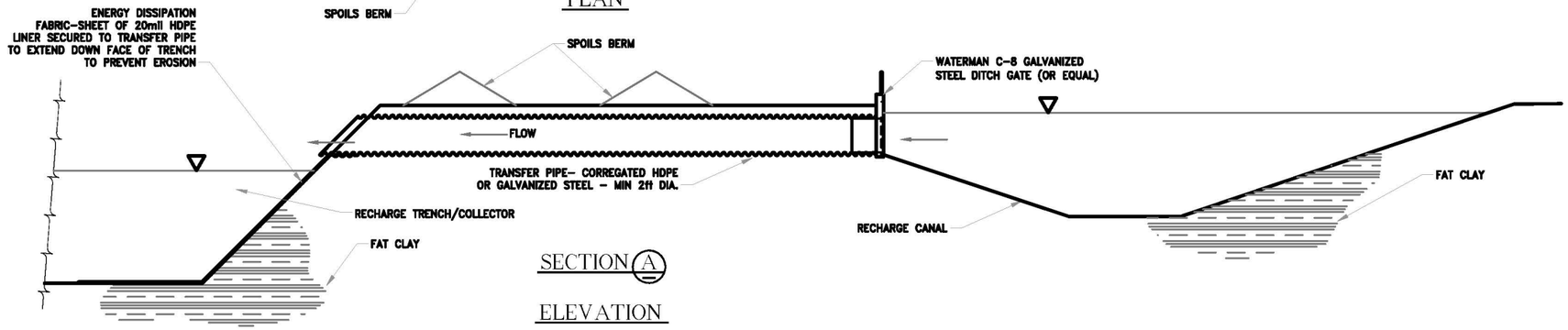
DATE: 09/21/2017
FILE: Figure 6-12 Typical Brine Transfer Pump

SCALE: As Shown

NORWEST CORPORATION



PLAN



SECTION A

ELEVATION

CRYSTAL PEAK MINERALS INC.

4 0 4 8

1"=4'

NO.	DATE	REVISION	BY	APVD
1	12/8/17	ADDED REQUESTED DETAILS	TJS	GG
0	9/21/17	INITIAL SUBMISSION	TJS	GG

DSGN	DR	CHK	APVD
TJS	TJS	GG	GG

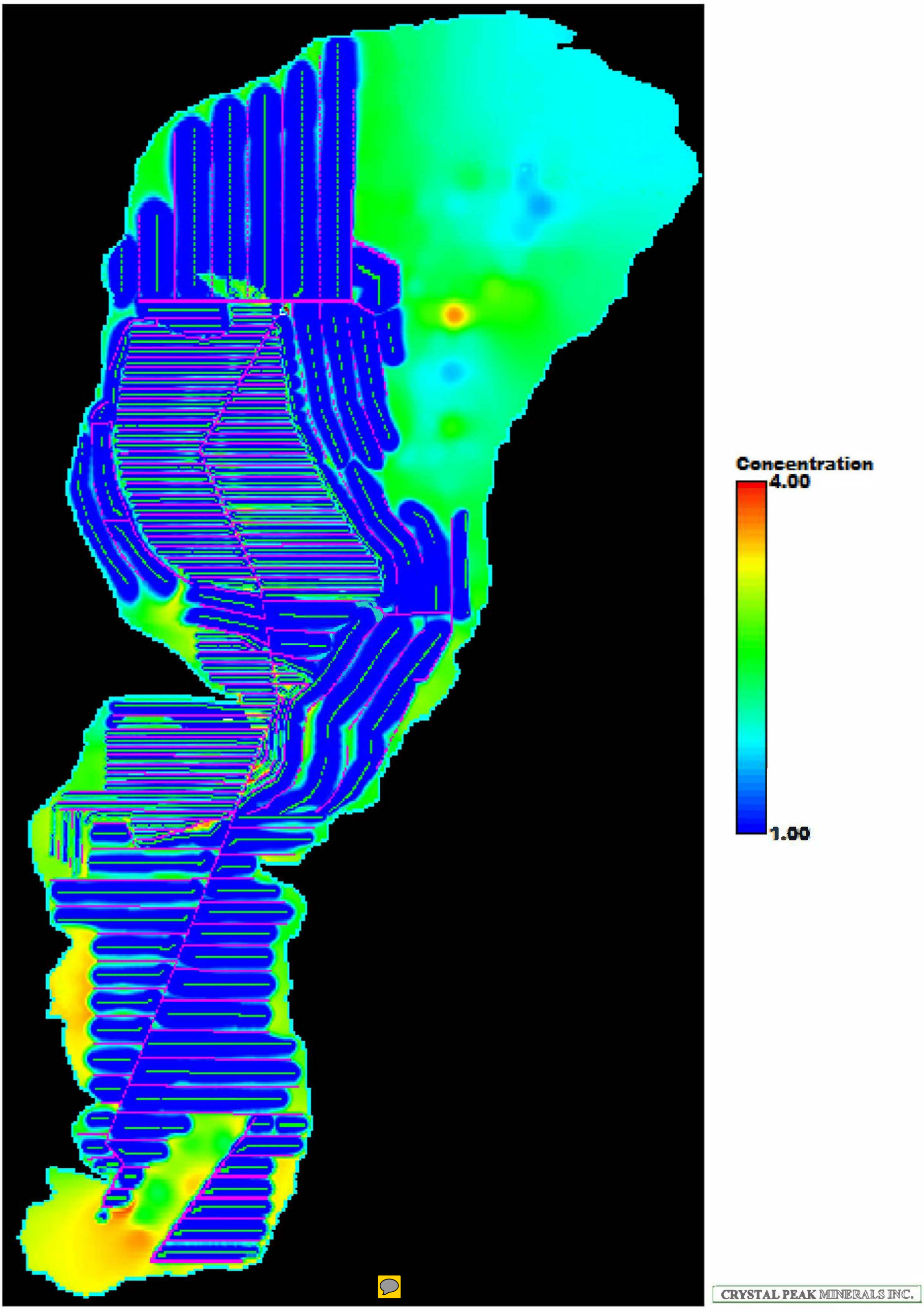
FIGURE 6-13

Sevier Playa Potash Project
Proposed Recharge Water Transfer with Ditch Gate Valve

DATE: 09/21/2017
FILE: Figure 6-13 Proposed Recharge Water Transfer

SCALE: 1" = 4'

NORWEST CORPORATION



CRYSTAL PEAK MINERALS INC.

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	DL	AB

DSGN	DR	CHK	APVD
DL	DL	AB	AB

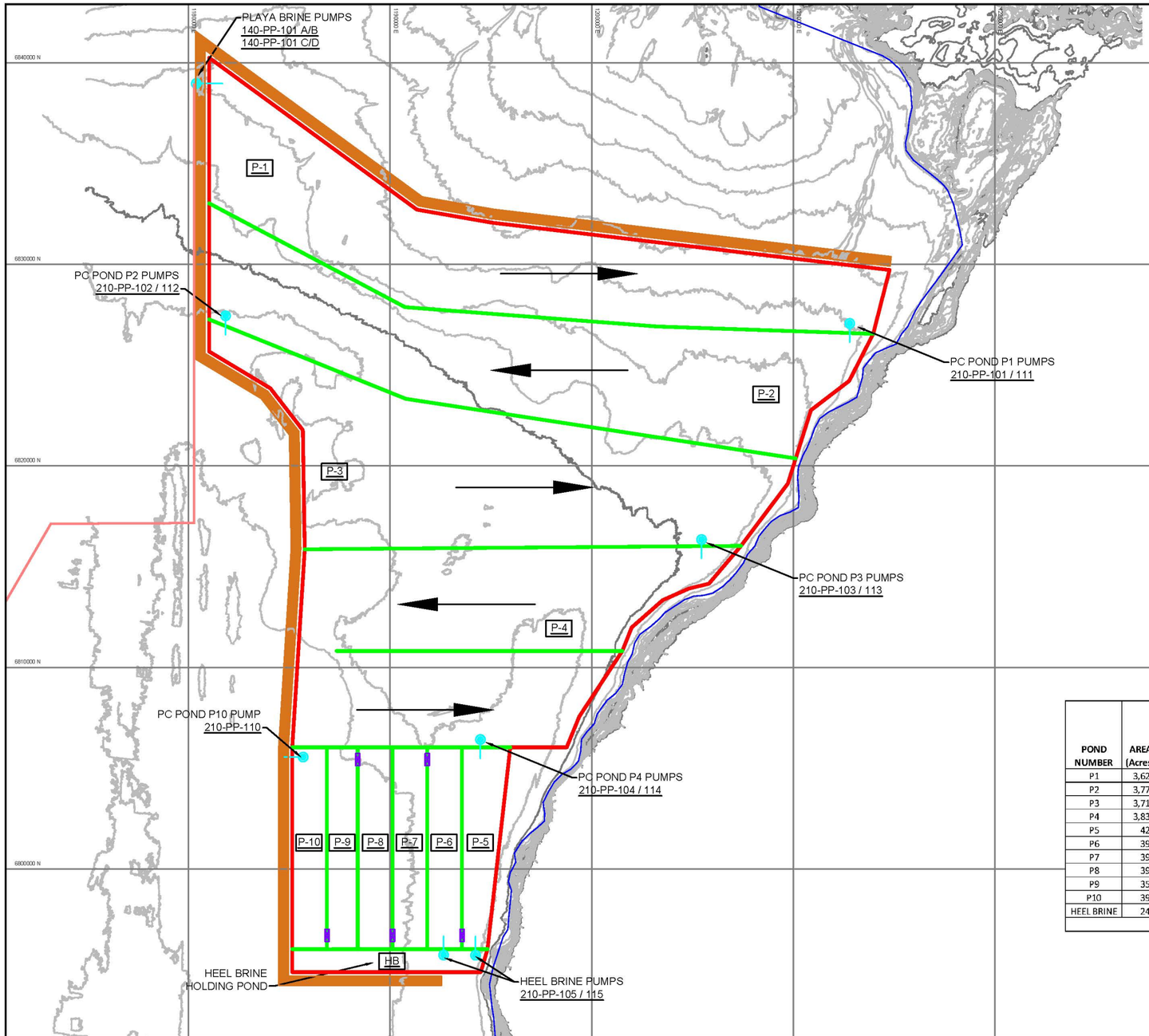
DATE: 9/22/2017

SCALE: As Shown

NORWEST CORPORATION

FIGURE 6-14

Sevier Playa Potash Project
Marl Clay Immobile Potassium Concentrations at 30 Years (g/L)



PRECONCENTRATION PONDS: YEAR 0 - 5

POND NUMBER	BERM HEIGHT (ft)	BRINE HEIGHT (ft)	AREA (Acres)	BRINE VOLUME (ft^3)	INTERIOR BERM LENGTH (miles)	EXTERIOR BERM LENGTH (miles)
P1	9	6	3,623	36,242,000	6.49	8.88
P2	6.5	3.5	3,779	21,337,000	5.70	2.52
P3	7	4	3,717	25,809,000	4.10	3.57
P4	8.5	5.5	3,839	35,952,000	4.73	5.00
P5	9	6	421	4,340,000	2.14	1.91
P6	8.5	5.5	395	3,733,000	2.22	0.00
P7	8.5	5.5	397	3,618,000	2.22	0.00
P8	8	5	397	3,374,000	2.22	0.00
P9	7.5	4.5	350	2,702,000	2.19	0.00
P10	7.5	4.5	397	3,074,000	0.33	1.90
HEEL BRINE	9	6	248	2,522,000	0.00	2.21
Total			**17,560**	**142,703,000**	**32.3**	**26.0**

	Year 0 - 5 Total (Initial 3 Year + 5 Year Expansion)			Year 5 - 15 Total (Expansions every year)				Year 15 - 30 Total (Expansions every year)			
POND NUMBER	AREA (Acres)	BERM HEIGHT (ft)	BERM CREST ELEV (ft)	INITIAL BERM VOLUME (yd^3)	ADDITIONAL BERM HEIGHT (ft)	TOTAL BERM HEIGHT (ft)	BERM CREST ELEV (ft)	ADDITIONAL BERM VOLUME (yd^3)	ADDITIONAL BERM HEIGHT (ft)	TOTAL BERM HEIGHT (ft)	BERM CREST ELEV (ft)	ADDITIONAL BERM VOLUME (yd^3)
P1	3,623	9.0	4532.0	985,476	-	9.0	4532.0	-	-	9.0	4532.0	-
P2	3,779	6.4	4527.5	567,932	-	6.4	4527.5	-	-	6.4	4527.5	-
P3	3,717	7.0	4527.0	577,736	1.0	8.0	4528.0	135,100	1.3	9.3	4529.3	147,310
P4	3,839	8.5	4528.0	788,820	6.5	15.0	4534.5	922,816	7.7	22.7	4542.2	883,571
P5	421	9.0	4528.5	285,956	5.0	14.0	4533.5	266,656	5.5	19.5	4539.0	299,743
P6	395	8.5	4527.5	254,420	5.0	13.5	4532.5	214,072	5.7	19.2	4538.2	192,310
P7	397	8.5	4527.0	252,844	4.5	13.0	4531.5	188,932	5.9	18.9	4537.4	149,275
P8	397	8.0	4526.5	229,542	5.0	13.0	4531.5	188,170	5.5	18.5	4537.0	157,344
P9	350	7.5	4526.0	203,803	5.0	12.5	4531.0	180,409	5.7	18.2	4536.7	152,849
P10	397	7.5	4526.0	210,187	4.5	12.0	4530.5	195,074	5.9	17.9	4536.4	190,825
HEEL BRINE	248	9.0	4528.0	259,285	-	9.0	4528.0	-	-	9.0	4528.0	-
		Year 0 - 5 Initial Berm Volume:		**4,616,000 yd^3**	Year 5 - 15 Raise Additional Berm Volume:			**2,291,000 yd^3**	Year 15 - 30 Raise Additional Berm Volume:			**2,173,000 yd^3**

CRYSTAL PEAK MINERALS INC.

LEGEND

- Type R1 Exterior Berm
- Type R1 Interior Berm
- Extraction Canal
- Sevier Playa Boundary
- Pump Station
- Weir
- Borrow Area

NOTES:

1. THE PONDS WERE DESIGNED IN CHRONOLOGICAL ORDER. INTERIOR SEPARATING BERMS ARE ALLOCATED TO THE POND UTILIZING THEM WITH THE LOWEST POND NUMBER. (EXAMPLE: P1 IS ALLOCATED THE LENGTH AND VOLUME OF THE INTERIOR BERM BETWEEN P1 AND P2)
2. INDIVIDUAL BERM VOLUMES ARE ESTIMATED BASED ON AVERAGE CROSS SECTIONAL AREA FOR THE TOTAL POND AND ARE ALLOCATED TO EACH POND BASED UPON INDIVIDUAL BERM LENGTHS.
3. TOTAL BERM VOLUME FOR ALL OF THE PRECONCENTRATION PONDS REMAINS ACCURATE.
4. THE AREA DELINEATED FOR THE BORROW AREA ACCOUNTS FOR AN OFFSET OF 500FT FROM WELLS, TRENCHES AND CANALS (NOT SHOWN). TO ACCOUNT FOR THIS DELINEATION, THE BORROW AREA FOOTPRINT HAS BEEN INCREASED BY 20 PERCENT.
5. DEPTH OF BORROW AREAS APPROXIMATELY 2 FEET.

0 2500 5000 7500
FEET

NO.	DATE	REVISION	BY	APVD
1	12/18/17	UPDATED BERM VOLUMES	JDS	GG
0	9/20/17	INITIAL SUBMISSION	TJS	GG

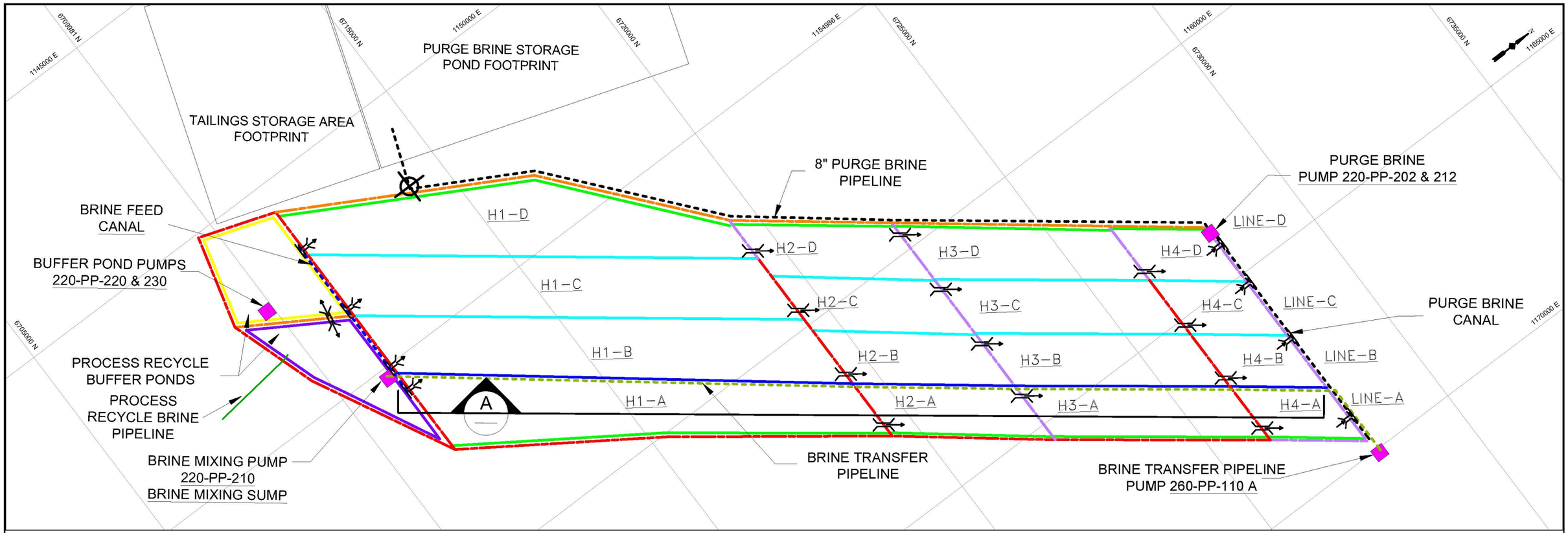
DSGN	DR	CHK	APVD
JDS	JDS	GG	GG

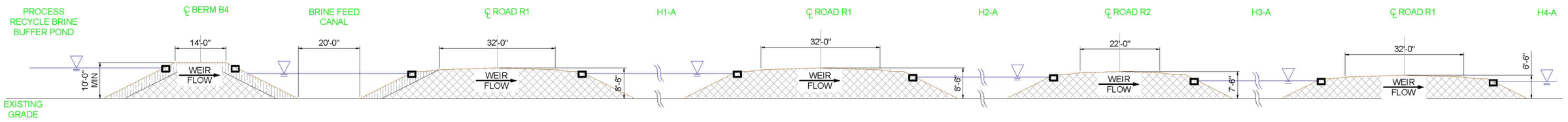
FIGURE 6-15

Sevier Playa Potash Project
Preconcentration Ponds
Plan-View

DATE: 12/18/2017 | FILE: Figure 6-14 PRECONCENTRATION PLAN VIEW.dwg | SCALE: 1":6000'

NORWEST CORPORATION





SECTION A, LOOKING WEST
(NOT TO SCALE)

CRYSTAL PEAK MINERALS INC.

LEGEND

- Road Type R1 (Main Haul Road - 32')
- Road Type R2 (Secondary Road - 22')
- Road Type R3 (Construction / Maintenance Road)
- Berm Type B1 (Berm - 6' width)
- Berm Type B2 (Berm - 14' width)
- Berm Type B3 (Berm - 14' width w/ pipe ledge)
- Berm Type B4 (Berm - 14' width)
- Berm Type B5 (Berm - 6' width)
- Brine Brine Canal
- Brine Transfer Pipeline
- Purge Brine Pipeline
- Process Recycle Pipeline
- Purge Brine Fill Station Dust Suppression
- Pump Station
- Weir (Pond to Pond)
- Weir (Canal to Pond)
- Weir (Pond to Canal)

0 2000 4000 6000
FEET

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	JB	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	JB	AB	AB

FIGURE 6-16

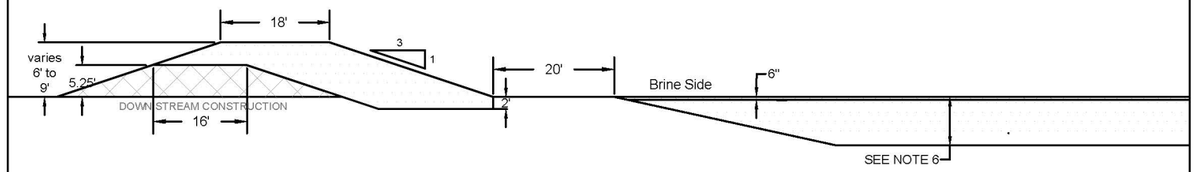
Sevier Playa Potash Project

Production Pond
Plan-View

DATE: 12/18/2017
FILE: Figure 6-16 Production Pond Plan View.dwg
SCALE: As Shown

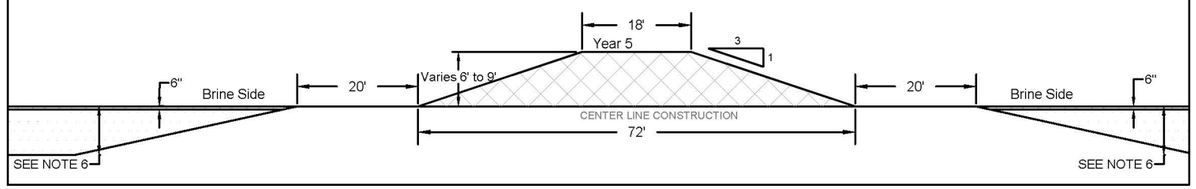
NORWEST CORPORATION

PRECONCENTRATION PONDS
EXTERIOR TYPICAL CROSS-SECTION: 5 YEARS OF OPERATION



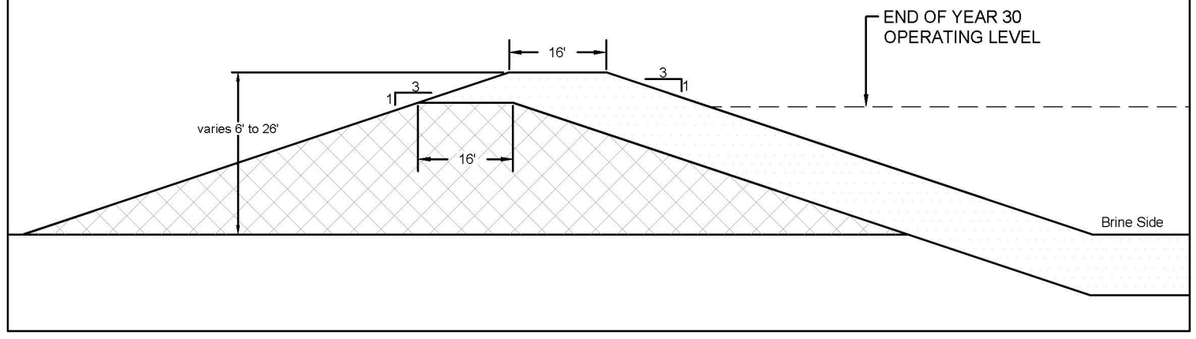
TYPICAL EXTERIOR BERM

PRECONCENTRATION PONDS
INTERIOR TYPICAL CROSS-SECTION: 5 YEARS OF OPERATION



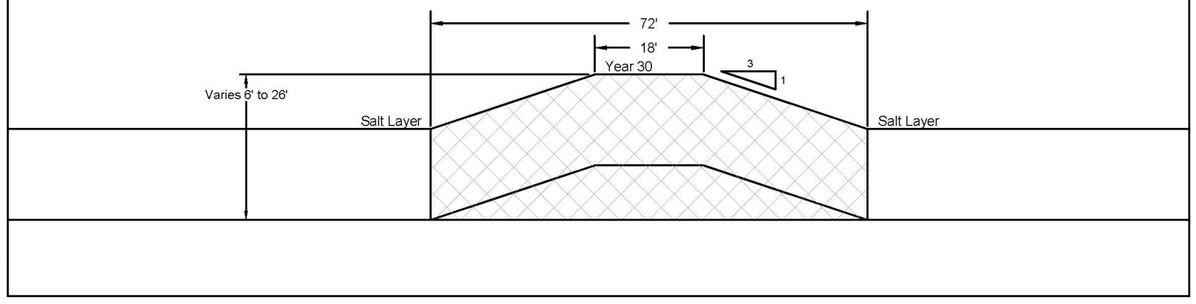
TYPICAL INTERIOR BERM

PRECONCENTRATION PONDS
EXTERIOR TYPICAL CROSS-SECTION: LIFE-OF-MINE



TYPICAL EXTERIOR BERM

PRECONCENTRATION PONDS
INTERIOR TYPICAL CROSS-SECTION: LIFE-OF-MINE



TYPICAL INTERIOR BERM

CRYSTAL PEAK MINERALS INC.

