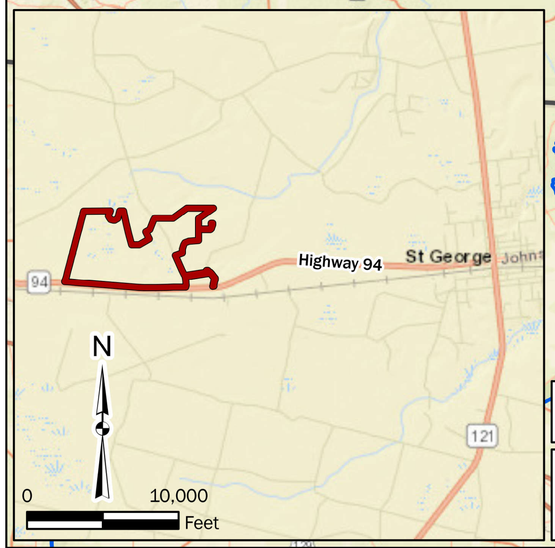
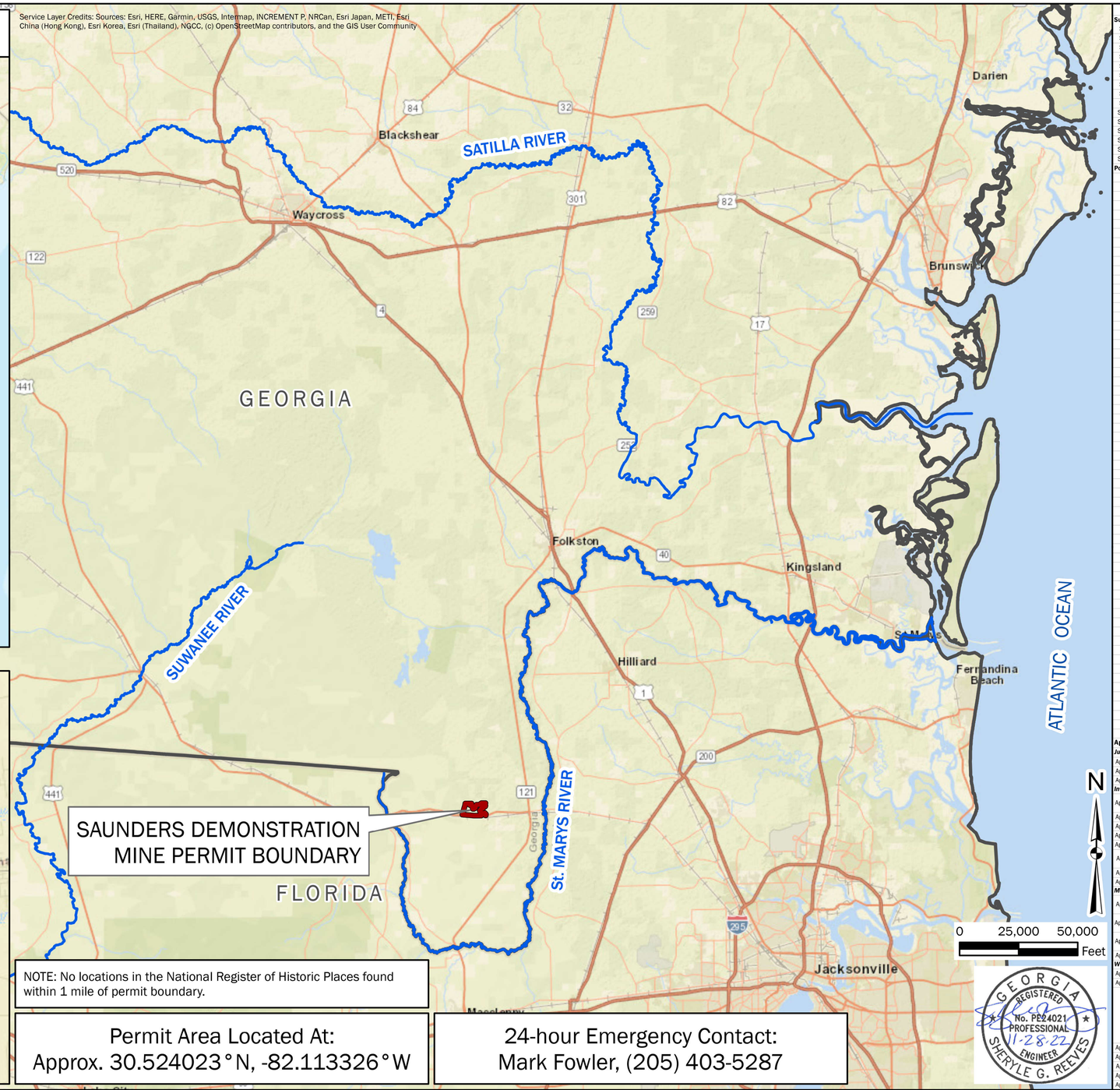
GEORGIA COUNTIES



Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



NOTE: No locations in the National Register of Historic Places found within 1 mile of permit boundary.