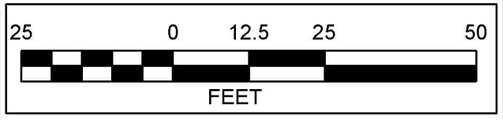
LEGEND

COMMON FILL

LOW PERMEABILITY FILL

NOTES:

1. SOURCE BERM MATERIAL WITHIN THE FOOTPRINT OF THE PONDS DURING INITIAL CONSTRUCTION.
2. DURING OPERATION BERM MATERIALS IS SOURCED OUTSIDE OF POND AREA.
3. BERM HEIGHT VARY BY POND.
4. DO NOT EXCAVATE CLOSER THAN 20' FROM THE TOE OF THE BERM FOR SOURCE MATERIAL. FURTHER GEOTECHNICAL FIELD TEST PROGRAM IS REQUIRED PRIOR TO BEGINNING CONSTRUCTION.
5. REMOVE TOP 6" OF UNSUITABLE NATIVE MATERIAL WITHIN FOOTPRINT OF THE BERMS.
6. DIGGING DEPTH IS INDICATIVE OF THE DEPTH TO MARL CLAY. LEAVE 2 FEET OF FAT CLAY BARRIER BETWEEN TOP OF MARL AND THE POND FLOOR.



NO.	DATE	REVISION	BY	APVD
1	01-05-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-17

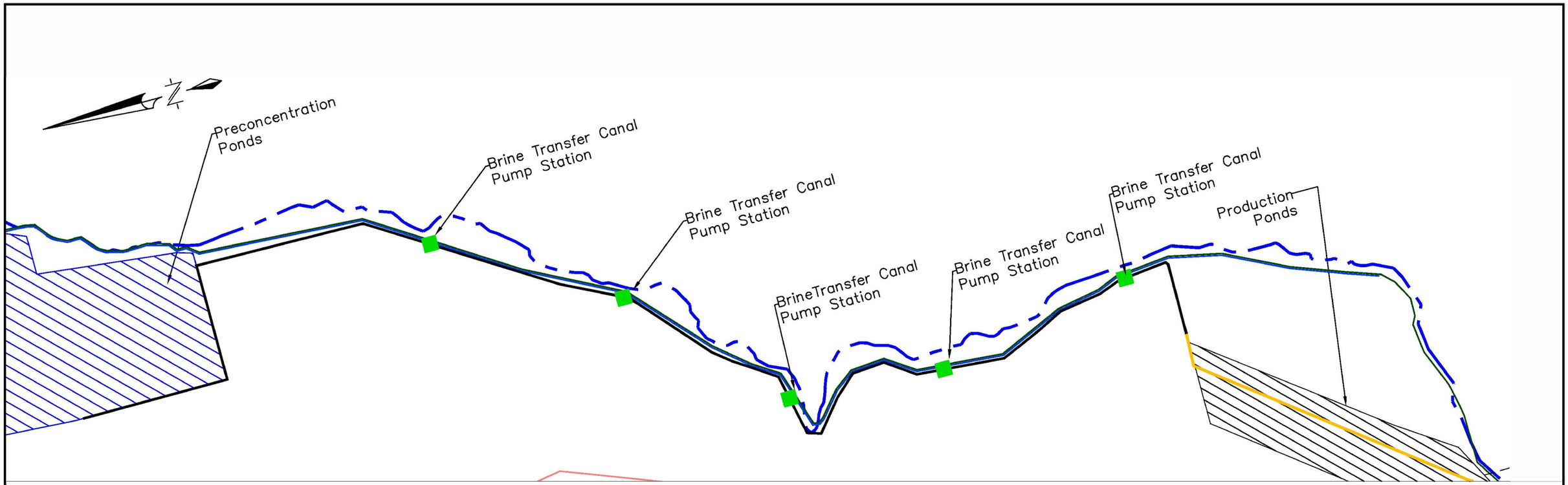
Sevier Playa Potash Project

Preconcentration Pond
Typical Cross Sections

DATE: 09/22/2017
FILE: Figure 6-17 PRECONCENTRATION TYPICAL CROSS SECTIONS.dwg

SCALE: As Shown

NORWEST CORPORATION



CRYSTAL PEAK MINERALS INC.

LEGEND

- Brine Transfer Canal
- Contours
- Existing Ground
- Perimeter Road
- Brine Transfer Pipeline
- Production Pond Area
- Preconcentration Pond Area
- Recharge Canal
- Sevier Playa Boundary

7000 0 7000 14000

1"=7000'

NO.	DATE	REVISION	BY	APVD
1	12/6/17	ADDED PROFILE LABELS	TJS	GG
0	9/20/17	INITIAL SUBMISSION	TJS	GG

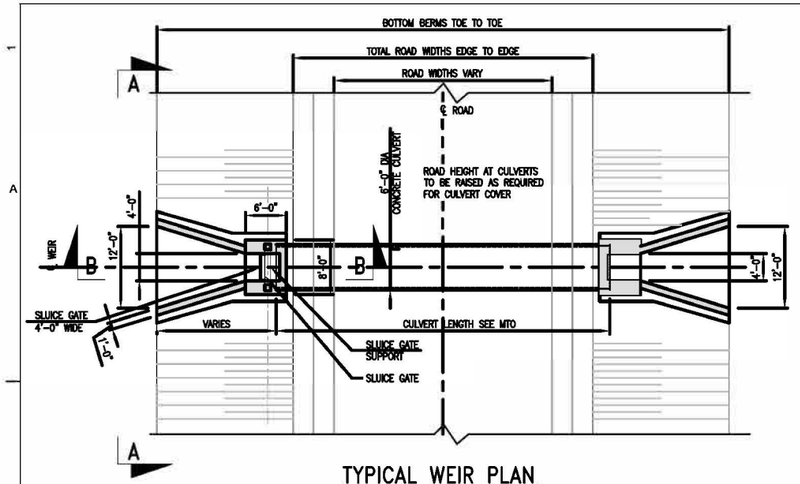
DSGN	DR	CHK	APVD
TJS	TJS	GG	GG

FIGURE 6-18

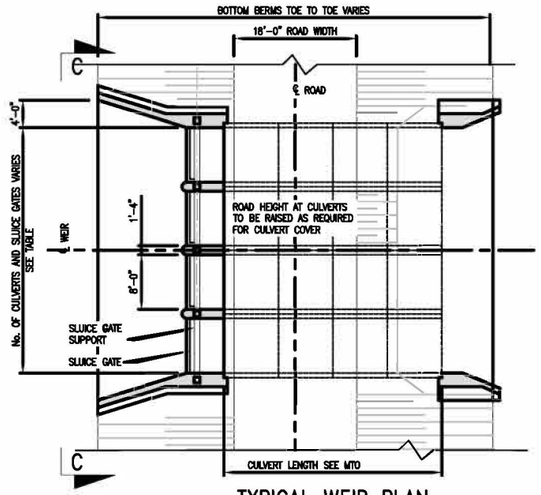
Sevier Playa Potash Project
Brine Transfer Canal
Plan and Profile

DATE: 09/20/2017
FILE: Figure 6-18 Transfer Canal Plan and Profile
SCALE: As Shown

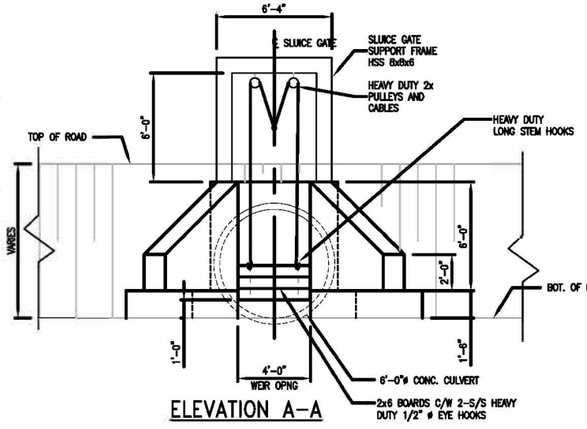
NORWEST CORPORATION



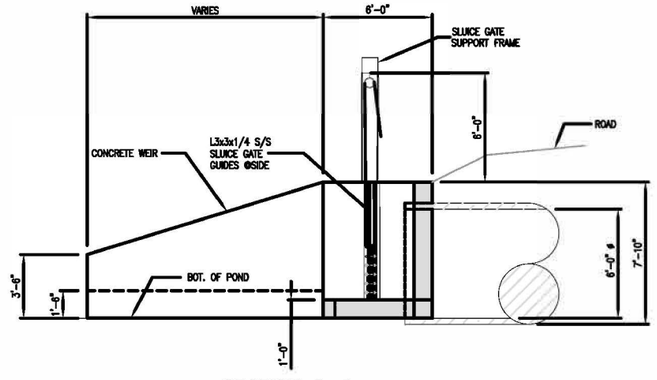
TYPICAL WEIR PLAN
TYPE 1



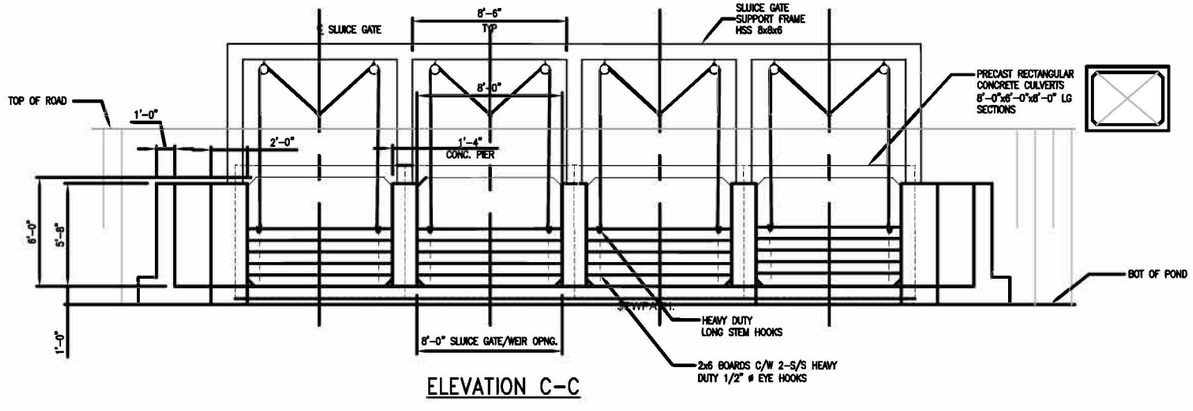
TYPICAL WEIR PLAN
TYPE 2



ELEVATION A-A



SECTION B-B



ELEVATION C-C

WEIR TABLE

PONDS – FLOW FROM	TO	BERM/ROAD HEIGHTS	SLUICE GATE WIDTHS	No. SLUICE GATE PER WEIR	REMARKS
BRINE FEED CANAL	H1A	8'-6" MIN	8'-0"	1	TYPE 2
BRINE FEED CANAL	H1B	8'-6" MIN	8'-0"	1	TYPE 2
BRINE FEED CANAL	H1C	8'-6" MIN	8'-0"	1	TYPE 2
BRINE FEED CANAL	H1D	8'-6" MIN	8'-0"	1	TYPE 2
H1A	H2A	8'-6" MIN	4'-0"	1	TYPE 1
H1B	H2B	8'-6" MIN	4'-0"	1	TYPE 1
H1C	H2C	8'-6" MIN	4'-0"	1	TYPE 1
H1D	H2D	8'-6" MIN	4'-0"	1	TYPE 1
H2A	H3A	7'-6" MIN	4'-0"	1	TYPE 1
H2B	H3B	7'-6" MIN	4'-0"	1	TYPE 1
H2C	H3C	7'-6" MIN	4'-0"	1	TYPE 1
H2D	H3D	7'-6" MIN	4'-0"	1	TYPE 1
H3A	H4A	6'-6" MIN	4'-0"	1	TYPE 1
H3B	H4B	6'-6" MIN	4'-0"	1	TYPE 1
H3C	H4C	6'-6" MIN	4'-0"	1	TYPE 1
H3D	H4D	6'-6" MIN	4'-0"	1	TYPE 1
H4B	PURGE BRINE CANAL	6'-0" MIN	4'-0"	1	TYPE 1
H4B	PURGE BRINE CANAL	6'-0" MIN	4'-0"	1	TYPE 1
H4C	PURGE BRINE CANAL	6'-0" MIN	4'-0"	1	TYPE 1
H4D	PURGE BRINE CANAL	6'-0" MIN	4'-0"	1	TYPE 1
PRE CONCENTRATION PONDS					
P5	P6	9'-0" MIN	8'-0"	4	TYPE 2
P6	P7	8'-6" MIN	8'-0"	3	TYPE 2
P7	P8	8'-6" MIN	8'-0"	4	TYPE 2
P8	P9	8'-0" MIN	8'-0"	3	TYPE 2
P9	P10	7'-6" MIN	8'-0"	2	TYPE 2

CRYSTAL PEAK MINERALS INC.

NO.	DATE	REVISION	BY	APVD
0	12/20/17	INITIAL SUBMISSION	JB	AB

DSGN	DR	CHK	APVD
AY/DB	R. HEISS	AY/DB	MR

FIGURE 6-19

Sevier Playa Potash Project

Typical Weir Configuration

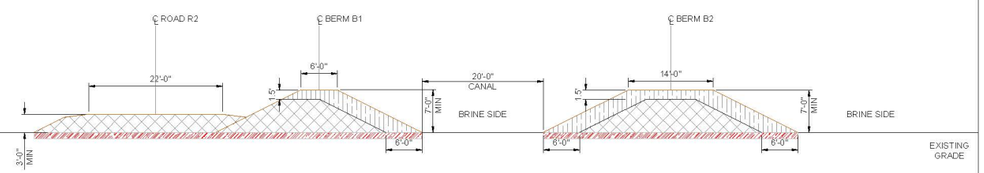
DATE: 12/20/2017

FILE: Figure 6-19 Typical Weir Configuration.dwg

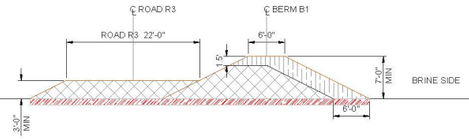
novoPRO Project Development & Management

T:\PeakMinerals_S_89\89-11_SevierPlayaBFS\Disc\Environment\Draft BLM Mine Plan\Figures\Rev. 1 Figures\Section 6\Figure 6-19 Typical Weir Configuration.dwg

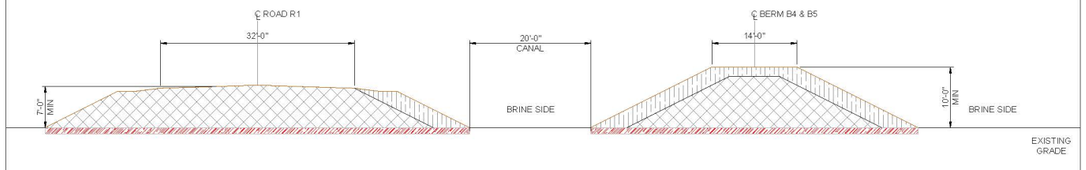
ROAD TYPE R1 & R2: TYPICAL CROSS-SECTION



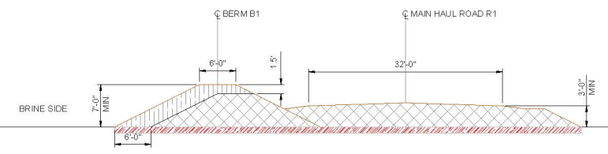
PURGE BRINE CANAL: TYPICAL CROSS-SECTION



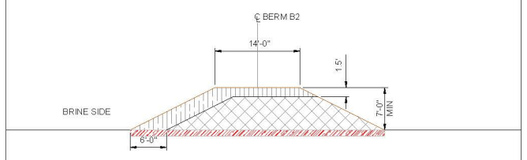
PERIMETER ROAD TYPE R3 & BERM TYPE B1 TYPICAL CROSS-SECTION



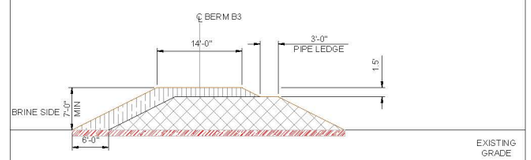
BRINE FEED CANAL: TYPICAL CROSS-SECTION



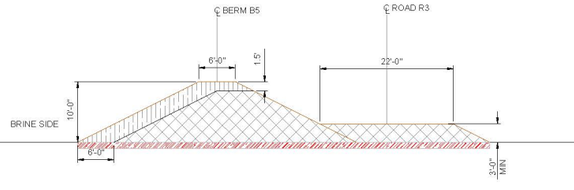
PERIMETER ROAD TYPE R1 & BERM TYPE B1: TYPICAL CROSS-SECTION



BERM TYPE B2: TYPICAL CROSS-SECTION



BERM TYPE B3: TYPICAL CROSS-SECTION



PERIMETER ROAD TYPE R3 & BERM B5: TYPICAL CROSS-SECTION

LEGEND

- TOP LAYER OF WASTE MATERIAL TO BE REMOVED
- LOW PERMEABILITY FILL
- COMMON FILL

25 0 12.5 25 50

FEET

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	JB	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	JB	AB	AB

FIGURE 6-21

Sevier Playa Potash Project

Production Pond

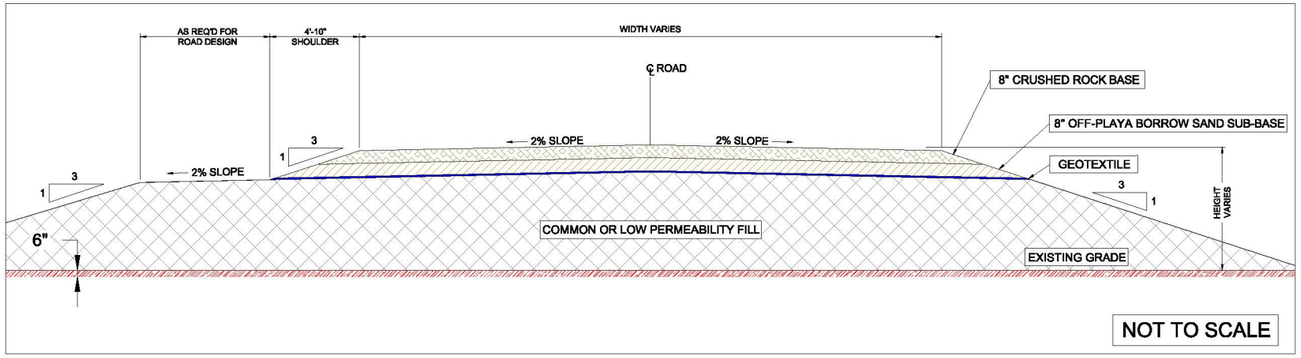
Typical Cross Sections

DATE: 12/18/2017

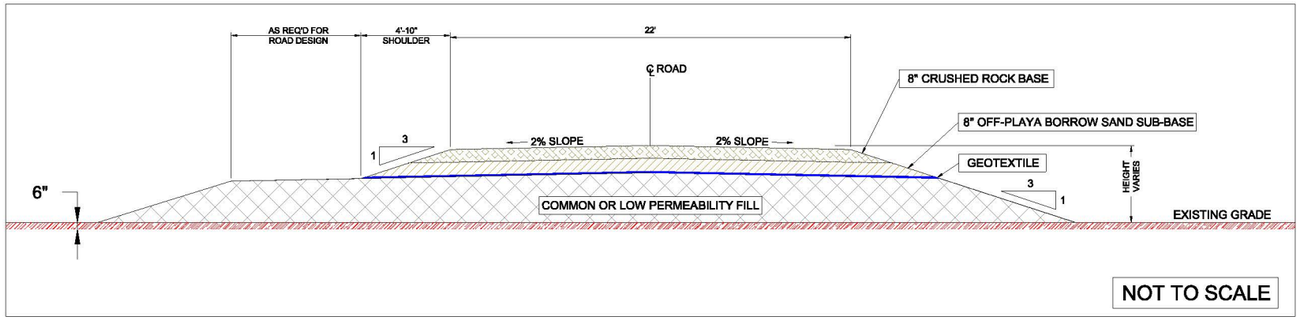
FILE: Figure 6-21 PRODUCTION TYPICAL CROSS SECTIONS.dwg

SCALE: As Shown

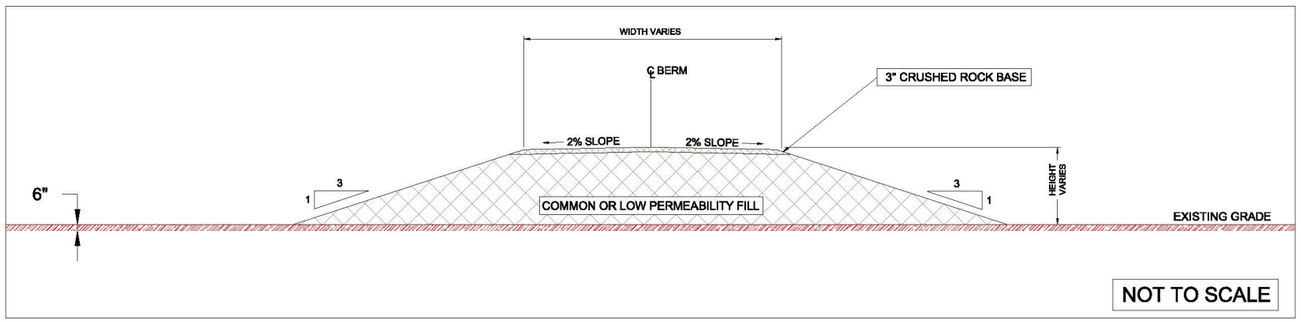
NORWEST CORPORATION



ROAD TYPE R1 (MAIN HAUL ROAD 32')



ROAD TYPE R2 (SECONDARY ROAD 22')
ROAD TYPE R3 (CONSTRUCTION AND MAINTENANCE 22')



BERM TYPE B2, B3, B4, B5
TYPICAL BERM DETAIL (LOW TRAFFIC)

CRYSTAL PEAK MINERALS INC.

LEGEND

- TOP LAYER OF WASTE MATERIAL TO BE REMOVED
- LOW PERMEABILITY FILL
- COMMON FILL
- GRANULAR SUB-BASE ENGINEERED FILL
- UNTREATED BASE COURSE
- GEOTEXTILE REINFORCEMENT

NOTES:

1. SOURCE BERM MATERIAL WITHIN THE FOOTPRINT OF THE PONDS DURING INITIAL CONSTRUCTION.
2. DO NOT EXCAVATE CLOSER THAN 20' FROM THE TOE OF THE BERM FOR SOURCE MATERIAL. FURTHER GEOTECHNICAL FIELD TEST PROGRAM IS REQUIRED PRIOR TO BEGINNING CONSTRUCTION.
3. REMOVE TOP 6" OF UNSUITABLE NATIVE MATERIAL WITHIN FOOTPRINT OF THE BERMS AND DISCARD.
4. DIGGING DEPTH IS INDICATIVE OF THE DEPTH TO MARL CLAY. LEAVE 2 FEET OF FAT CLAY BARRIER BETWEEN TOP OF MARL AND THE POND FLOOR.

0 12.5 25

SCALE 1":11.9'

NO.	DATE	REVISION	BY	APVD
0	05-08-18	ISSUED FOR REVIEW	GDI	GG

DSGN	DR	CHK	APVD
GDI	GDI	GG	AB

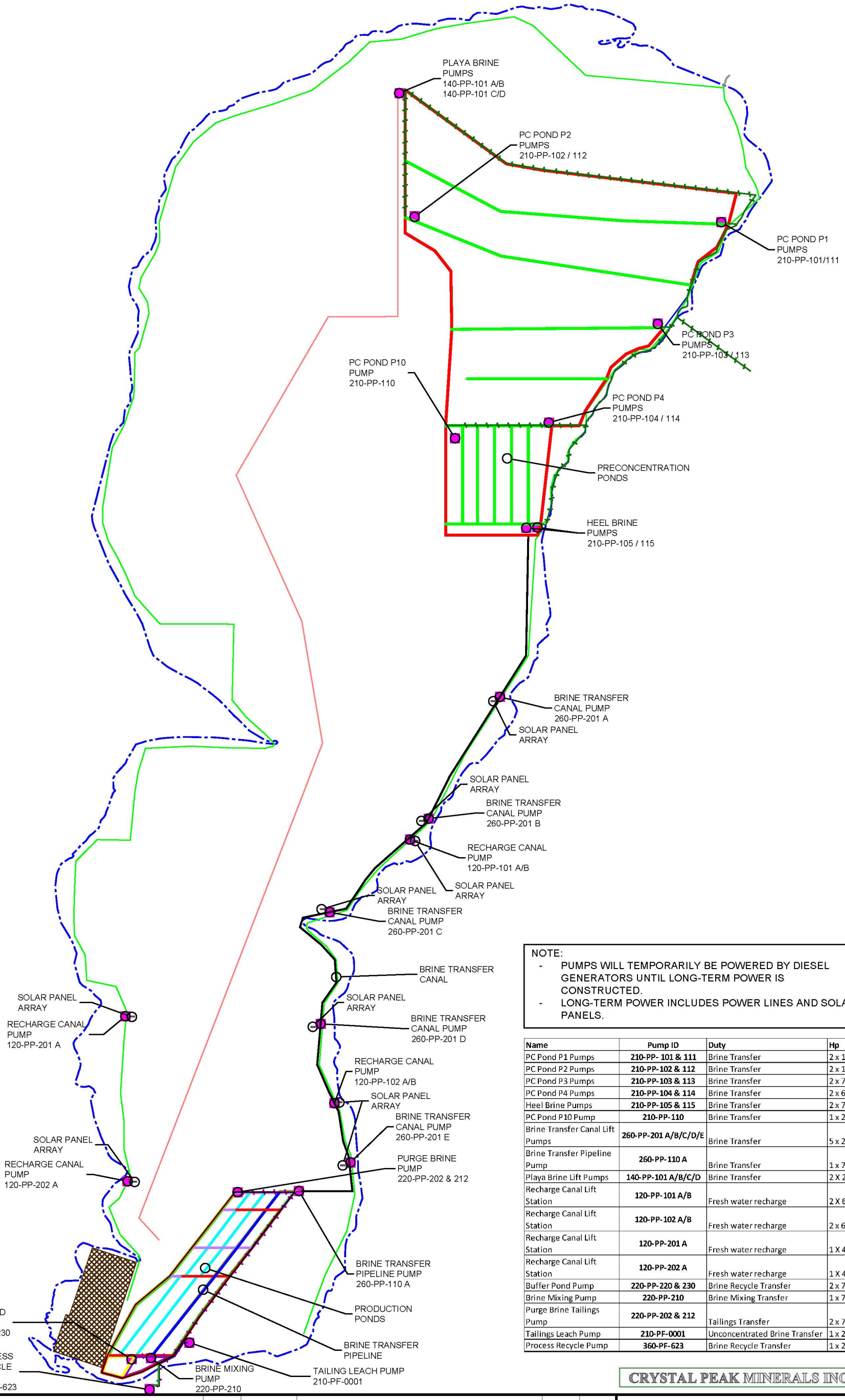
FIGURE 6-22

Sevier Playa Potash Project
Production Ponds
Typical Road Cross Sections

DATE: 05/18/2018
7: Figure 6-22 PROD TYPICAL ROAD CROSS SECT

SCALE: As Shown

NORWEST CORPORATION



NOTE:
- PUMPS WILL TEMPORARILY BE POWERED BY DIESEL GENERATORS UNTIL LONG-TERM POWER IS CONSTRUCTED.
- LONG-TERM POWER INCLUDES POWER LINES AND SOLAR PANELS.

Name	Pump ID	Duty	Hp
PC Pond P1 Pumps	**210-PP- 101 & 111**	Brine Transfer	2 x 150
PC Pond P2 Pumps	**210-PP-102 & 112**	Brine Transfer	2 x 100
PC Pond P3 Pumps	**210-PP-103 & 113**	Brine Transfer	2 x 75
PC Pond P4 Pumps	**210-PP-104 & 114**	Brine Transfer	2 x 60
Heel Brine Pumps	**210-PP-105 & 115**	Brine Transfer	2 x 75
PC Pond P10 Pump	**210-PP-110**	Brine Transfer	1 x 25
Brine Transfer Canal Lift Pumps	**260-PP-201 A/B/C/D/E**	Brine Transfer	5 x 20
Brine Transfer Pipeline Pump	**260-PP-110 A**	Brine Transfer	1 x 75
Playa Brine Lift Pumps	**140-PP-101 A/B/C/D**	Brine Transfer	2 X 250
Recharge Canal Lift Station	**120-PP-101 A/B**	Fresh water recharge	2 X 60
Recharge Canal Lift Station	**120-PP-102 A/B**	Fresh water recharge	2 x 60
Recharge Canal Lift Station	**120-PP-201 A**	Fresh water recharge	1 X 40
Recharge Canal Lift Station	**120-PP-202 A**	Fresh water recharge	1 X 40
Buffer Pond Pump	**220-PP-220 & 230**	Brine Recycle Transfer	2 x 75
Brine Mixing Pump	**220-PP-210**	Brine Mixing Transfer	1 x 75
Purge Brine Tailings Pump	**220-PP-202 & 212**	Tailings Transfer	2 x 75
Tailings Leach Pump	**210-PF-0001**	Unconcentrated Brine Transfer	1 x 20
Process Recycle Pump	**360-PF-623**	Brine Recycle Transfer	1 x 25

CRYSTAL PEAK MINERALS INC.

LEGEND
- Brine Transfer Canal
- Recharge Canal
- Extraction Canal
- Brine Transfer Pipeline
- Sevier Playa Boundary
- Tailings Leach Pipeline
- Process Recycle Pipeline
- Pump Station
- Solar Panel Field
- Production Ponds
- Preconcentration Ponds
- Waste Product Storage Area
- 12.47 kV Powerline
- 25 kV Powerline

N

10,000 0 10,000
1"=10,000ft

NO.	DATE	REVISION	BY	APVD
2	2/26/18	REVISED AND CORRECTED TEXT	TJS	GG
1	12/8/17	REVISED COLORS AND CORRECTED TEXT	TJS	GG
0	11/8/17	INITIAL SUBMISSION	TJS	GG

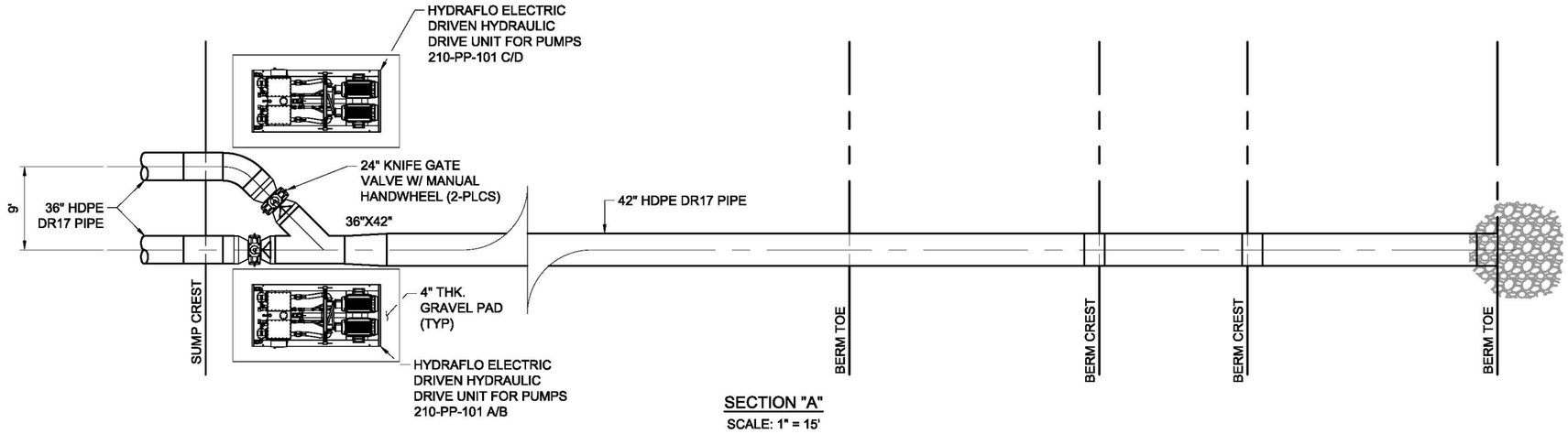
DSGN	DR	CHK	APVD
TJS	JDS	TJS	GG

FIGURE 6-23

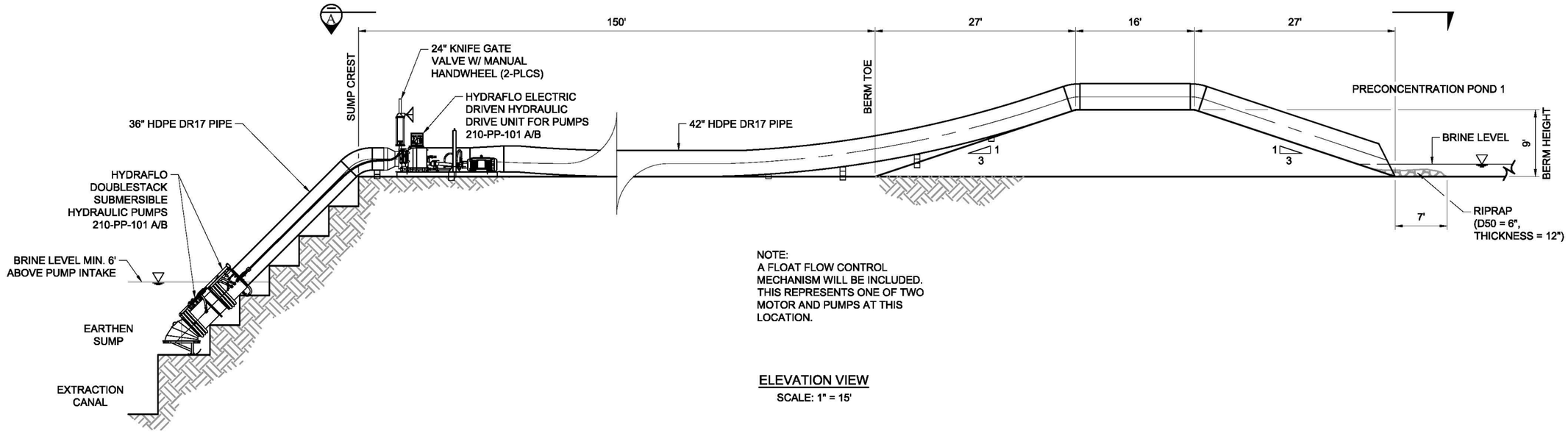
Sevier Playa Potash Project
Brine Pump Locations

DATE: 11/8/2017
FILE: Figure 6-22 Pump Locations Rev 1
SCALE: As Shown

NORWEST CORPORATION



SECTION "A"
SCALE: 1" = 15'



NOTE:
A FLOAT FLOW CONTROL MECHANISM WILL BE INCLUDED. THIS REPRESENTS ONE OF TWO MOTOR AND PUMPS AT THIS LOCATION.

ELEVATION VIEW
SCALE: 1" = 15'

CRYSTAL PEAK MINERALS INC.

15 0 15 30
1"=15'-0"

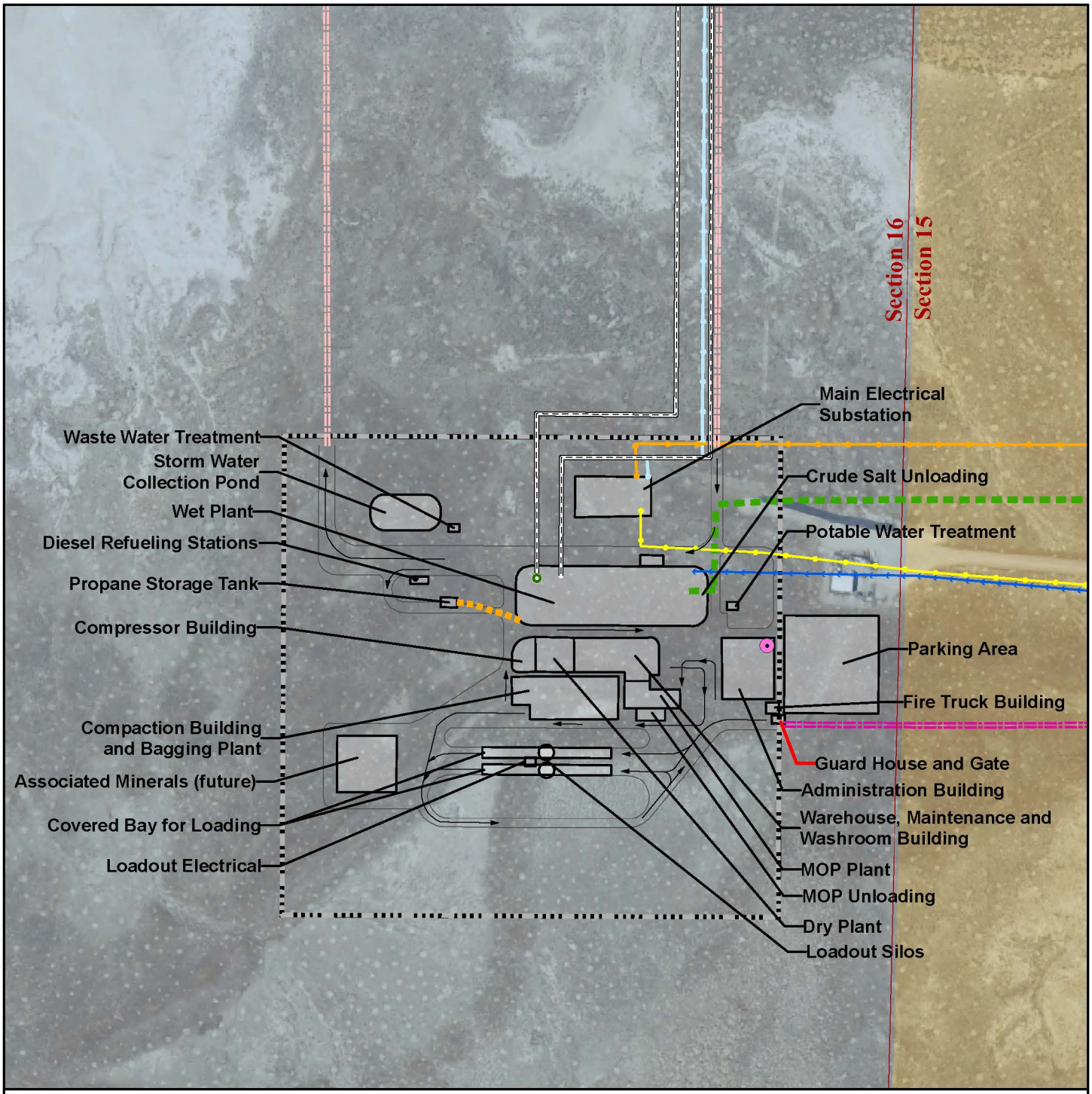
NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-24

Sevier Playa Potash Project
Playa Brine Pump

DATE: 09/21/2017
FILE: Figure 6-23 Playa BrineSump RevA
SCALE: As Shown
NORWEST CORPORATION



Proposed Project Features

- 69-kV Power and Communication Line
- 12.47-kV Power and Communication Line
- 12.47-kV Power Line
- Water Supply Pipeline
- Natural Gas Pipeline
- Propane Pipeline
- Process Recycle Brine Pipeline and Tailings Leach Pipeline
- Process Recycle Brine Pump
- Perimeter Security Fence
- Communication Tower
- Access Road
- Haul Road

Land Ownership

- BLM
- State Lands

N

0 250 500 Feet

1 in = 400 ft 1:4,800

Sources:
Project features, Crystal Peak Minerals, 2015, 2016, 2017;
Public land survey system, BLM 2013;
Roads, Millard County, 2013;
Aerial Imagy, NAIP 2016

Notes:
- Some project facilities not drawn to exact scale to improve legibility of figure.
- The project facilities shown on this map are draft and may be revised and/or refined throughout the development of the project.