Permit Area Located At:
Approx. 30.524023°N, -82.113326°W

24-hour Emergency Contact:
Mark Fowler, (205) 403-5287

GEORGIA REGISTERED No. PE24021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

TABLE OF CONTENTS

wood.
Wood Environmental & Infrastructure Solutions
4000 Meadow Lake Dr #125, Birmingham, AL 35242

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

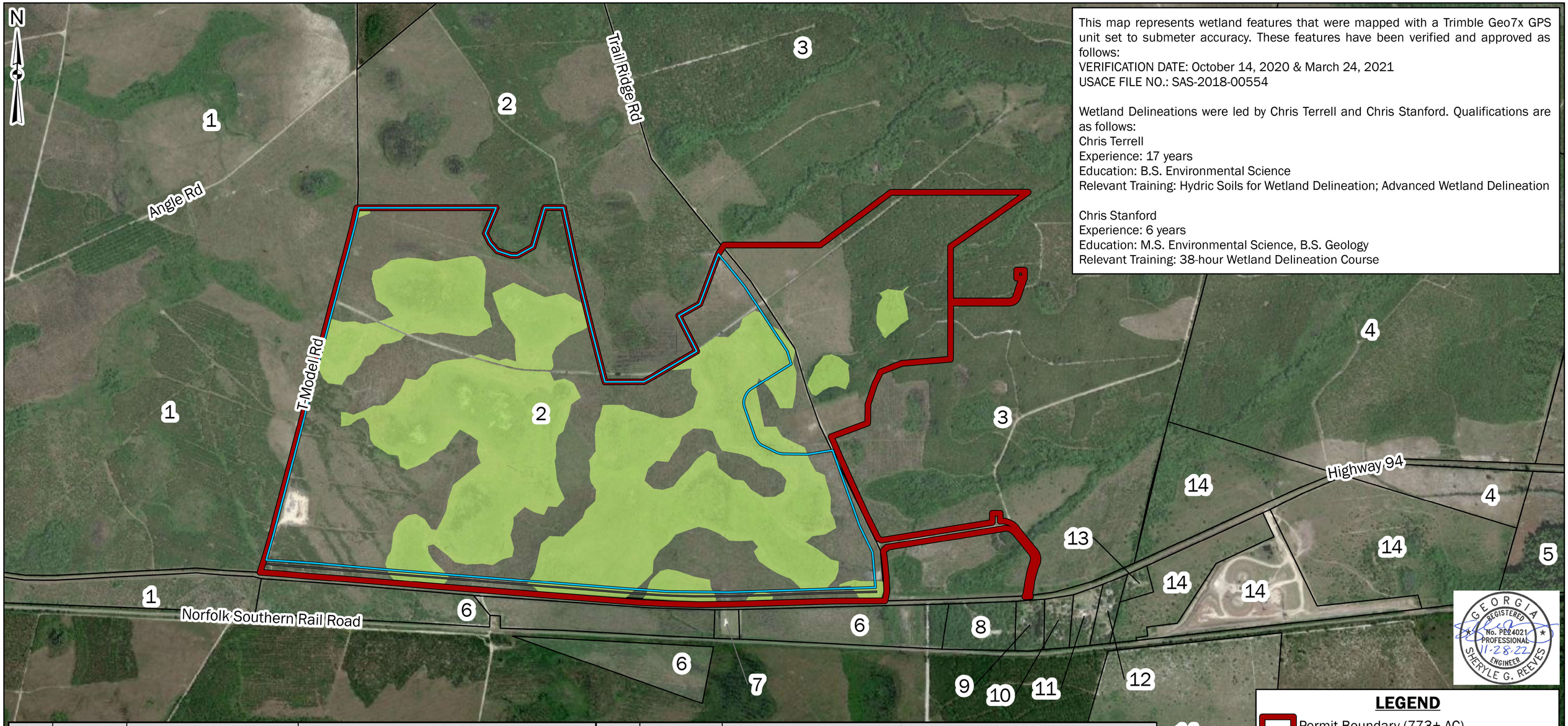
SHEET 1: COVER SHEET - SAUNDERS DEMONSTRATION MINE

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: ESRI World Street Map (See Service Layer Credits).