NO.	DATE	REVISION	BY	APVD
1	5/18/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

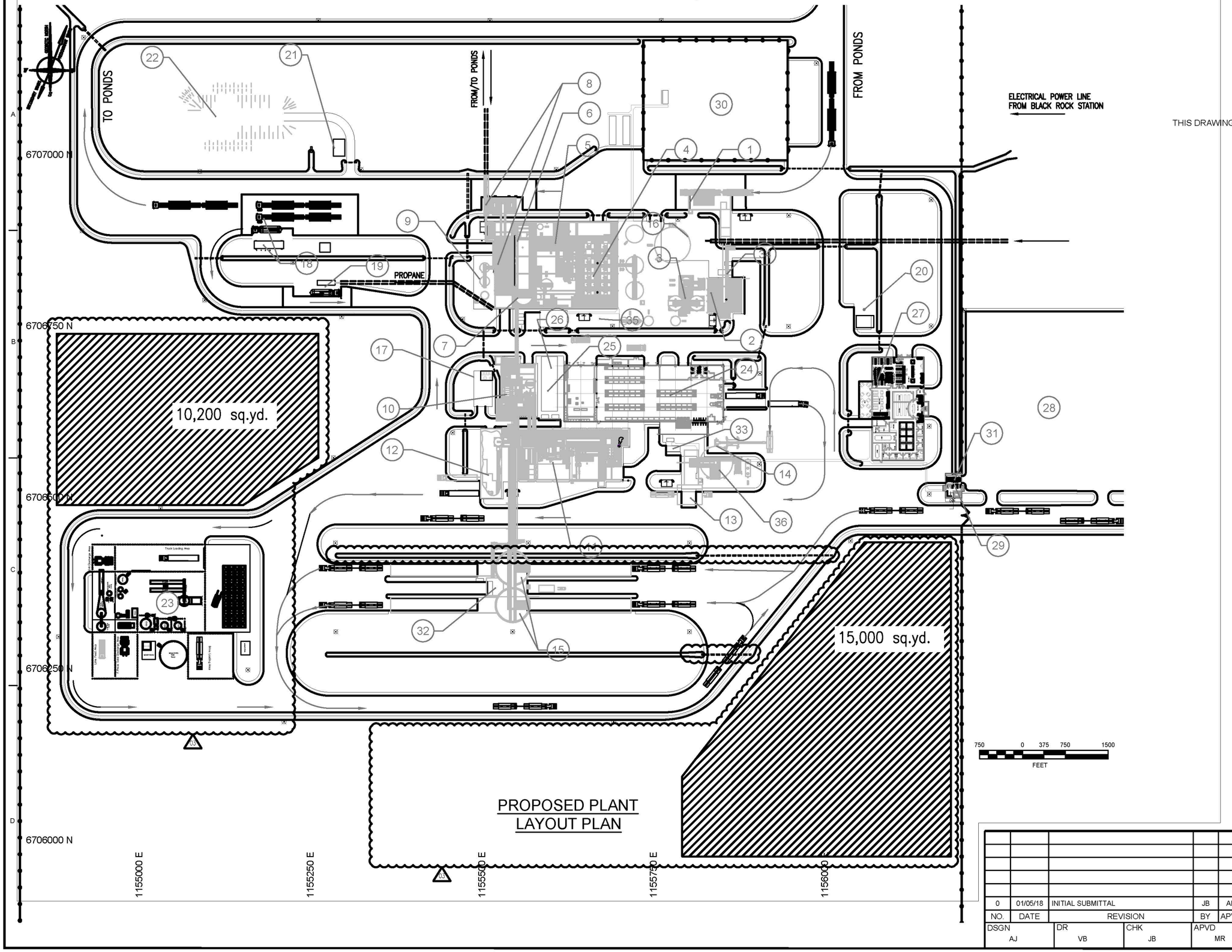
FIGURE 6-25

Sevier Playa Potash Project
Processing Facility Site Plan

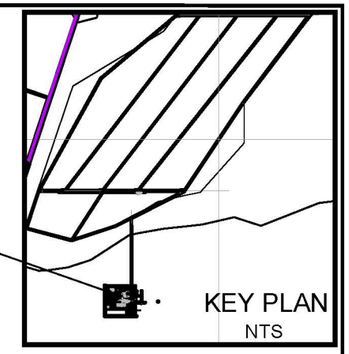
MINING PLAN

DATE: 5/31/2018 SCALE: 1:4,800

CRYSTAL PEAK MINERALS INC.



PROPOSED PLANT
LAYOUT PLAN



LEGEND

No.	ITEM
1	CRUDE SALT UNLOADING
2	CRUDE SALT CRUSHING
3	CONVERSION
4	FLOTATION
5	SCHOENITE LEACH
6	SCHOENITE S/L SEPARATION AREA
7	CRYSTALLIZATION AREA
8	TAILINGS SEPARATION & LOADING
9	TAILINGS LEACH
10	DRYING BUILDING
11	COMPACTION BUILDING
12	BAGGING PLANT
13	MOP (KCL) UNLOADING
14	OFF SPEC PRODUCT RETURN
15	LOADOUT SILOS
16	PROCESS & FIRE WATER TANK
17	COMPRESSOR BUILDING
18	DIESEL REFUELING STATION
19	PROPANE STORAGE TANK
20	POTABLE WATER TREATMENT
21	WASTEWATER TREATMENT
22	STORM WATER COLLECTING POND
23	ASSOCIATED MINERALS (FUTURE)
24	WAREHOUSE & MAINTENANCE & WASHROOMS
25	DRY PLANT ELECTRICAL ROOM
26	MAIN CONTROL ROOM
27	ADMINISTRATION BUILDING (HOLD)
28	PARKING
29	GUARDHOUSE & GATE
30	MAIN ELECTRICAL SUBSTATION
31	FIRE TRUCK BUILDING
32	LOADOUT ELECTRICAL & CONTROL ROOM
33	MOP HANDLING ELECTRICAL ROOM
34	SALT CRUSHING ELECTRICAL ROOM
35	WET PLANT ELECTRICAL ROOM
36	MOP (KCL) SILO

XX ITEM NUMBER

ROADS

TRAFFIC FLOW

FENCE

UNDERGROUND PIPELINES

CONSTRUCTION LAYDOWN AREA

CRYSTAL PEAK MINERALS INC.

FIGURE 6-26

Sevier Playa Potash Project

Processing Facility
Detailed Layout

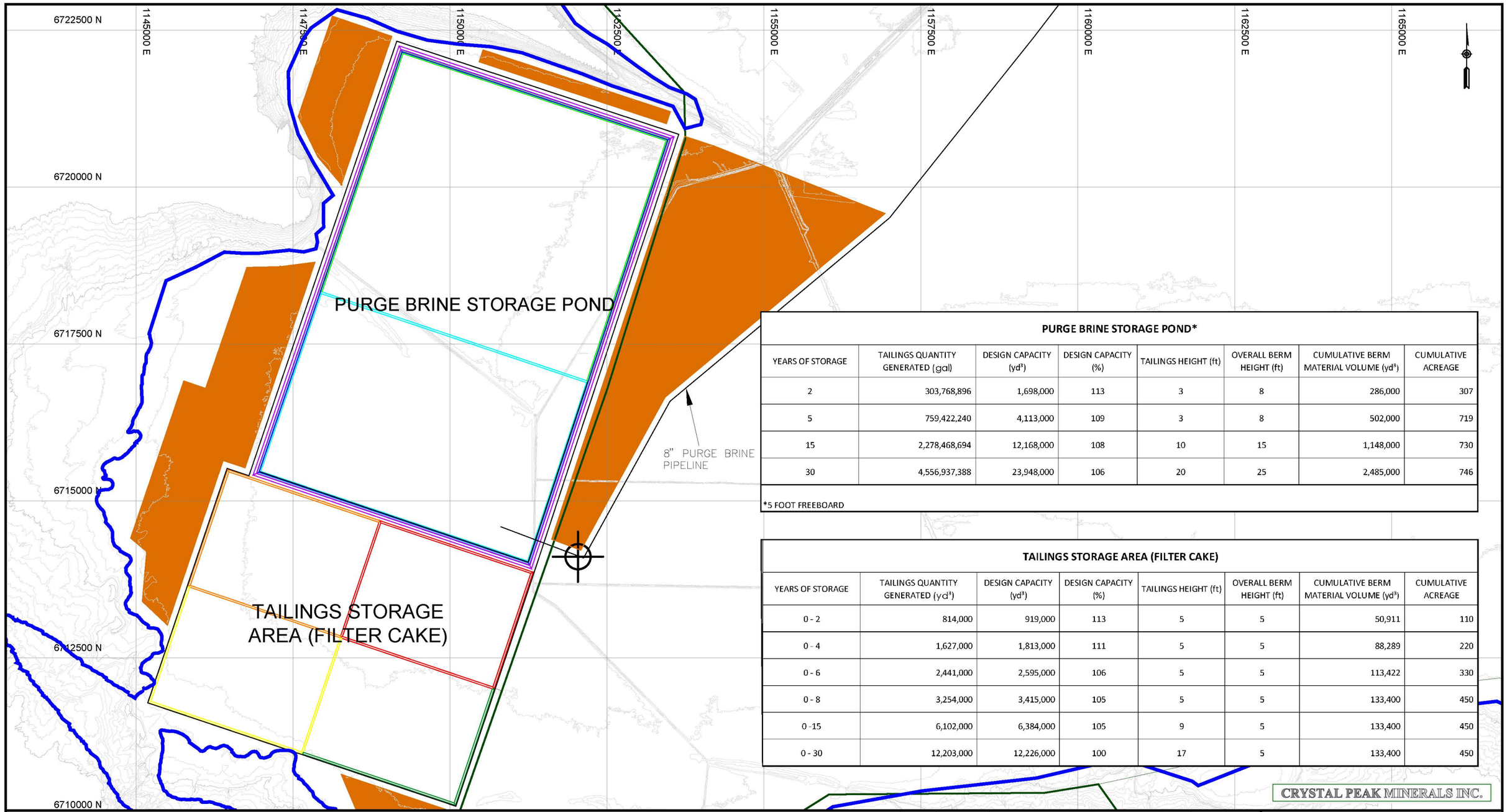
NO.	DATE	REVISION	BY	APVD
0	01/05/18	INITIAL SUBMITTAL	JB	AB

DSGN	DR	CHK	APVD
AJ	VB	JB	MR

DATE: 12/20/2017

FILE: Figure 6-25 Processing Detailed Layout.dwg

novoPRO Project Development & Management



PURGE BRINE STORAGE POND*

YEARS OF STORAGE	TAILINGS QUANTITY GENERATED (gal)	DESIGN CAPACITY (yd^3)	DESIGN CAPACITY (%)	TAILINGS HEIGHT (ft)	OVERALL BERM HEIGHT (ft)	CUMULATIVE BERM MATERIAL VOLUME (yd^3)	CUMULATIVE ACREAGE
2	303,768,896	1,698,000	113	3	8	286,000	307
5	759,422,240	4,113,000	109	3	8	502,000	719
15	2,278,468,694	12,168,000	108	10	15	1,148,000	730
30	4,556,937,388	23,948,000	106	20	25	2,485,000	746

*5 FOOT FREEBOARD

TAILINGS STORAGE AREA (FILTER CAKE)

YEARS OF STORAGE	TAILINGS QUANTITY GENERATED (yd^3)	DESIGN CAPACITY (yd^3)	DESIGN CAPACITY (%)	TAILINGS HEIGHT (ft)	OVERALL BERM HEIGHT (ft)	CUMULATIVE BERM MATERIAL VOLUME (yd^3)	CUMULATIVE ACREAGE
0 - 2	814,000	919,000	113	5	5	50,911	110
0 - 4	1,627,000	1,813,000	111	5	5	88,289	220
0 - 6	2,441,000	2,595,000	106	5	5	113,422	330
0 - 8	3,254,000	3,415,000	105	5	5	133,400	450
0 -15	6,102,000	6,384,000	105	9	5	133,400	450
0 - 30	12,203,000	12,226,000	100	17	5	133,400	450

CRYSTAL PEAK MINERALS INC.

LEGEND

- Purge Brine Berm Crest (2 years)
- Purge Brine Berm Crest (5 years)
- Purge Brine Berm Crest (15 years)
- Purge Brine Berm Crest (30 years)
- Filter Cake Berm Crest (2 years)
- Filter Cake Berm Crest (4 years)
- Filter Cake Berm Crest (6 years)
- Filter Cake Berm Crest (8 years)
- Ultimate Footprint (30 Years)
- Sevier Playa Boundary
- Perimeter Road
- Purge Brine Fill Station
- Dust Suppression
- Borrow Area

NOTES:

1. THE AREA DELINEATED FOR THE BORROW AREA ACCOUNTS FOR AN OFFSET OF 500FT FROM WELLS AND TRENCH. TO ACCOUNT FOR THIS DELINEATION, THE BORROW AREA FOOTPRINT HAS BEEN INCREASED BY 20 PERCENT.
2. DEPTH OF BORROW AREAS ARE APPROXIMATELY 2 FEET.

1500 0 750 1500 3000
FEET

NO.	DATE	REVISION	BY	APVD
1	01-05-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

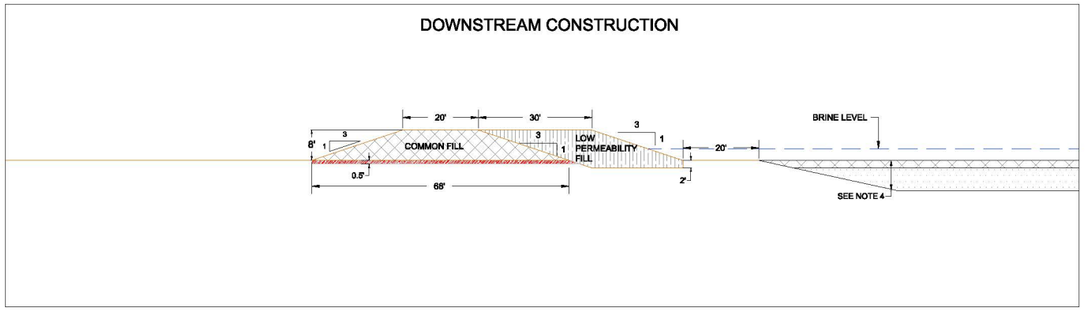
FIGURE 6-27

Sevier Playa Potash Project
Waste Product Storage Area
Plan View

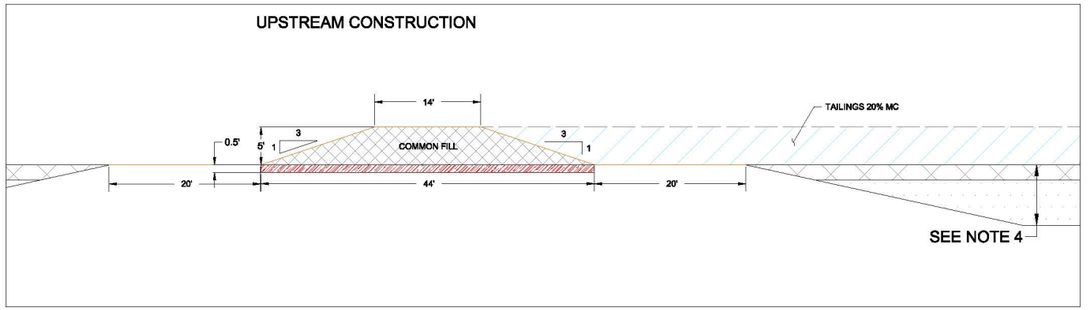
DATE: 10/10/2017
6: Figure 6-26 TSF PLAN-VIEW.DWG

SCALE: 1":1500'

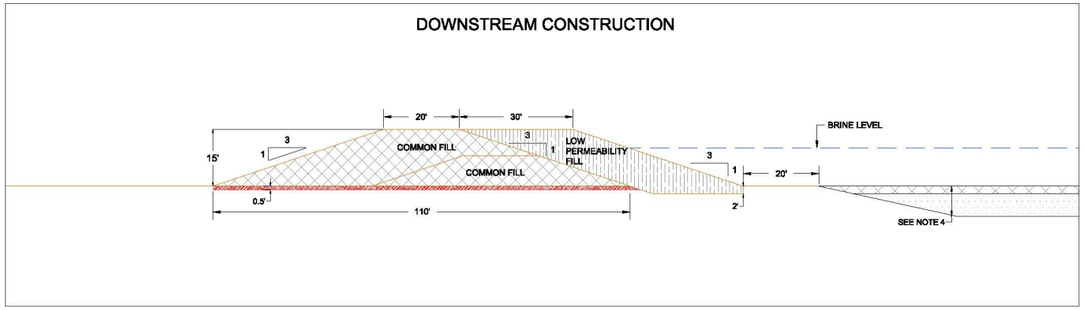
NORWEST CORPORATION



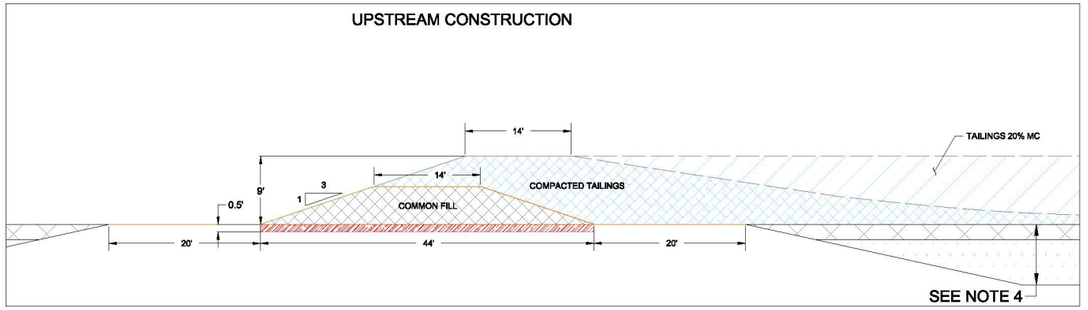
PURGE BRINE STORAGE POND TYPICAL CROSS-SECTION: 5 YEARS OF OPERATION
SCALE B



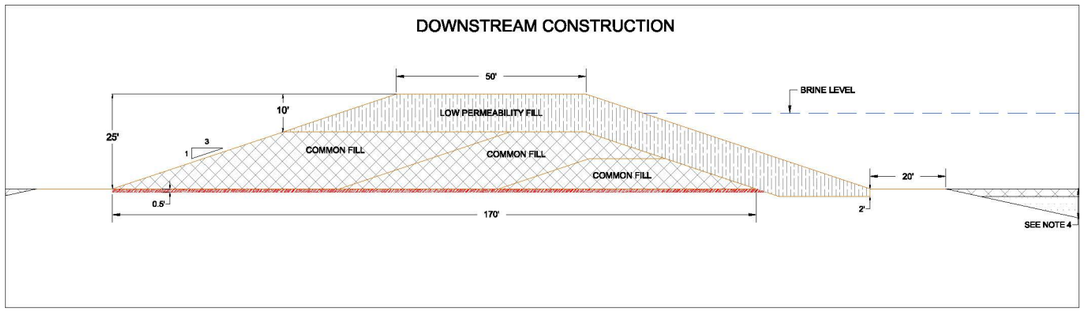
TAILINGS STORAGE AREA TYPICAL CROSS-SECTION: 8 YEARS OF OPERATION
SCALE A



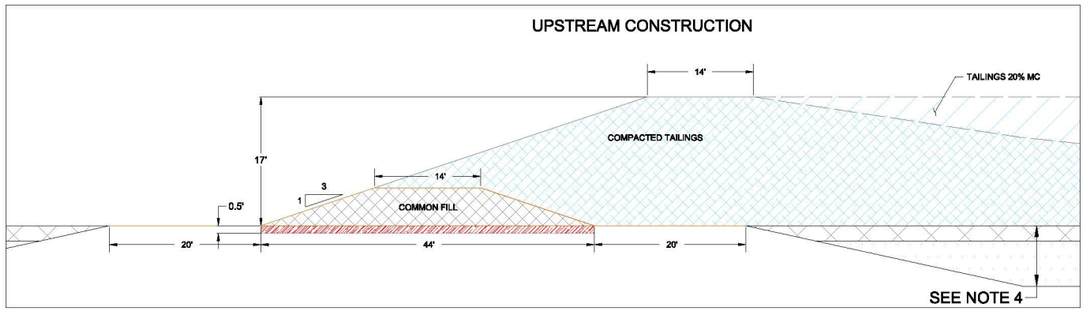
PURGE BRINE STORAGE POND TYPICAL CROSS-SECTION: 15 YEARS OF OPERATION
SCALE B



TAILINGS STORAGE AREA TYPICAL CROSS-SECTION: 15 YEARS OF OPERATION
SCALE A



PURGE BRINE STORAGE POND TYPICAL CROSS-SECTION: 30 YEARS OF OPERATION
SCALE B



TAILINGS STORAGE AREA TYPICAL CROSS-SECTION: 30 YEARS OF OPERATION
SCALE A

CRYSTAL PEAK MINERALS INC.

LEGEND

- TOP LAYER OF WASTE MATERIAL TO BE REMOVED
- LOW PERMEABILITY FILL
- COMMON FILL
- DECANTED AND COMPACTED FILTER CAKE
- FILTER CAKE: 20% MC

NOTES:

1. SOURCE BERM MATERIAL WITHIN THE FOOTPRINT OF THE PONDS DURING INITIAL CONSTRUCTION.
2. DO NOT EXCAVATE CLOSER THAN 20' FROM THE TOE OF THE BERM FOR SOURCE MATERIAL. FURTHER GEOTECHNICAL FIELD TEST PROGRAM IS REQUIRED PRIOR TO BEGINNING CONSTRUCTION.
3. REMOVE TOP 6" OF UNSUITABLE NATIVE MATERIAL WITHIN FOOTPRINT OF THE BERMS AND DISCARD.
4. DIGGING DEPTH IS INDICATIVE OF THE DEPTH TO MARL CLAY. LEAVE 2 FEET OF FAT CLAY BARRIER BETWEEN TOP OF MARL AND THE POND FLOOR.

SCALE A: 20 0 20 40
SCALE: 1" = 20'-0"

SCALE B: 40 0 40 80
SCALE: 1" = 40'-0"

NO.	DATE	REVISION	BY	APVD
1	01-05-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-28

Sevier Playa Potash Project
Waste Product Storage Area
Typical Cross Sections

DATE: 09/22/2017
7: Figure 6-27 TSF TYPICAL CROSS SECTIONS
SCALE: As Shown

NORWEST CORPORATION

R13W R12W R11W R10W R9W R8W R7W

T18S T19S T20S T21S T22S T23S T24S T25S

Long Ridge Communication Tower

Long Ridge Reservoir Rd

6 50

Black Rock Substation

69-kV Power and Communication Line

Black Rock Communication Tower

SR 257 Cutoff Rd

257

25-kV Power Line

North Playa Substation

Off-Lease Recharge Collector

Drop Structure

Sevier River

Diversion Canal Spoils Pile

Diversion Berm

Diversion Canal

Perimeter Road Culvert Crossing Location. Culvert is 16 feet long

Diversion Sump

Lake Point Road

Steamboat Pass Rd

Off-Lease Recharge Collectors

Headlight Canyon Rd

12.47-kV Power Line

Rail Loadout Facility

Processing Facility

Crystal Peak Spur Rd

Crystal Peak Rd

Iron Mine Pass Rd

257

Black Rock Rd

South Peak Rd

Natural Gas Pipeline

Proposed Project Features

- 69-kV Power and Communication Line
- 25-kV Power Line
- 12.47-kV Power and Communication Line
- 12.47-kV Power Line
- 12.47-kV Power Line Spur
- Recharge Canal - On-Lease
- Recharge Canal - Off-Lease
- Access Road - Off-Lease
- Perimeter Road and Spurs - On-Lease
- Perimeter Road Segment - Off-Lease
- Brine Transfer Canal/Pipeline - On-Lease
- Brine Transfer Canal - Off-Lease
- Recharge Collector - Off-Lease
- Rail Spur and Access Corridor
- Rail Loadout Facility
- Water Supply Pipeline
- Water Supply Pipeline Spur
- Water Supply Well
- Gravel Pit
- Natural Gas Pipeline
- Pump Station - Off-Lease
- Pump Station - On-Lease
- Diversion Sump
- Communication Tower
- Substation
- Preconcentration and Production Ponds
- Preconcentration Ponds - Off-Lease

Existing Facilities

- Communication Site
- UNEV Pipeline
- Kern River Natural Gas Pipeline
- IPP Transmission Line
- Milford Wind Corridor Transmission Line
- Milford Wind Corridor Phase I & II
- Telescope Array Project
- Kern River Natural Gas Valve Station
- Black Rock Substation
- Telescope Array - Long Ridge Fluorescence Detector
- Telescope Array Communication Tower

General Reference

- BLM and SITLA Lease Boundary
- Sevier Playa Boundary
- US Highway, State Highway
- Class B Road
- Dirt Track Road
- Railroad

Land Ownership

- BLM
- State Lands
- Private

N 0 2 4 Miles

Sources:
Project features, Crystal Peak Minerals 2015-2018;
Public land survey system, Land jurisdiction BLM 2013;
Sevier Playa Boundary, SWCA 2015;
Roads, Millard County 2013; Railroads ESRI 2000;
Kern River gas pipeline BLM 2011;
UNEV Pipeline, IPP Transmission Line,
Milford Wind Corridor Transmission Line,
Telescope Array Project,
Milford Wind Corridor Phase I & II BLM 2015
Aerial Imagy, USDA/APFO 2016

Note:
- The rail facility and utility siting areas shown on this map are draft and may be revised and/or refined throughout the development of the project.

NO.	DATE	REVISION	BY	APVD
2	2/13/2018	Updated Drop Structure		
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

FIGURE 6-29

Sevier Playa Potash Project
Project Off-Lease Facilities Overview

MINING PLAN

DATE: 5/24/2018 SCALE: 1:238,000

CRYSTAL PEAK MINERALS INC.

MP_Fig 6-29_Project Off Lease_Facilities_Overview 180518 5/18/2018 1:18:47 PM

R13W R12W R11W R10W R9W

T19S T20S T21S T22S T23S T24S

Amasa Well
UDOT 2
257 Cut-Off
Highway 50/6
Sevier River
Mud Flat Well
Mudhole Well
SN3-12-045c
SN3-12-049
Glass Ocean Well
Glitter Gulch Well
SEV-11-014
Miller Canyon Reservoir
SN3-12-026
SN3-12-029
SN3-12-053R
SN3-12-073
SN3-12-112c
SN3-12-069
North Cricket
SN3-12-104
Steamboat Pass Rd
Candland Spring
SN3-12-133c
SN3-12-179
Guzzler
S13
SN3-12-239
SN3-12-226c
SN3-12-232
SN3-12-251
SEV-11-013
SN3-12-260
SN3-12-270
SN3-12-126
Red Boat Well
Nautilus Well
Black Hills Well
Erehwon Well
Bonneville
PVC Shoal Well
SEV-11-007 (Monument Point Well)
Laceration Well
Provo
Machine Gun Well
Headlight Gap Well
Head Light Rd
SN1-11-301
SN1-11-303
SN1-11-302
SN2-11-400-1"
SN2-11-400-4"
SN1-11-300
QQ7 SONIC
Beaver River
Highway 257
RR7-1
Wishing Well
RR7-4
Dike Access
Black Rock Well
Crystal Peak Road Well
Lakeview Well
Crystal Peak Rd

Project Features

- Monitoring Well
- Crystal Peak Minerals Corporation 1980's - Canal and Ponds

General Reference

- BLM and SITLA Lease Boundary
- Sevier Playa Boundary
- River
- Intermittent Stream
- Contour Lines - .1 Meter Interval
- Township and Range

Land Ownership

- BLM
- State Lands
- Private

N 0 1 2 4 Miles

1 in = 2 miles 1:151,000

NO.	DATE	REVISION	BY	APVD
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

FIGURE 6-30

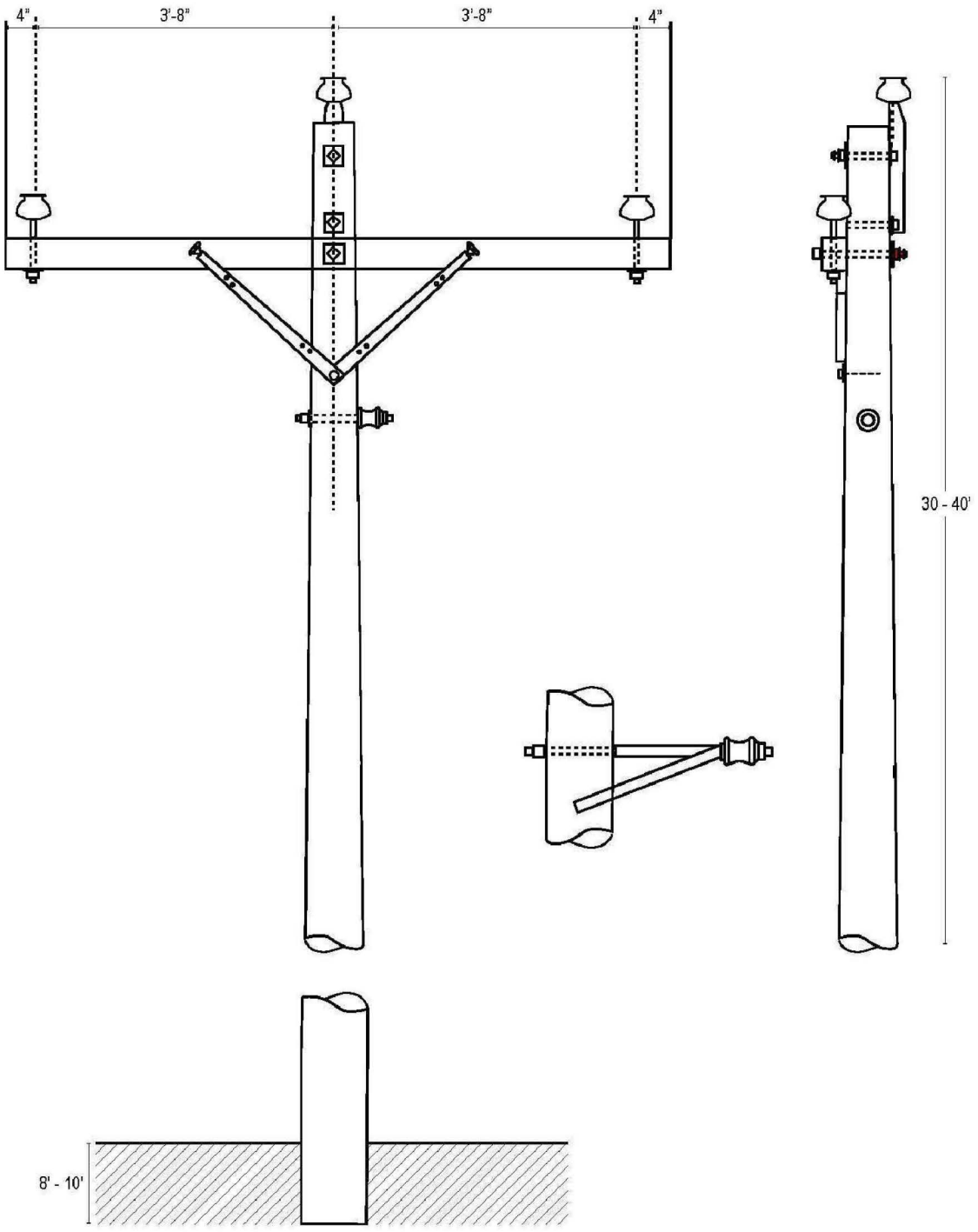
Sevier Playa Potash Project
Existing Project Area
Conditions as of March 2013

MINING PLAN

DATE: 5/18/2018 SCALE: 1:151,000

CRYSTAL PEAK MINERALS INC.

MP Fig 6-30_March 2013 Project Area Conditions_1805185/18/2018 12:22:08 PM



Power line structures and installed raptor protection devices will comply with APLIC guidelines for the protection of birds.

CRYSTAL PEAK MINERALS INC.

NO.	DATE	REVISION	BY	APVD
0	10-25-17	INITIAL SUBMITTAL	JDS	AB

DSGN	DR	CHK	APVD
JDS	JDS	AB	AB

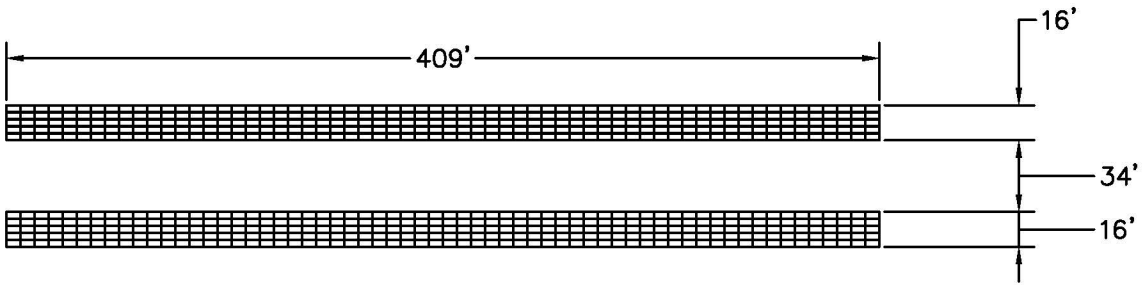
FIGURE 6.31

Sevier Playa Potash Project

Typical Single Pole Support Structure for 12.47-kV and 25-kV Power Line

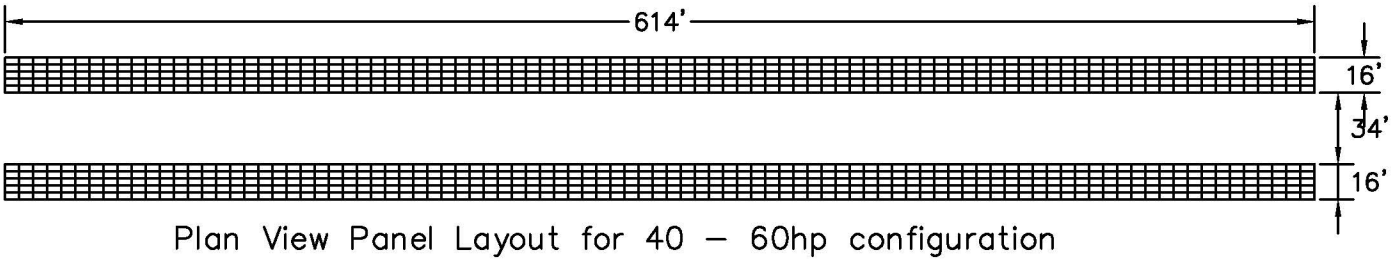
DATE: 09/20/2017 | SCALE: NTS | FILE: Figure 6.31 Typical Single Pole Power Line

NORWEST CORPORATION



Plan View Panel Layout for 20hp configuration

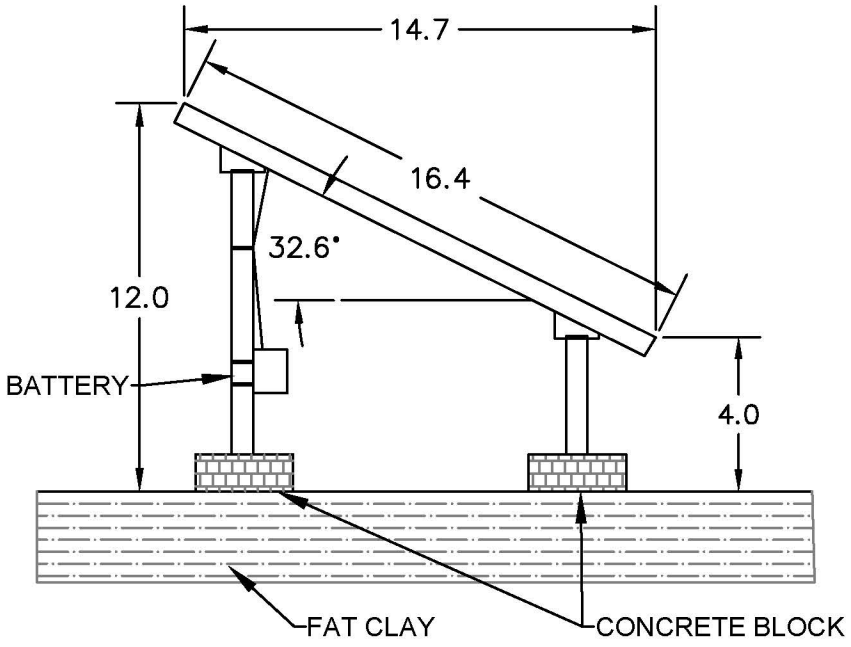
2 structures 34' apart–5 rows of 62 columns



Plan View Panel Layout for 40 – 60hp configuration

2 structures 34' apart–5 rows of 93 columns

PLAN VIEW



CROSS–SECTION VIEW

CRYSTAL PEAK MINERALS INC.

NO.	DATE	REVISION	BY	APVD
0	1–5–18	INITIAL SUBMITTAL	JB	AB

DSGN	DR	CHK	APVD
JB	JB	AB	AB

FIGURE 6-32

Sevier Playa Potash Project

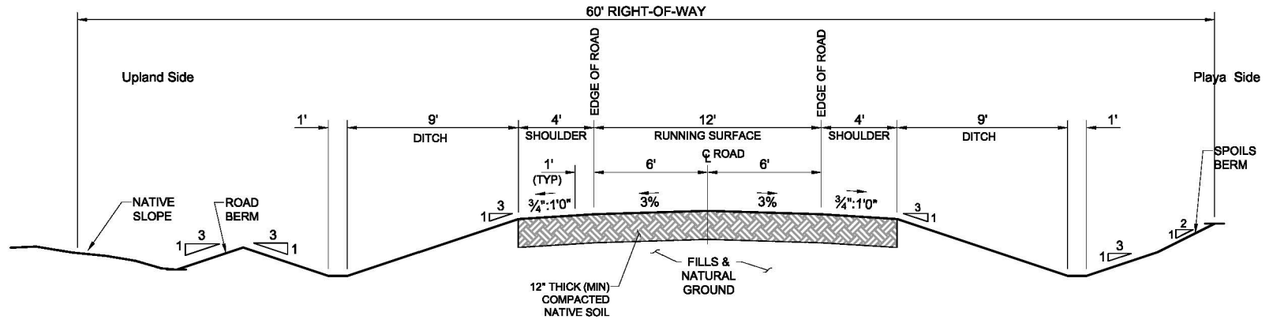
Brine Transfer and Recharge Canal

Pump Solar Panel Typical Layouts

DATE: 12/15/2017 SCALE: NTS

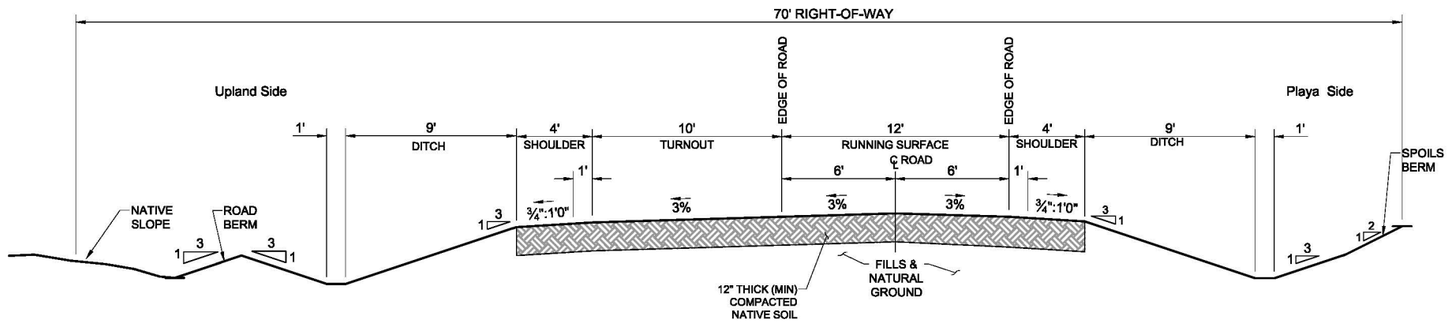
FILE: Figure 6-23 Typical Solar Panel Layout

NORWEST CORPORATION



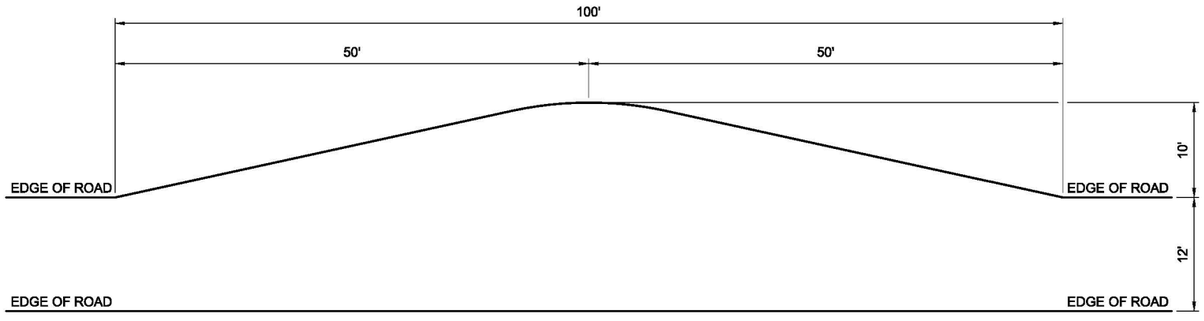
TYPICAL PERIMETER ROAD SECTION

SCALE: 1/8" = 1'0"



TYPICAL PERIMETER ROAD SECTION W/ TURNOUT

SCALE: 1/8" = 1'0"



TYPICAL TURNOUT - PLAN VIEW

SCALE: 1/16" = 1'0"

CRYSTAL PEAK MINERALS INC.

8 0 8 16

1"=8'

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-33

Sevier Playa Potash Project

Perimeter Road

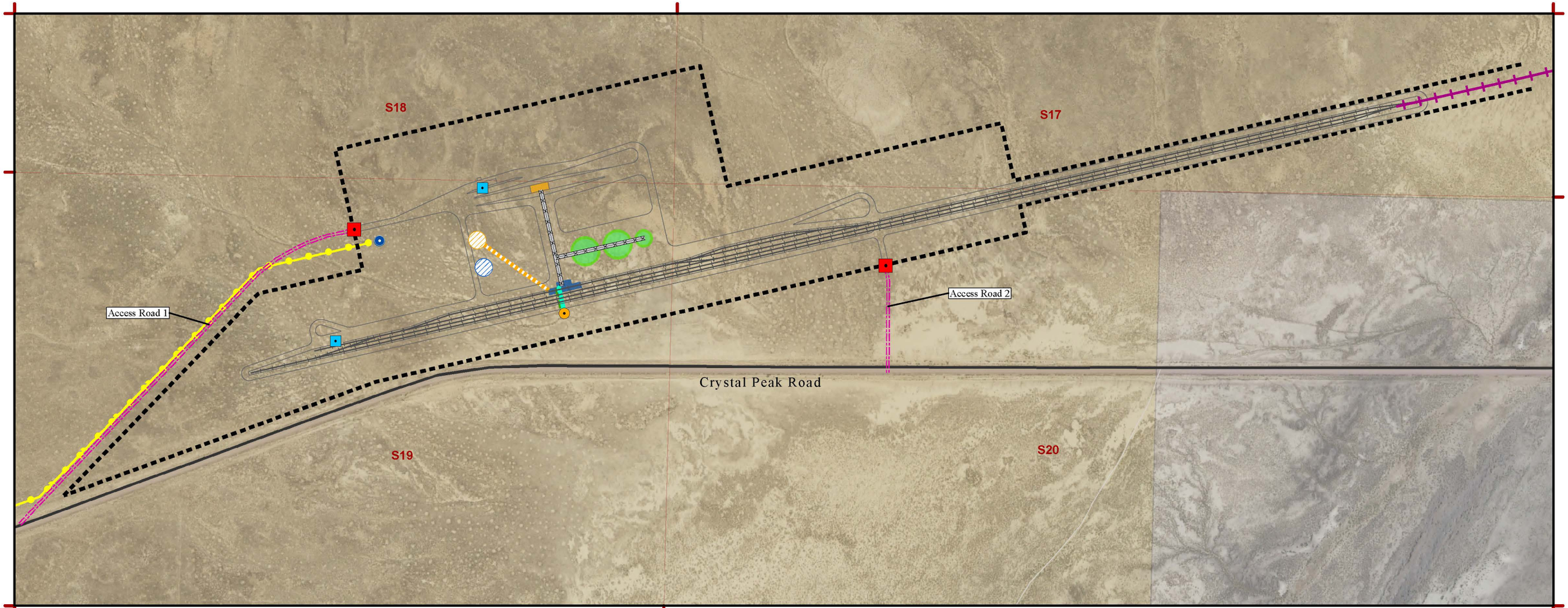
Typical Sections & Turnouts

DATE: 09/22/2017

FILE: Figure 6-32 Perimeter Road Typical Sections RevC

SCALE: As Shown

NORWEST CORPORATION



Proposed Project Features

- Rail Spur
- Rail Car Staging Tracks
- Substation
- 12.47-kV Power and Communication Line
- Rail Loadout Facility Access Road
- Rail Loadout Facility Access Road Gate
- Truck Loadout
- Train Loadout
- Storage Dome
- Conveyor Belt
- Rail Loadout Facility Boundary Fence and Gravel Yard
- Natural Gas Spur Valve
- Propane Storage Tank
- Propane Pipeline
- Refueling Station
- Water Storage Tank
- Natural Gas Pipeline Spur
- Natural Gas Pipeline

General Reference

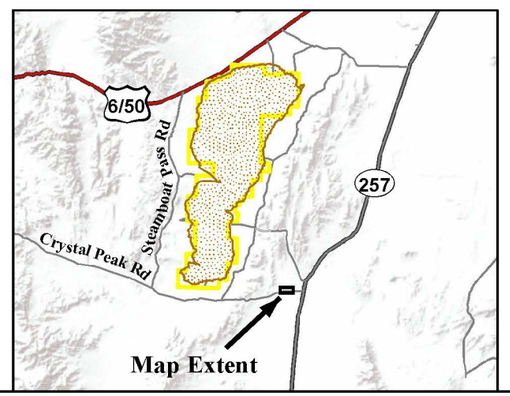
Land Ownership

- BLM
- Private
- Class B Road

N

0 250 500 1,000 Feet

1 inch = 533 feet



Note:
• The rail facility and utility siting areas shown on this map are draft and may be revised and/or refined throughout the development of t he project.