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: 1 in = 20,000 ft



This map represents wetland features that were mapped with a Trimble Geo7x GPS unit set to submeter accuracy. These features have been verified and approved as follows:
VERIFICATION DATE: October 14, 2020 & March 24, 2021
USACE FILE NO.: SAS-2018-00554

Wetland Delineations were led by Chris Terrell and Chris Stanford. Qualifications are as follows:
Chris Terrell
Experience: 17 years
Education: B.S. Environmental Science
Relevant Training: Hydric Soils for Wetland Delineation; Advanced Wetland Delineation

Chris Stanford
Experience: 6 years
Education: M.S. Environmental Science, B.S. Geology
Relevant Training: 38-hour Wetland Delineation Course

GEORGIA REGISTERED No. PE024021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

LEGEND
- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- USACE Verified Non-Jurisdictional Wetland
- 20' Wide Access/Haul Road
- Adjacent Parcels

0 600 1,200 2,400 Feet

LABEL	PIN	OWNER	ADDRESS
1	0036001	TIAA TIMBERLANDS, LLC	1500 S FIRST AVE, STE 1150, PORTLAND, OR 97201
2	0059001002	TRAIL RIDGE LAND, LLC	2100 SOUTHBRIDGE PKWY, BIRMINGHAM, AL 35209
3	0058001	TRAIL RIDGE LAND, LLC	2100 SOUTHBRIDGE PKWY, BIRMINGHAM, AL 35209
4	0084001	JOHN, VERNON GOWEN	315 AGNES ROAD, FOLKSTON, GA 31537
5	0061002	W L OLIVER/CHARLTON, LLC	P.O. BPX 161139, MOBILE, AL 36616
6	0060009	TRAIL RIDGE LAND, LLC	2100 SOUTHBRIDGE PKWY, BIRMINGHAM, AL 35209
7	0060003	CHARLTON COUNTY FORREST	FOLKSTON, GA 31537

LABEL	PIN	OWNER	ADDRESS
8	0060007	WALTER & DEBRA SCHEIDERER	8024 HWY 94, ST GEORGE, GA, 31562
9	0060006	RANDAL DUKES	8208 HWY 94, ST GEORGE, GA 31562
10	0060004	FINLEY W WOLFE	8242 HWY 94, ST GEORGE, GA 31562
11	0060004001	KIRK W WOLFE	8296 HWY 94, ST GEORGE, GA 31562
12	0060005	ERNST HARDEN	SUITE 107, JACKSONVILLE, FL 32211
13	0084003001	FRED & MARLENE WINECOFF	8422 HWY 94, ST GEORGE, GA 31562
14	0084003	SHARON BELL & ELI L. PADGETT	10624 HILLSIDE DR, MACCLENNY, FL 32063

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 2: BOUNDARY SHEET - ADJACENT PROPERTIES MAP & AERIAL PHOTOGRAPH

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

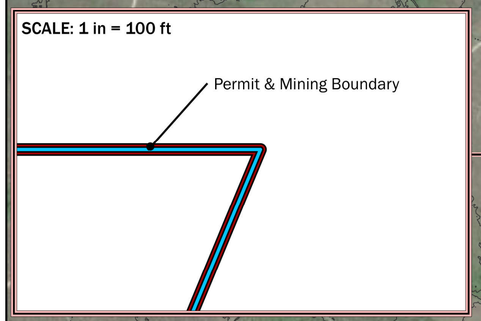
BASEMAP: Maxar Technologies, Vivid Imagery, 5/7/2021 (0.5 m Resolution).