MP Fig 6-34 Rail Loadout Detail 180530 5/31/2018 12:35:05 PM

NO.	DATE	REVISION	BY	APVD
1	1/5/2018	Revised based on comments		
0	10/25/2017	Initial Submission		

DSGN	DR	CHK	APVD

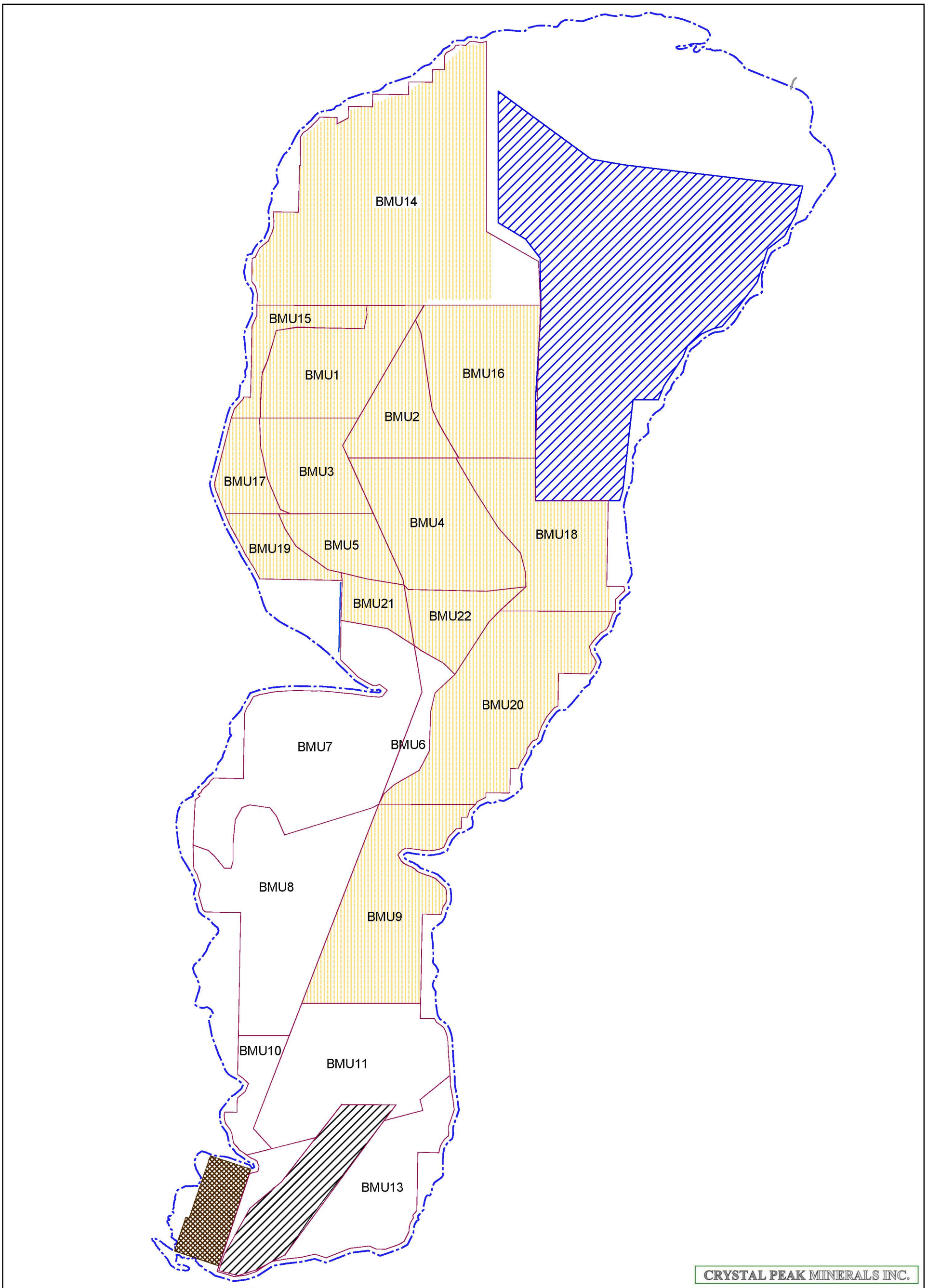
FIGURE 6-34

Sevier Playa Potash Project
Rail Loadout
Facility Overview

MINING PLAN

DATE: 5/31/2018 SCALE: 1:6,400

CRYSTAL PEAK MINERALS INC.



CRYSTAL PEAK MINERALS INC.

LEGEND

- Production Ponds
- Preconcentration Ponds
- Waste Product Storage Area
- BMU Boundary
- Sevier Playa Boundary

BMU CONSTRUCTION TIMING

- Year 1 - 4

N

10,000 0 10,000 20,000

1"=10,000'

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

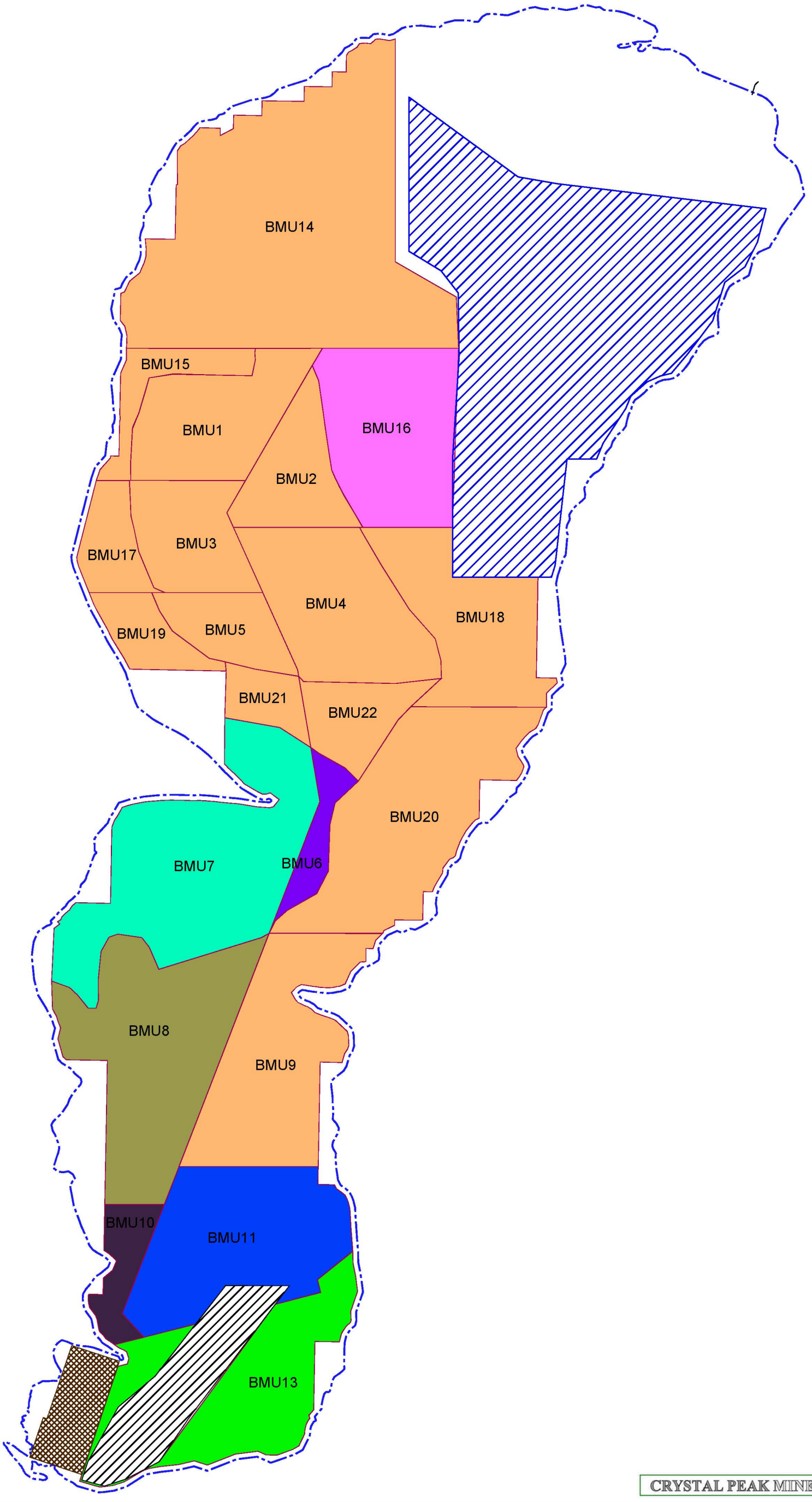
FIGURE 6-35

Sevier Playa Potash Project
Initial BMU
Construction Excavation

DATE: 09/14/2017
FILE: Figure 6-33 M117 Initial Build Out_Trenches

SCALE: As Shown

NORWEST CORPORATION



CRYSTAL PEAK MINERALS INC.

LEGEND

- Production Ponds
- Preconcentration Ponds
- Waste Product Storage Area
- BMU Boundary
- Sevier Playa Boundary

BMU CONSTRUCTION TIMING

- Year 1 to 4
- Year 4 to 5
- Year 5 to 7
- Year 8 to 9
- Year 9 to 11
- Year 14 to 16
- Year 21 to 23
- Year 23 to 25

N

10,000 0 10,000 20,000

1"=10,000'

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

DATE: 09/25/2017

FILE: Figure 6-34 Timing & Sequence Map Trenches_M117

SCALE: As Shown

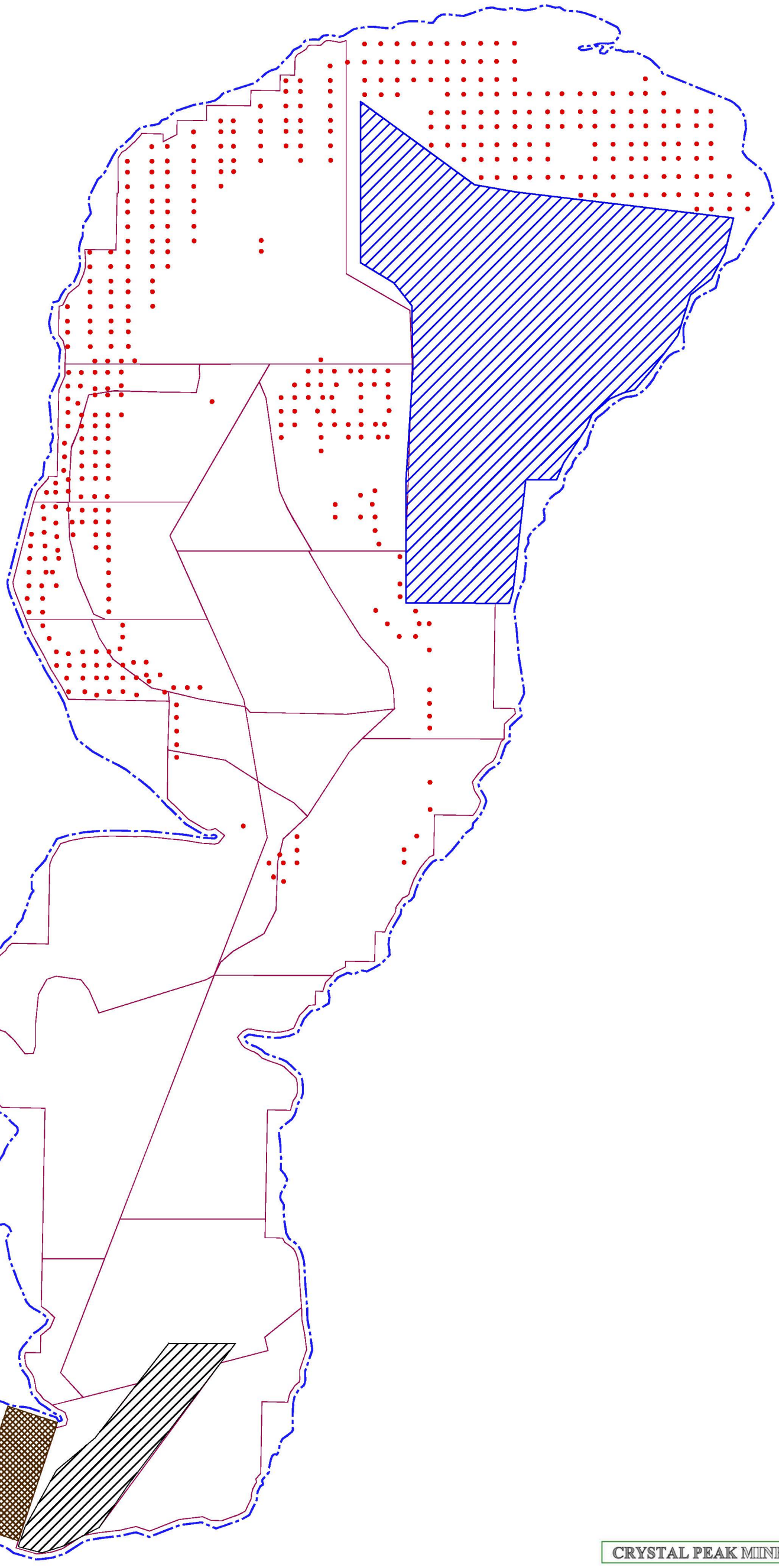
NORWEST CORPORATION

FIGURE 6-36

Sevier Playa Potash Project

Construction Timing

BMU



LEGEND

- Production Ponds
- Preconcentration Ponds
- Waste Product Storage Area
- BMU Boundary
- Sevier Playa Boundary

WELLS PRODUCTION TIMING

- Year 8 & 9

N

10,000 0 10,000 20,000

1"=10,000'

CRYSTAL PEAK MINERALS INC.

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

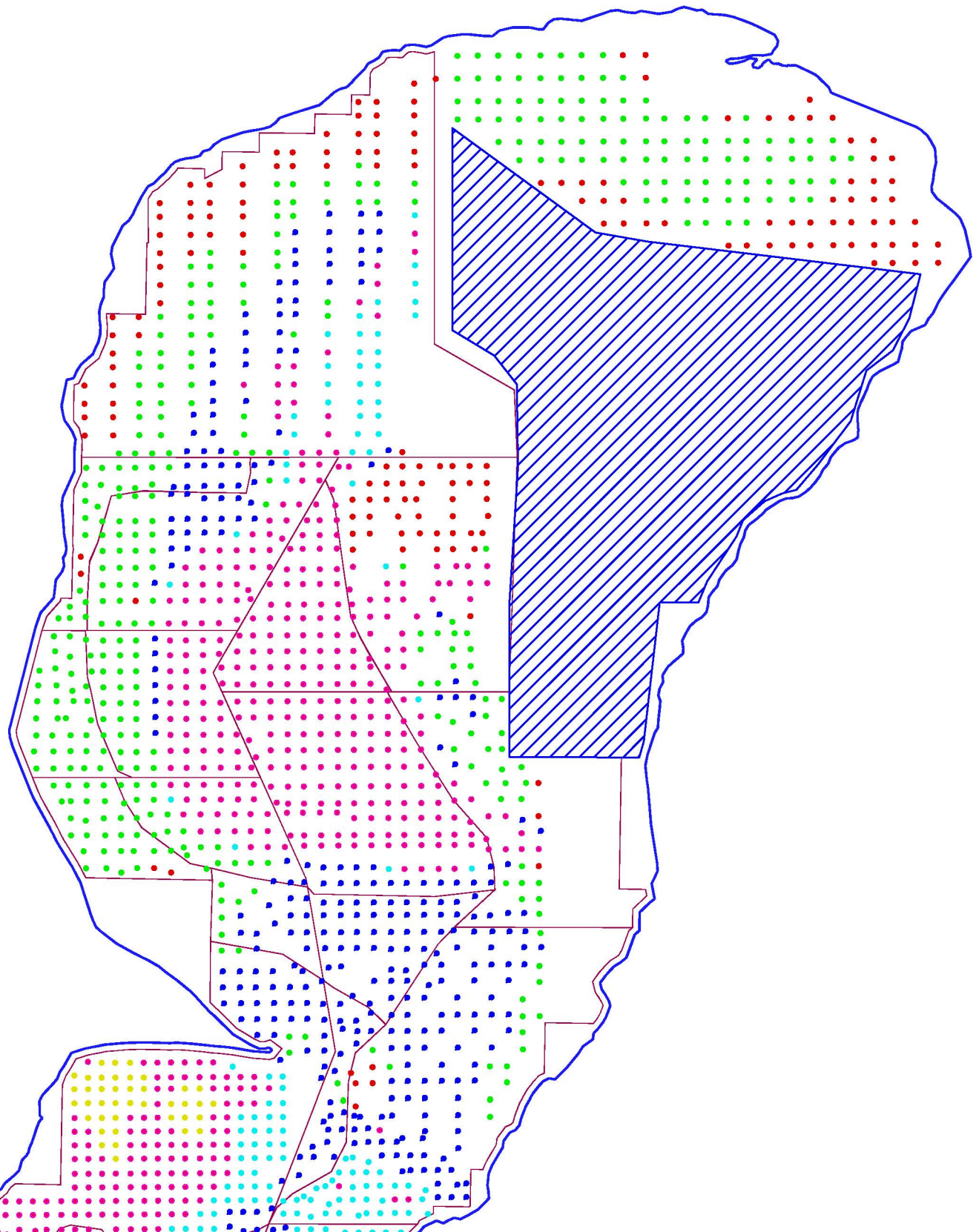
FIGURE 6-37

Sevier Playa Potash Project
Initial Extraction Wells Production

DATE: 09/14/2017
5: Figure 6-35 Initial Wells Build Out Years 3-4

SCALE: As Shown

NORWEST CORPORATION



CRYSTAL PEAK MINERALS INC.

LEGEND

- Production Ponds
- Preconcentration Ponds
- Waste Product Storage Area
- BMU Boundary
- Sevier Playa Boundary

WELLS PRODUCTION TIMING

- Year 5 & 6
- Year 9 & 10
- Year 11 & 12
- Year 13 & 14
- Year 17 & 18
- Year 19 & 20

N

10,000 0 10,000 20,000

1"=10,000'

NO.	DATE	REVISION	BY	APVD
1	1-5-18	MADE REQUESTED CHANGES	GWH	AB
0	10-25-17	INITIAL SUBMITTAL	GWH	AB

DSGN	DR	CHK	APVD
GWH	GWH	AB	AB

FIGURE 6-38

Sevier Playa Potash Project

Extraction Wells Production

DATE: 10/17/2017

FILE: Figure 6-36 Timing & Sequence Map Wells_M117

SCALE: As Shown

NORWEST CORPORATION

Appendix A
As-Built Drawings

(Place Holder – Drawings would be provided after construction)

Appendix B
Confidential Technical References

List of Documents

CH2M. 2012. *CONFIDENTIAL - Results of Clean Water Test Hole.* Memorandum to Rick Dye, Crystal Peak Minerals. Salt Lake City, Utah. July 3.

———. 2013a. *CONFIDENTIAL - Preliminary Draft - Sevier Playa Basin Conceptual Model Report.* December.

———. 2013b. *CONFIDENTIAL - Preliminary Feasibility Study of the Sevier Lake Playa Sulphate of Potash Project*. NI 43-101 Technical Report, Millard County, Utah. November 18.

———. 2013d. *CONFIDENTIAL - Documentation of a Probabilistic Reservoir Model for the Sevier Playa Project.* Technical Memorandum. October 10.

———. 2016a. *CONFIDENTIAL - Sevier Playa SOP Feasibility Study, Re: CPM Sevier Playa SOP FS – Site Conditions*. Technical Memorandum. December 15.

———. 2016b. *CONFIDENTIAL - Crystal Peak Minerals Freshwater Production Well Effects Analysis.* Memorandum to Mike Gates, Clara Stevens, Paul Summers, Tom Gibbons, Todd Leeds, and Cindy Ledbetter, Bureau of Land Management. Salt Lake City, Utah. December 22.

———. 2017a. *CONFIDENTIAL - Draft Engineering Design Report E2 Sever River Diversion Canal and Structures.* July.

———. 2017b. *CONFIDENTIAL - Sevier Playa Potash Project Feasibility Study – Water Balance Model Report*. Prepared for Crystal Peak Minerals Inc. August 2017.

Crystal Peak Minerals Inc. (CPM). 2018g. *CONFIDENTIAL* - CPM SPP Project – Groundwater Model. Technical Memorandum. Salt Lake City, Utah: Crystal Peak Minerals Inc. January 2018.

DSB International. 2013. *CONFIDENTIAL* - Solar Pond Balance Rev3-2013.xls. Excel spreadsheet.

Novopro Projects Inc. 2016. *CONFIDENTIAL - Flotation Reagents Screening & Performance Testing Campaign – Summary of Results*. November 25.

SWCA. 2017a. *CONFIDENTIAL - Response to BLM Questions Regarding Sevier Playa Potash Project Sevier River Water Delivery.* September 15, 2017. Memorandum to Clara Stevens, Bureau of Land Management. Salt Lake City, Utah.

Appendix C
Publicly Available Technical References

List of Documents

Avian Power Line Interaction Committee (APLIC). 2006. *Suggested Practices for Avian Protection On Power Lines: The State of the Art in 2006.* Available at: http://www.aplic.org/uploads/files/2643/SuggestedPractices2006%28LR-2%29.pdf. Accessed January 24, 2017.

Alkar. 2015. *Thermal Processing*. Available at: http://middprocessing.com/alkar.html.

Baxter, J. 2010. *Class I Inventory for the Sevier Lake Competitive Potash Leasing Project, Millard County, Utah*. Report Number 10-19. Orem, Utah: Bighorn Archaeological Consultants, LLC.

Beck, K. 2013. *An Overview of Known Cultural Resources Along Proposed Utility Corridors and Facilities for the Sevier Playa Project in Millard County, Utah*. Salt Lake City, Utah: SWCA Environmental Consultants.

Case, R. W., and K. L. Cook. 1979. A Gravity Survey of the Sevier Lake Area, Millard County, Utah. *Utah Geology* 6(1):55–76.

Carlton, S. M. 1985. Fish Springs multi-basin flow system. Unpublished M.S. thesis, Mackay School of Mines, University of Nevada, Reno.

———. 2013c. *Soil Assessment for the Sevier Playa Project.* October.

———. 2014. *General and Special-Status Wildlife and Plant Species Survey Report for the Sevier Playa Project*. September.

Coastal Engineering Research Center. 1984. *Shore Protection Manual*. Available at: https://ia802604.us.archive.org/34/items/shoreprotectionm01unit/shoreprotectionm01unit.pdf

Crystal Peak Minerals Inc. (CPM). 2018a. *NI 43-101 Technical Report – Sevier Playa Sulfate of Potash Project*. Salt Lake City, Utah: Crystal Peak Minerals Inc. February 21.

———. 2018b. *Stormwater Pollution Prevention Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018c. *Reclamation Plan.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018d. Groundwater Discharge Permit Application. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018e. *DRAFT Plan of Development for Off-Lease Facilities for the Sevier Playa Potash Project.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018f. *Fugitive Dust Control Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018h. *Noxious Weed Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018i. *Gravel Pits Mining Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018j. *Environmental Compliance and Inspection Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018k. *Adaptive Wildlife Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018l. *Spill Prevention, Control, and Countermeasures Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018m. *Solid and Hazardous Waste Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018n. *Transportation and Traffic Management Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018o. *Blasting Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018p. *Cultural Resources Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018q. *Site Safety Plan*. Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018r. *Water Monitoring Plan.* Salt Lake City, Utah: Crystal Peak Minerals Inc. (*In Process*).

———. 2018s. *Fresh Water Baseline Study.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

———. 2018t. *Combined Sampling and Analysis Plan and Quality Assurance Project Plan for the Sevier Playa Project.* Salt Lake City, Utah: Crystal Peak Minerals Inc.

Fortier, S., and F. C. Scobey. 1926. Permissible Canal Velocities. *Transactions of the American Society of Civil Engineers*, 89:940–956, Paper No. 1588.

Gilbert, G. K. 1890. Lake Bonneville. U.S. Geological Survey. Washington – Government Printing Office.

Gwynn, J. W. 2006. *History and Mineral Resources Characterization of Sevier Lake, Millard County, Utah*. Miscellaneous Publication 06-6. Utah Geological Survey.

Harrill, J. R., and D. E. Prudic. 1998. *Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States – Summary Report.* Prepared for U.S. Geological Survey. Professional Paper 1409-A. Washington, D.C.

Heilweil, V. M., and L. E. Brooks. 2011. *Conceptual Model of the Great Basin Carbonate and Alluvial Aquifer System.* Prepared for U.S. Geological Survey. Scientific Investigations Report 2010-5193. Washington, D.C.

Intermountain GeoEnvironmental Services, Inc. (IGES). 2013. *CONFIDENTIAL - SDRI Summary Report*. July 18.

Lane, E. W. 1955. The Importance of Fluvial Morphology in Hydraulic Engineering. *Proceedings of American Society of Civil Engineers* 81(745):1–17.

Lenntech. 2017. Water Analysis Accuracy Tester. Available at: https://www.lenntech.com/calculators/accuracy/accuracy-water-analysis.htm.

March Consulting Associates Inc. 2012. *Preliminary Economic Assessment, Sevier Dry Lake, Utah, United States*. Technical Report NI 43-101. Prepared for EPM Mining Ventures Inc. Saskatoon, Saskatchewan: March Consulting Associates Inc., in cooperation with Norwest Corporation.

Millard County. 2013. *Millard County General Plan*. Available at: https://www.millardcounty.org/wp-content/uploads/departments/planning-zoning/general-plan/GENERAL-PLAN.pdf.

Natural Resources Conservation Service (NRCS). 2013 *Soil Survey of West Millard/Juab Area, Utah – Parts of Millard and Juab Counties* (Unpublished). Access via telephone and email communication with Mr. Burke Davenport, Natural Resources Conservation Service, Fillmore, Utah. July 22, 2013.

———. 2018. Web Soil Survey. Available at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. January 11, 2018.

Oregon State University. 2012. *Parameter-elevation Regressions on Independent Slopes Model* (PRISM). Available at: http://www.prism.oregonstate.edu/index.phtml.

Rasmussen, J. D. 1997. *Geology and Evaporite Mineral Resources, Sevier Lake Project, Millard County, Utah*. Prepared for Salada Minerals LLC. Salt Lake City, Utah.

Soil Conservation Service (SCS). 1970. *Soil Survey of the Beaver-Cove Fort Area, Utah – Part of Beaver and Millard Counties*.

———. 1971. *Soil Survey of Delta Area, Utah – Part of Millard County*.

SWCA Environmental Consultants (SWCA). 2016. *Wetland and Riparian Baseline Inventory for the Sevier Playa Potash Project.* Prepared for Crystal Peak Minerals Inc.

———. 2017b. Sevier Playa Waterbird Use and Habitat Evaluation Study. Prepared for Crystal Peak Minerals Inc. (*In Process*).

U.S. Army Corps of Engineers (USACE). 2003. *Slope Stability – Engineer Manual*. Available at: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1902.pdf.

———. 2013. Approved Jurisdictional Determination for the Peak Minerals, Sevier Lake Project. SPK-2013-00295. Bountiful, Utah: Utah Regulatory Office.

———. 2018. Approved Jurisdictional Determination for the Peak Minerals, Sevier Lake Project. April 25, 2018. SPK-2013-00295. Bountiful, Utah: Utah Regulatory Office.

U.S. Bureau of Land Management (BLM). 1987. *Warm Springs Resource Area, The Resource Management Plan, Record of Decision Rangeland Program Summary*. U.S. Department of the Interior, U.S. Bureau of Land Management, Richfield District Office. April.

———. 2011a. *Sevier Lake Competitive Potash Leasing Proposal, Millard County, Utah, Environmental Assessment DOI-BLM-UT-W020-2010-014-EA*. U.S. Department of the Interior, U.S. Bureau of Land Management, Fillmore Field Office. February.

———. 2011b. *Sevier Dry Lake Exploratory Testing, Millard County, Utah, Environmental Assessment DOI-BLM-UT-W020-2011-0015-EA*. U.S. Department of the Interior, U.S. Bureau of Land Management, Fillmore Field Office. October.

———. 2011c. Peak's Potassium Lease, UTU-88387

U.S. Environmental Protection Agency (EPA). 2005. Appendix W of 40 CFR Part 51—Guideline on Air Quality Models (Revised), Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. November.

U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. 2010. *Federal Land Managers' Air Quality Related Values Work Group (FLAG).* Phase I Report—Revised (2010). Natural Resource Report NPS/NRPC/NRR—2010/232. Denver, Colorado: National Park Service.

U.S. Geological Survey (USGS). 2014. Fetch- and Depth-Limited Wave Calculations. https://woodshole.er.usgs.gov/staffpages/csherwood/sedx_equations/ RunSPMWave.html. November 24.

Utah Automated Geographic Reference Center. 2012. Ten-meter-grid resolution DEM data. Available at: https://gis.utah.gov/#data. Accessed 2012.

Utah Division of Air Quality (UDAQ). 2013. *Emissions Impact Assessment Guidelines*. Available at: http://www.deq.utah.gov/Permits/air/docs/2013/03Mar/EmissionsImpactAssessmentGuideline.pdf.

Utah Division of Wildlife Resources (UDWR). 2013. Utah Conservation Data Center. Database search for the Sevier Project including a 1-mile buffer around the gas lines and a 0.5-mile buffer around other Project components. Available at: http://dwrcdc.nr.utah.gov/ucdc.

Western Regional Climate Center. 2013. Average annual precipitation of Milford and Delta, Utah. Available at: http://www.wrcc.dri.edu/.

Whetstone Associates, Inc. 2017. *Draft Baseline Water Resources Technical Report for the Sevier Playa Potash Project.* October.

Appendix D
Royalty Allocation and Unit Agreement

(Place Holder – Agreement will be provided in Final Mining Plan)

Appendix E Best Management Practices and Mitigation Recommendations for Minimizing Resources Impacts of the Proposed Project

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
General					
1	CPM would avoid or minimize degradation of land, water quality, landscape, and biological resources. During construction, operation, maintenance, and decommissioning of the Project, CPM would perform its activities in accordance and compliance with applicable air and water quality standards, related facility siting standards, and related permits associated with implementation, including but not limited to: NEPA; the Clean Air Act (CAA); Endangered Species Act (ESA); state and federal historic preservation acts; and other established federal, state, and local regulations as required by law.	✓	✓	✓	✓
2	CPM would conduct kickoff meetings prior to commencing construction and surface-disturbing activities for the Project. The contractors and agents involved with construction, other surface-disturbing activities, and monitoring would attend this meeting to review the construction stipulations, including those in the Record of Decision (ROD), Mining Plan, leases, Plan of Development (POD), right-of-way (ROW) grants, and mineral material sales contracts.		✓	✓	✓
3	All personnel would be instructed on the protection of cultural, paleontological, and ecological resources before starting work on the Project. Training materials and briefings would include, but would not be limited to, discussion of the federal ESA, the consequences of non-compliance with this act, identification and values of wildlife and natural plant communities, general behavior and sensitivity to human activities, penalties for violation of state and federal laws (including the Migratory Bird Treaty Act [MBTA] and Bald and Golden Eagle Protection Act), hazardous substance spill prevention and containment measures, all required and recommended mitigation measures, and reporting requirements.		✓	✓	✓
4	The construction contractors would maintain copies of the ROD, Mining Plan, POD, and ROW grants, along with BMPs, site-specific mitigation measures, and ROW grant terms and conditions on the construction site at all times.		✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
5	CPM would survey and clearly mark the centerline and exterior limits of the ROWs, at 200-foot intervals or as determined by the Authorized Officer (AO). No surface disturbance or construction activity would be allowed within buffers around culturally and environmentally sensitive areas, which would be clearly marked as specified by the AO. Any deviation from this requirement would have the prior written approval of the AO. CPM would set centerline stakes to identify the locations of the linear routes as directed by the AO. Markers would be used to limit access within work and travel areas to restrict construction access from unnecessarily affecting important culturally and environmentally sensitive areas. Buffers for culturally sensitive areas are defined in the Programmatic Agreement (PA) (see Measure #23). Buffers for environmentally sensitive areas are defined in other measures (for example, Measure #98 for raptors and Measure #103 for migratory birds).		✓*	✓*	✓*
6	If disturbance must occur outside of the flagged areas, a BLM-approved biologist would survey the area prior to disturbance. If wildlife species are found within the area to be disturbed, the AO would be notified immediately. Prior to disturbance, an appropriate course of action would be taken to ensure proper protection of the species.		✓*	✓*	✓*
7	Clearing, grading, and other surface disturbance would be limited to the minimum area required for construction. New disturbance would be limited to that which is necessary for safe and efficient construction, operation, and decommissioning of the Project. Clearing or grading equipment paths and other overland access routes would be limited to the extent necessary to allow for safe and effective vehicle passage. In most areas, clearing or grading of the site would be substantially less than the temporary work area limits to reduce potential effects to existing resources.		✓*	✓*	✓*
8	CPM would construct, operate, maintain, and decommission Project facilities, improvements, and structures in strict conformity with the ROD, Mining Plan, leases, POD, ROW grants, and mineral material sales contracts. Any relocation, additional construction, or use that is not in accord with the ROD, Mining Plan, leases, POD, ROW grants, or terms and stipulations of mineral material sales would not be initiated without the prior written approval of the AO.		✓	✓	✓
9	All design, material, construction, operation, maintenance, and decommissioning activities would be in accordance with safe and proven engineering practices.	✓	✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
10	All work would be performed in compliance with Mine Safety and Health Administration (MSHA) or Occupational Safety and Health Administration (OSHA) regulations, as appropriate. Project personnel would be instructed in health and safety procedures and would participate in regular safety meetings during construction and operation. Adaptive management would be used to continuously monitor the safety of workers and the public during construction and operation of the Project with a goal of zero injuries or accidents.		✓	✓	✓
11	CPM would develop and implement a Site Safety Plan for construction, operation, maintenance, and decommissioning of the Project. The Site Safety Plan would include, at a minimum, sections on site safety, emergency response, and fire safety. CPM and its contractors would be responsible for implementing the Site Safety Plan, including compliance with applicable MSHA or OSHA standards.	✓	✓	✓	✓
12	Adaptive management would be used to respond to local, recreational, OHV travel, hunting, and other public uses of BLM-administered lands to assure that multiple uses are continued without hazard to the health or safety of either the public or Project operators and workers.		✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
13	Winter Construction Snow would be removed where necessary to provide access to roads, work sites, and to expose soils for backfilling and grading. Snow would typically be bladed or pushed off the roads and work area (but within the ROW, lease area, or gravel pit) with a motor grader, snowplow, or dozer. Care would be taken when removing snow to minimize mixing of soil with snow. If snow removal is required in off-road areas, backfilling and grading in muddy or frozen areas would be postponed until the soil is dry enough to result in good seedbed preparation, unless approved in advance by the AO. Tracked equipment used for snow removal operations in off-road areas, if required, would be equipped with shoes to keep the blade 2 inches off the ground. Special precautions would be taken where the surface of the ground is uneven and at drainage crossing to ensure equipment blades do not destroy vegetation. In areas where snow fills trenches or holes, CPM or its contractors would be responsible for removing it to allow visual inspection of the trench or holes prior to installing Project facilities and backfilling. CPM and its contractors would backfill trenches with unfrozen soils to minimize the potential for ditch line settlement resulting from voids between frozen chunks of backfill. As directed by the AO, roads would be winterized by providing a well-drained roadway. This may be achieved by water barring, maintaining drainage, and other measures necessary to minimize erosion and other damage to the roadway or the surrounding public lands.		✓*	✓*	✓*

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
14	Speed limits for Project traffic would be set at a maximum of 30 mph on-road and 15 mph off-road to reduce the generation of fugitive dust and minimize the risk for collisions between Project traffic and livestock or wildlife. This measure would apply on all unpaved roads authorized for use by Project traffic, including unpaved Millard County Class B roads. This measure would not apply on paved roads, where Project traffic would follow posted speed limits. The Adaptive Wildlife Management Plan (Measure #95) would include monitoring and adaptive measures to adjust speed limits to changes in road conditions or use, or for corrective actions (for example, fencing, or signage) in the event that Project traffic causes an unacceptable increase in collisions between Project vehicles and wildlife or livestock. In the event that vehicle traffic causes visible dust emissions, equipment operators would be instructed to reduce speed to a level that does not cause excessive dust in accordance with the Fugitive Dust Control Plan (Measure #16).		✓	✓	✓
Air Quality					
15	CPM would meet all applicable federal, state, and local emission standards for air quality.	✓	✓	✓	✓
16	CPM would develop and implement a Fugitive Dust Control Plan, to be approved by BLM, to minimize Project effects from fugitive dust.	✓	✓	✓	✓
17	Dust control would be provided throughout construction, operation, maintenance, and decommissioning to protect soils from erosion and minimize fugitive dust from Project activities. Dust control methods would be specified in the Fugitive Dust Control Plan and would be approved by the BLM prior to their implementation.		✓	✓	✓
18	Trucks hauling the finished product from the Processing Facility to the Rail Loadout Facility would minimize dust emissions by limiting vehicle speed or using dust control methods specified in the Fugitive Dust Control Plan.			✓	
19	Earthen and other materials, which may become airborne, would be promptly removed from paved roads or handled as described in the Fugitive Dust Control Plan.		✓	✓	✓
20	No burning of debris, garbage, or other materials would be allowed.		✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
21	Dust emissions caused by truck loading and unloading would be minimized, as described in the Fugitive Dust Control Plan. The drop distance at material transfer points would be minimized to reduce dust generation as described in the Fugitive Dust Control Plan.			✓	
22	Tailpipe emissions from diesel-powered equipment would be minimized through use of engines meeting Tier 2 standards or better.		✓	✓	✓
Cultural Resources					
23	Section 106 requirements would be determined through a Programmatic Agreement (PA), as described in 36 CFR 800.14.b.	✓			
24	Clearance surveys for cultural resources would be conducted prior to the start of construction. Prior to the initiation of any pre-construction surveys, the necessary permits for federal and state land and rights-of-entry to privately owned land would be obtained. Mitigation measures could include avoidance of specific areas during construction, or modification of facility locations to avoid or minimize effects.	✓	✓	✓	✓
25	If National Register of Historic Places (NRHP)-eligible cultural resources sites are identified during pre-construction surveys, they would be avoided through design and layout selection, or effects to the sites would be minimized or mitigated through data recovery or other appropriate efforts, as identified in the Cultural Resource Management Plan. CPM would adjust workspace boundaries, if necessary, to achieve this goal.	✓	✓	✓	✓
26	The protocol for discoveries covered under the Native American Graves Protection and Repatriation Act (NAGPRA) would be determined during development and implementation of the PA.	✓	✓	✓	✓
27	Where required by the BLM through the Section 106 process, ground-disturbing activities would be monitored by a qualified, professional archaeologist. If any archaeological evidence is discovered, the archaeological monitor would report the discovery to the Compliance Inspection Contractor (CIC) and follow protocols determined through the PA.		✓	✓	✓
28	NRHP-eligible sites, if any are identified, would be protected with a 100-foot buffer. The buffer area would be staked and flagged by a qualified archaeologist as a location outside of the work area.		✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
29	Cultural resources (historic or prehistoric site or object) discovered by CPM, or any person working on their behalf, would be immediately reported to the AO. All operations would be suspended within 300 feet of such discovery until written authorization to proceed is issued by the AO. After initial investigation by an archaeologist, the buffer may be reduced to 100 feet. Discoveries would be handled as determined in the PA.		✓	✓	✓
Fire Management					
30	CPM would develop and implement a Site Safety Plan, which includes measures for prevention and suppression of fire. Project personnel would be instructed regarding individual responsibility in implementation of the plan.	✓	✓	✓	✓
31	CPM and its contractors would notify the BLM of any fires and comply with all rules and regulations administered by the BLM concerning the use, prevention, and suppression of fires on federal lands, including any fire prevention orders that may be in effect at the time of the permitted activity. CPM or its contractors may be held liable for the cost of fire suppression, stabilization, and rehabilitation if they are the cause of the fire. In the event of a fire, personal safety would be the first priority of CPM and its contractors		✓	✓	✓
32	CPM and its contractors would operate all internal and external combustion engines (for example, off-highway vehicles, chainsaws, generators, and heavy equipment) with a qualified spark arrester. Qualified spark arresters would be maintained and not modified, and meet the Society of Automotive Engineers Recommended Practices J335 or J350. Refer to 43 CFR §8343.1.		✓	✓	✓
33	CPM and its contractors would maintain and clean all equipment regularly to remove flammable debris buildup and prevent fluid leaks that can lead to ignitions.		✓	✓	✓
34	CPM and its contractors would carry at least one shovel, water, and a fire extinguisher rated at a minimum of ABC - 10 pound on each piece of equipment and each vehicle.		✓*	✓*	✓*

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
35	When welding, grinding, cutting or conducting other similar, spark-producing work outside of an enclosed building, choose an area large enough to contain the sparks that is naturally free of all flammable vegetation or remove the flammable vegetation in a manner compliant with the permitted activity. If adequate clearance cannot be made, wet an area large enough to contain all sparks prior to the activity and periodically throughout the activity to reduce the risk of wildfire ignition. Regardless of clearance, maintain readiness to respond to an ignition at all times. In addition, keep one shovel per person and at least one fire extinguisher ready, minimum, as specified above (Measure #34) during this activity.		✓	✓	✓
36	CPM and its contractors would keep apprised of current and forecasted weather and fire conditions at http://www.wrh.noaa.gov/firewx/?wfo=slc and take additional fire precautions when fire danger is rated High or greater. Red Flag Warnings for high winds and low humidity are issued by the National Weather Service when fire conditions are most dangerous and ignitions escape control quickly. Extra precautions would be required during these warnings such as additional water, patrols, and tools. When fire danger is rated Extreme and a Red Flag Warning is forecasted, all off-playa activities, including any road improvements, would be shut down. All on-playa activities, activities that take place within the graveled areas at the Processing and Rail Loadout Facilities, and travel on established and regularly-maintained access roads would be exempt from this shutdown. Any exceptions must be approved in advance by the AO.		✓*	✓*	✓*
37	CPM and its contractors would initiate fire suppression actions in the work area to prevent fire spread to or on federally administered lands. If a fire spreads beyond the capability of workers with the stipulated tools, all would cease fire suppression action and leave the area immediately via pre-identified escape routes.		✓	✓	✓
38	CPM and its contractors would call **911** or the **Richfield Interagency Fire Center at 435-896-8404** immediately with the location and status of any fire **AND** notify the **BLM Fillmore Field Office at 435-743-3100** immediately to report the incident.		✓	✓	✓
Geology					
39	Project facilities would be designed, constructed, maintained, and reclaimed to avoid or minimize the potential for land subsidence and landslides.	✓	✓	✓	✓
Hazardous Materials and Solid Wastes					

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
40	CPM would develop and implement a Solid and Hazardous Waste and Hazardous Materials Management Plan, to be approved by the BLM, which would include measures that address the transportation, storage, use, and disposal of hazardous materials used during Project construction, operation, maintenance, and decommissioning. This plan would also address non-hazardous and non-petroleum wastes generated by construction, operation, maintenance, and decommissioning of the Project.	✓	✓	✓	✓
41	CPM would develop a Spill Prevention, Control, and Countermeasures (SPCC) Plan, to be approved by the BLM. The SPCC Plan would be implemented to ensure protection of surface and ground water resources, prevent spills of petroleum products, and identify response procedures. Specific measures would prohibit vehicle refueling or maintenance areas within 100 feet from any stream bank or wetland, canal, or other drainage feature outside of the Sevier Playa. Contaminated soil from accidental spills would be cleaned up immediately as required by regulation.	✓	✓	✓	✓
42	Hazardous materials usage, storage, and disposal would comply with applicable local, state, and federal environmental laws and regulations.		✓	✓	✓
43	Hazardous materials would be stored in a manner that provides secondary containment. Where space allows, transfer of hazardous materials would also occur within secondary containment. Personnel would be trained in the proper handling, use, storage, and cleanup of hazardous chemicals used for the Project.		✓	✓	✓
44	Hazardous materials spill mitigation, cleanup, and disposal procedures would be in place, including EPA spill notification quantities and contact information.		✓	✓	✓
45	Routine maintenance of vehicles and equipment would be restricted to locations authorized for such use by the BLM. Only emergency repairs of vehicles and equipment would take place away from authorized locations. Disabled/inoperative vehicles or equipment would typically be trucked or towed to authorized locations for repair.		✓	✓	✓
46	It would be necessary and practical for heavy equipment left on the site during construction, operation, maintenance, or decommissioning to be refueled in place. CPM and its contractors would implement standard refueling procedures, including spill prevention practices. Each fueling station would be equipped with a spill kit and would be operated consistent with SPCC requirements.		✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
47	Fuel trucks would be equipped with automatic shut-off valves and would carry spill kits, and spill protection measures would be in place.		✓	✓	✓
48	No personal or light-duty vehicles would be refueled on the site, except at locations authorized by the BLM. The equipment refueling section of the SPCC Plan would identify authorized methods and locations for refueling.		✓	✓	✓
49	Vehicle drip pans would be used for overnight parking of non-passenger vehicles.		✓	✓	✓
Land Management					
50	The Project would be subject to valid prior existing ROWs, and its construction, operation, maintenance, and decommissioning would be coordinated with other ROW holders and adjacent non-federal landowners.	✓	✓	✓	✓
51	CPM would provide notification and would obtain any necessary encroachment permit or approval from operators of pipelines, transmission lines, railroads, state or county roads, and other existing ROWs to be crossed or paralleled by Project facilities. The BLM would provide the names and addresses for existing ROW holders and applicants for pending ROWs to CPM. A letter, reviewed by the BLM, would be sent by CPM to the ROW holders and applicants. CPM would provide the BLM with documentation (a copy of the final letter and recipient list) that contact was made and copies of any agreements reached. Prior to commencing construction, the contractors would notify utility companies with existing lines near Project facilities (via the One-Call system or similar utility notification system) for field marking.	✓	✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
52	Protection of Survey Corner and Boundary Line Markers: The responsible party (CPM) would identify and protect evidence of the Public Land Survey System (PLSS) and related federal property boundaries prior to commencement of any ground-disturbing activity. The AO would contact BLM Cadastral Survey to coordinate data research, evidence examination and evaluation, and locating, referencing, or protecting monuments of the PLSS and related land boundary markers from destruction. In the event of obliteration or disturbance of the federal boundary evidence, the responsible party would immediately report the incident in writing to the AO. BLM Cadastral Survey would determine how the marker would be restored. In rehabilitating or replacing the evidence, the responsible party would reimburse the BLM for the costs or, if instructed to use the services of a Certified Federal Surveyor, procurement would be per qualification-based selection. All surveying activities would conform to the Manual of Surveying Instructions and appropriate state laws and regulations. BLM Cadastral Survey would review local surveys before being finalized or filed in the appropriate state or county office. The responsible party would pay for all survey, investigation, penalties, and administrative costs.		✓	✓	✓
Livestock Grazing					
53	The BLM would be notified 15 days prior to construction on an allotment so affected livestock permittees could be contacted. Construction activities during April and October would take precautions to avoid sheep trailing along Black Rock and Crystal Peak Roads.		✓*	✓*	✓*
54	Gates on established roads on public lands would be left open or closed, as found, or as designated by the AO.		✓*	✓*	✓*
55	CPM would minimize disturbance to existing fences and other improvements and would promptly repair damaged improvements to their original state or better. If fences need to be disturbed, they would be braced and secured to prevent loss of tension before cutting. Gates and cattle guards would be installed or replaced as required. If cattle guards, fences, or gates are damaged by CPM or its contractors, they would be repaired or replaced to their original conditions, as required by the BLM. Temporary gates would be installed only with the permission of the BLM.		✓*	✓*	✓*

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
56	Cuts or breaks in fences or natural barriers used for livestock control would be temporarily fenced to prevent passage of livestock during construction activities. After construction is completed in that area, the original fence or natural barrier would be reestablished to pre-construction conditions.		✓*	✓*	✓*
57	Stock watering pipelines that must be crossed by construction activities would be marked in advance for avoidance as appropriate. Any cut or damaged pipelines to stock watering features would be repaired immediately.		✓*	✓*	✓*
58	The Project would be designed to avoid disruption of the flow of water to stock watering reservoirs and to avoid disturbance that would prevent them from functioning properly.		✓*	✓*	✓*
59	Revegetation of disturbed areas would be designed on a site-specific basis in consultation with the BLM to maintain or enhance the value of grazing allotments.		✓*	✓*	✓*
60	CPM would notify Project personnel and contractors when livestock are grazing along the roadway and that extra caution is required to avoid collisions. Speed limits would be reduced, if necessary, when livestock are present along Project roads. If a vehicle collision with livestock does occur, CPM would notify the BLM as soon as practical. The BLM would notify the permittee. CPM would be responsible for removing the carcass after the BLM is notified, to prevent attracting wildlife along the roadway and causing additional hazards. CPM would be responsible for compensating the permittee for the value of any livestock killed or injured by Project personnel and contractors.		✓*	✓*	✓*
Noise					
61	Equipment would be properly muffled.		✓	✓	✓
Noxious Weeds					
62	CPM would develop and implement a Noxious Weed Management Plan, to be approved by BLM, to control, manage, and prevent the introduction or spread of noxious weeds and invasive species by Project construction, operation, maintenance, or decommissioning.	✓	✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
63	State-designated noxious weeds or others listed by Millard County that are found prior to or during construction would be avoided or treated prior to disturbance.		✓*		
64	Prior to entering BLM lands, all equipment would be cleaned of soils, seeds, vegetative matter, or other debris that could contain noxious weed seeds. Designated wash stations would be established at key locations to assure vehicles entering federal lands are cleaned and weed free. Any vehicles working off-road in an area of known noxious weed infestation would be washed before leaving the area. Daily washing would not be required for vehicles that are only traveling to and from the Project and have not entered an area with a known noxious weed infestation.		✓*	✓*	✓*
65	Gravel, sand, and other materials brought in for road and other Project activities would be weed-free to the greatest extent possible.		✓*	✓*	✓*
66	After construction, all areas of soil disturbance would be monitored for noxious weeds and invasive species as outlined in the Noxious Weed Management Plan. Infested areas would be inventoried, mapped (using Global Positioning Systems [GPS]), and treated. Weed control measures would be initiated according to the Noxious Weed Management Plan upon evidence of noxious weed or invasive species introduction. Treatment would be completed during the first growing season following completion of construction to ensure that weed populations are controlled. Noxious weed control would continue during the revegetation process and operation, maintenance, and decommissioning phases of the Project.		✓*	✓*	✓*

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		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
67	Weed control would consist of the appropriate manual, mechanical, biological, and chemical methods. If herbicides are used, their use would be coordinated with the BLM. All herbicide applications would be performed in accordance with federal, state, and local regulation, and in compliance with the BLM requirements. If needed, a Pesticide Use Proposal (PUP) would be submitted to the BLM for approval prior to any chemical treatment. It is the BLM's responsibility to monitor pesticide applications on public land, to ensure the product label and approved PUP are followed, and the PUP is completed. To comply with this requirement, the BLM would be notified when spraying/treating on public land would occur, and all completed Daily Pesticide Application Records would be sent to the BLM within 24 hours after treatment. Pesticides would be applied by a certified licensed applicator in strict accordance with the product label, the PUP, and mitigation measures outlined in the EIS and ROD. Pesticides would not be permanently stored on public lands.		✓*	✓*	✓*
Paleontology					
68	CPM would immediately notify the AO of any paleontological resources discovered during construction, operations, maintenance, or decommissioning, protect the discovery from damage or looting, and suspend all activities within 300 feet of such discovery until written authorization to proceed is issued by the AO. CPM is not required to suspend operations if activities can avoid further effects to a discovered locality or be continued elsewhere.		✓	✓	✓
69	The AO would evaluate, or would have evaluated, such discoveries as soon as possible but not later than 10 working days after being notified. Appropriate measures to mitigate adverse effects to important paleontological resources would be determined by the AO after consulting with CPM. Approval for the Project to proceed would be granted when recovery of the fossil material and field data is completed.		✓	✓	✓
70	CPM would be responsible for the cost of any investigation necessary for the evaluation and mitigation of paleontological resources. CPM would not be responsible for the cost of recovery outside of the approved area of disturbance plus a 50-foot buffer, even if the paleontological resource continues outside that area.		✓	✓	✓
Reclamation					
71	CPM would develop and implement a Reclamation Plan, to be approved by the BLM, which would address both interim reclamation of temporary construction disturbance and final reclamation during Project decommissioning.	✓	✓	✓	✓

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
72	Following construction, areas that have been temporarily disturbed by grading or other construction activities would be returned to the original contours of the land, consistent with future operating needs, as approved by the BLM. Reclamation work may consist of re-contouring eroded areas, extending water bars, creating berms, installing rock barriers, establishing vegetation, applying mulch to provide additional erosion control, and other activities as required by the AO. Reclamation would begin as soon as practical after construction is complete to minimize the potential for erosion, except that re-seeding may be deferred until the fall following completion of construction to improve the opportunity for successful seed germination.		✓*	✓*	✓*
73	Seed mixes and seeding methods would be determined by the AO, in consultation with the BLM's Rangeland Management Specialist. Seed mixes would be appropriate for different soil types and ecological sites. Revegetation on private lands would occur according to landowner specifications. When broadcast seeding is used, it would be followed by raking or harrowing to cover the seed. Should an area be broadcast seeded, the seeding rate would be doubled unless the soil is disturbed sufficiently following seeding to cover the seed with soil.		✓*	✓*	✓*
74	Trees, brush, other woody material, and rocks removed during construction would be placed in designated areas for later use in reclamation, at the AO's direction. CPM would pull these materials back over disturbed areas following construction to aid in erosion control, create wildlife habitat, and discourage OHV use of the disturbed areas.		✓*	✓*	✓*
Soil and Water Resources					
75	A Stormwater Pollution Prevention Plan (SWPPP), to be approved by the BLM, would be prepared for the UPDES permit(s) required for the Project. The SWPPP would include BMPs to ensure compliance with applicable regulations and to prevent offsite migration of contaminated stormwater or increased soil erosion. Construction practices would comply with the UPDES permit(s) and SWPPP. Construction, operation, maintenance, and decommissioning crew supervisors would ensure compliance with SWPPP guidelines to stabilize disturbed soils and minimize erosion and sedimentation. Erosion control measures would be implemented in areas where surface disturbance or slope leave the soil open to wind or water erosion. Erosion control methods may include construction of water diversion structures and site-specific applications of mulch or other materials as approved by the AO to dissipate water flow as needed to control surface water runoff across disturbed areas.		✓*	✓*	✓*

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		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
76	Topsoil that is suitable for reclamation would be removed in conjunction with clearing and grading and reserved in shallow windrows for use in reclamation of temporarily disturbed areas. The depth of topsoil segregation would depend on the soil type and would be determined by CPM, its contractors, or the CIC (as applicable), with approval by the AO. Erosion control measures would be used in areas where surface disturbance or slope leave the stockpiled soil susceptible to wind or water erosion.		✓*	✓*	✓*
77	Inspections would be conducted to monitor the success and maintenance of erosion control measures. The monitoring program would identify problem areas and corrective measures to ensure vegetation cover and erosion control.		✓*	✓*	✓*
78	Concrete trucks would not be washed out on public lands except at designated sites where washout materials would be handled in accordance with the SWPPP. The designated sites would be reclaimed in accordance with the Reclamation Plan once work is completed. Concrete would be disposed of at an authorized location and would not be disposed of in drains, inlets, stormwater drainages, or watercourses.		✓*	✓*	
79	CPM would develop and implement a Blasting Plan, to be approved by the BLM, if blasting is deemed necessary at any point during construction, operation, maintenance, or decommissioning of the Project. The Blasting Plan would include notification and safety measures, as well as monitoring (pre- and post-blasting) of springs or other groundwater sources near blasting areas.	✓	✓	✓	✓
Transportation and Access					
80	CPM would develop and implement a Transportation and Traffic Management Plan, to be approved by the BLM, which describes regional and local access routes and affected roadways, traffic volumes, pavement conditions, and traffic mitigation measures. It would also discuss traffic and circulation within and in the immediate vicinity of Project facilities.	✓	✓	✓	✓
81	Existing roads would be used to the extent possible to minimize new disturbance. Overland vehicle traffic through undisturbed areas would be minimized. Unless authorized by the AO, travel would be restricted to public roads, authorized existing roads, and the ROWs. Where appropriate, CPM would upgrade or maintain authorized existing roads using the standards outlined in BLM Road Manual 9113.		✓*	✓*	✓*

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		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
82	Nighttime travel would be minimized to reduce the potential for vehicle collisions with wildlife and livestock.		✓	✓	✓
83	The at-grade crossings and associated warning devices would be designed and constructed to achieve compliance with UDOT standards. A New Rail Crossing Application, including a development plan and preliminary engineering drawings, would be submitted to UDOT to begin the approval process.	✓	✓		
84	Design and construction of the Rail Loadout Facility access roads and the Rail Spur Access Corridor would be coordinated with Millard County staff to achieve compliance with county standards and with the BLM to achieve compliance with design standards in BLM Road Manual 9113.	✓	✓		
85	All roads to be used by the Project would be evaluated based on the frequency and weight of Project vehicles that are anticipated to travel each road. A table would be developed and placed in the Transportation and Traffic Management Plan and SWPPP for the Project. The table would identify any requirements for maintenance or improvements that may be needed to accommodate the anticipated use and loading. Road improvements would include construction of proper subgrade and addition of a wear course, where appropriate.	✓*			
86	This mitigation measure applies to roads that would not be improved or maintained. Travel on these roads would be avoided to the extent practicable during periods when the soil is too wet to support equipment adequately, as evidenced by the creation of ruts in excess of four inches deep. The Transportation and Traffic Management Plan would identify measures to minimize rutting (for example, placement of mats or gravel), if equipment creates ruts more than 4 inches deep. If Project activities create any ruts deeper than 4 inches, the AO would be notified. Damage to soils, including compaction, rutting, and displacement, would be repaired as described in the Transportation and Traffic Management Plan.		✓*	✓*	✓*
87	This mitigation measure applies to roads that would be improved and maintained. If at any time during the life of the Project, equipment creates ruts that penetrate the native soil or wear course and start to damage the native soil or subgrade, localized activities would be halted and repairs made. Ruts more than 4 inches deep would be repaired regularly to ensure a smooth and stable road surface.		✓*	✓*	✓*
88	Oversize loads greater than 16 feet in width would require permits and police escorts.				

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		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
89	CPM would plan for safe and accessible conditions at roadway crossings and access points during construction, operation, maintenance, and decommissioning of the Project.		✓*	✓*	✓*
90	For public safety, appropriate road signs such as "Caution Heavy Truck Traffic" or "Be Prepared to Stop" would be used during construction, operation, maintenance, and decommissioning of the Project. Flaggers would be used when required by existing law.		✓*	✓*	✓*
91	Equipment and material hauling would be performed in such a manner as to prevent damage to areas outside the Project and to minimize interference with normal uses of lands crossed.		✓*	✓*	✓*
92	Permanent roads and parking areas would be constructed to provide drainage and minimize erosion. Gravel, rock, or other appropriate surfacing materials would be applied if needed, subject to BLM approval. Culverts would be installed if necessary to maintain drainage.		✓*	✓*	
93	CPM would conduct regular inspections to identify road problems such as ruts, holes, crown-and-ditch elements, standing water on the road surface, surfacing materials, blockage of water flowing into and discharging from culverts, interim reclamation, and control of noxious and invasive weeds. Inspections would be conducted following rapid snowmelt and prolonged rain events. Maintenance activities may include, but would not be limited to, blading, resurfacing, dust abatement, spot repairs, placement of rock or gravel, culvert cleaning, noxious and invasive weed control, reseeding, regrading, and snow removal, as approved by the BLM. The road surface and shoulders would be kept in a safe and usable condition and would be maintained in accordance with the original construction standards. All drainage ditches and culverts would be kept clear and free flowing and would be maintained according to original construction standards.		✓	✓	✓
BLM Sensitive Plant Species					
94	If a sensitive plant species that could be affected or disturbed is discovered during the course of Project construction, operation, maintenance, or decommissioning, the AO would be immediately notified. All ground-disturbing activities that may affect the resource would immediately cease until the AO issues written authorization to proceed. The AO, in coordination with the BLM's Threatened and Endangered Species Plants Specialist would develop and implement appropriate mitigation measures.		✓	✓	✓

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		Applicability to the Project * Not applicable within the playa boundary				
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]	
Wildlife						
95	CPM would develop and implement an Adaptive Wildlife Management Plan, to be approved by the BLM, to guide the evaluation of information collected during wildlife monitoring and to inform management of wildlife resources. Operational monitoring and reporting would be conducted as described in the Adaptive Wildlife Management Plan. CPM would provide the monitoring results to, and consult with, the BLM regarding potential management decisions regarding unanticipated effects to wildlife.	✓	✓	✓	✓	
96	All power and communication lines, including structures and substations, would be designed to minimize the potential for adverse avian interactions, including collision and electrocution. Avian protection measures would be consistent with guidance provided by the Avian Power Line Interaction Committee (APLIC) and the USFWS (APLIC 2006, 2012).	✓	✓	✓		
97	Pre-construction biological clearance surveys for avian and other terrestrial resources would be conducted for wildlife species identified as having the potential to occur in the area or to be affected by the Project. The details of these surveys would be coordinated with the BLM, USFWS, and UDWR. If special-status species are encountered during the pre-construction surveys or construction, appropriate BMPs and mitigation measures would be implemented to avoid or minimize any anticipated effects. Prior to the surveys, permits for federal and state land and rights-of-entry to privately owned land would be obtained. BMPs and mitigation measures could include, but are not limited to, avoidance of specific areas during the construction process or modification of facility locations to avoid or minimize effects.	✓	✓	✓	✓	

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		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
98	Appropriate seasonal and spatial buffers would be placed on all known and discovered raptor (eagle, falcon, hawk, and owl) nests in accordance with Utah Field Office Guidelines for Raptor Protection from Human and Land use Disturbances (USFWS 2002) and Best Management Practices for Raptors and their Associated Habitats in Utah (BLM 2006). Construction activities would not occur within these buffers if pre-construction monitoring indicates the nests are active, unless a site-specific evaluation is completed prior to construction and a BLM wildlife biologist, in coordination with USFWS and UDWR, recommends that activities may proceed. The BLM would coordinate with the USFWS and UDWR and have a recommendation within 3 to 5 business days of notification. Any construction activities authorized within a spatial or seasonal buffer for raptors would require an on-site monitor. If there are any indications that activities are adversely affecting the raptor or its young, the on-site monitor would suspend activities and contact the AO immediately. Construction may be considered within the buffers of inactive nests, after coordination with the BLM, if proper surveys have been completed and have shown that the nest is unoccupied, has become unsuccessful, or young have fledged and are no longer dependent on the nest.		✓	✓	✓
99	Existing roads would be used to the extent possible for access and linear components of the Project, such as power and communication lines, the Natural Gas Pipeline, and water supply pipelines, to minimize disturbance, loss, and fragmentation of wildlife habitat, unless approved by the AO. Site clearing would be limited to the minimum time, duration, and space necessary. Clearing of sagebrush shrubland, a high-value habitat type that is increasingly rare in the Project vicinity, would be limited to the greatest extent practicable.	✓*	✓*	✓*	
100	At the end of each workday, all excavated holes and trenches that may trap wildlife would be inspected before backfilling. If backfilling is not feasible, excavations would be sloped at the ends to provide escape ramps or covered to completely prevent access by wildlife. Before work commences, excavation areas would be inspected and any wildlife removed.		✓*	✓*	✓*
101	Construction, operation, maintenance, and decommissioning of the Project would be conducted in a manner that does not cause “take” as defined by the applicable law(s) for each wildlife species. Any take or wildlife problems would be reported to the BLM biologist as soon as practicable. All wildlife are to be appreciated and given space to carry out their biological/ecological activities.		✓	✓	✓*

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		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
102	A litter control program would be implemented to reduce the attractiveness of Project facilities to opportunistic predators such as common ravens, coyotes, and kit fox. All domestic trash would be promptly placed in covered containers that would be removed on a regular basis for disposal at an authorized facility.		✓	✓	✓
103	CPM would attempt to avoid or minimize ground-disturbing activities, noise, and light during the migratory bird nesting season (March 1 through July 30) so as not to disturb nesting avian species during the critical nesting season. Anticipating that ground-disturbing activities may be proposed during the migratory bird nesting season, CPM would develop a migratory bird nest survey protocol and nest avoidance program to mitigate disturbance to nesting migratory birds. The nest survey protocol and nest avoidance program would be included in the Adaptive Wildlife Management Plan, which would be reviewed by the BLM, UDWR, and USFWS, and approved by the BLM.		✓*	✓*	✓*
104	To prevent and avoid birds becoming entrapped, all vertical pipes that would not allow a bird to exit would be permanently capped.		✓	✓	✓
105	All open pipes, culverts, and similar Project features greater than 4 inches in diameter would be inspected prior to disturbance or removal to avoid trapping, injuring, or killing kit foxes.		✓	✓	✓
106	Over the term of the authorization for the Project, information regarding a plant or animal species may change. If the status of a species changes (for example, a species is proposed for listing or becomes listed under the ESA, or is added to the BLM's Special Status Species list), the BLM would notify CPM. The BLM and CPM would discuss the potential for construction, operation, maintenance, or decommissioning to affect the species and any appropriate BMPs and mitigation measures. Should it be determined by the BLM that construction, operation, maintenance, or decommissioning may adversely affect a federally listed (ESA) species, consultation with the USFWS would be initiated.		✓	✓	✓
107	Fences would be constructed according to BLM standards, including sufficient clearance to allow passage of pronghorn. Wire spacing and type would comply with BLM requirements. Metal fence posts with white tips would be used for visibility and to minimize perch locations for raptors. In areas of high wildlife migration, new fence wires would be flagged during construction to be conspicuous. Post spacing, number or stays, and other fence specifications would be determined based on site conditions.		✓*	✓*	

Table E-1 Standard Mitigation Measures and Best Management Practices					
		Applicability to the Project * Not applicable within the playa boundary			
	Mitigation Measure	Design and Engineering	Construction	Operation and Maintenance[1]	Decommissioning[1]
108	Roadways would be monitored for carcasses of wildlife or livestock that have collided with vehicles. Carcasses would be removed immediately (within 24 hours of discovery) to the extent practical. CPM would coordinate in advance with the UDWR and USFWS to obtain all required permits to avoid delays in carcass removal.		✓*	✓*	✓*
109	If direct disturbance of active burrows or dens of any special-status species is necessary, it would occur outside critical breeding periods according to species biology, unless approved by the AO. Physical destruction of known, active kit fox or burrowing owl burrows would be avoided wherever possible. No other burrows, regardless of activity classification, would be destroyed unnecessarily.		✓*	✓*	✓*

* Not applicable within the playa boundary.

[1] During operations, maintenance, and decommissioning, some mitigation measures would only apply to the initiation of new activities.

Date of Table – October 2018