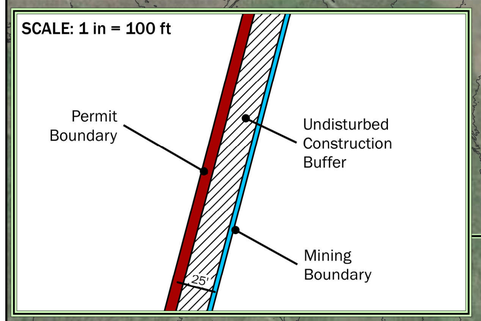
DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: 1 in = 600 ft

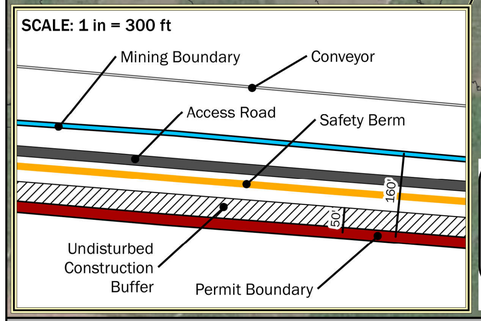
SURVEY SOURCE INFORMATION:
As a part of the field data acquisition activities, two separate surveys were conducted within the project study area. Southern Resource Mapping, located in Tuscaloosa Alabama, was subcontracted by Twin Pines Minerals, LLC, to perform an aerial topographic survey using a Riegl LIDAR 780i (digital ortho) sensor. The LIDAR configuration included an Applanix AP60 IMU coupled with an AirBourne GPS and was affixed to a Cessna 206 fixed-wing aircraft. A flight plan was generated that produced 18 points-per-square meter(s), and was flown at an elevation of 1,700 feet above ground surface (ags). This resulted in a total of 17 flight lines which included one cross line. From the data collected by Southern Resource Mapping, a topographic map layer containing one-foot contour intervals was generated and used as a workable base map for the majority of the project area (shown at five foot interval).

Site Survey Control		
Type	Identifier	Location
Property Boundary	Fence Post/Stake – Red	Property Corners
Mining Permit Boundary	Fence Post/Stake – Green	Approx. 200-foot intervals*
Buffer Boundary	Fence Post/Stake – Blue	Approx. 200-foot intervals*
Mining Pit Boundary	Fence Post/Stake – Orange	Approx. 200-foot intervals*
Permanent Survey Control Markers	Fence Post/Stake – Yellow	To be determined

*Intervals may be adjusted based on site conditions.







[OPERATOR'S NAME]
[MINE NAME]
[PERMIT NUMBER]
[CONTACT INFORMATION]

IDENTIFICATION SIGN (Typical)

LEGEND

- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- USACE Verified Non-Jurisdictional Wetland
- 20' Wide Access Road
- Safety Berm
- Undisturbed Construction Buffer
- Process and/or Water Management Pond
- PCP/WCP Pre-Concentration Plant / Wet Concentration Plant
- 5 ft Elevation Contour (See Survey Source Information)
- Permit Boundary Corner Coordinates

0 600 1,200 2,400 Feet

N

	Area (AC)
Permit Boundary	773±
Mining Footprint	582±
Undisturbed Buffer	12±
Haul Road	4±

Trail Ridge Rd
T-Model Rd
Sand Processing Area Water Management Storage Pond
Sand Processing Area Water Management Pond
Mine Pit Water Management Pond
Alternate Storage Pond
E: 678288 N: 193419
E: 678241 N: 192420
E: 669719 N: 193222
M1
M2
M3
M4
Pumping Well FPW-02
Primary Overflow Pond
P1
P2
P3
P4
Parking & Offices
Stockpile
PCP/WCP Plant
Substation
Covered Facility
Above-Ground Fuel Storage
Process Water Ponds
Stockpiles
Pumping Well FPW-01
Process Water Piping to Mineral Separation Plant
Highway 94
Mineral Separation (Dry) Plant Location
Portable Conveyors
Tails Stockpile
Feed Conveyor
Tails Conveyor
E: 668477 N: 188569
E: 678303 N: 188291
Norfolk Southern Rail Road
Electrical Substation
Site Entrance (Identification Sign)

NOTES:
- Access road will be installed between the safety berm and the mining area.
- Undisturbed construction buffer will be located between the safety berm and Highway 94.
- See Sheet 5 for plan view, cross-sections and details of the typical dragline mining operation.
- Tails stockpile and conveyors will move in accordance with the moving mine pit and are not permanent features; runoff will be controlled by berms, silt fence, hay bales or any combination thereof (see Sheet 6 for erosion & sediment control plan).
- Process water will be piped to the Mineral Separation Plant from Water Management Pond M3. Any wastewater from the Mineral Separation Plant will be hauled, by tanked trucks, to the Wet Concentration Plant for re-use.
- See Sheets C-001 through C-801 for design and details related to management ponds.

GEORGIA REGISTERED No. PEO14021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 3: MINING PLAN SHEET - SITE LAYOUT

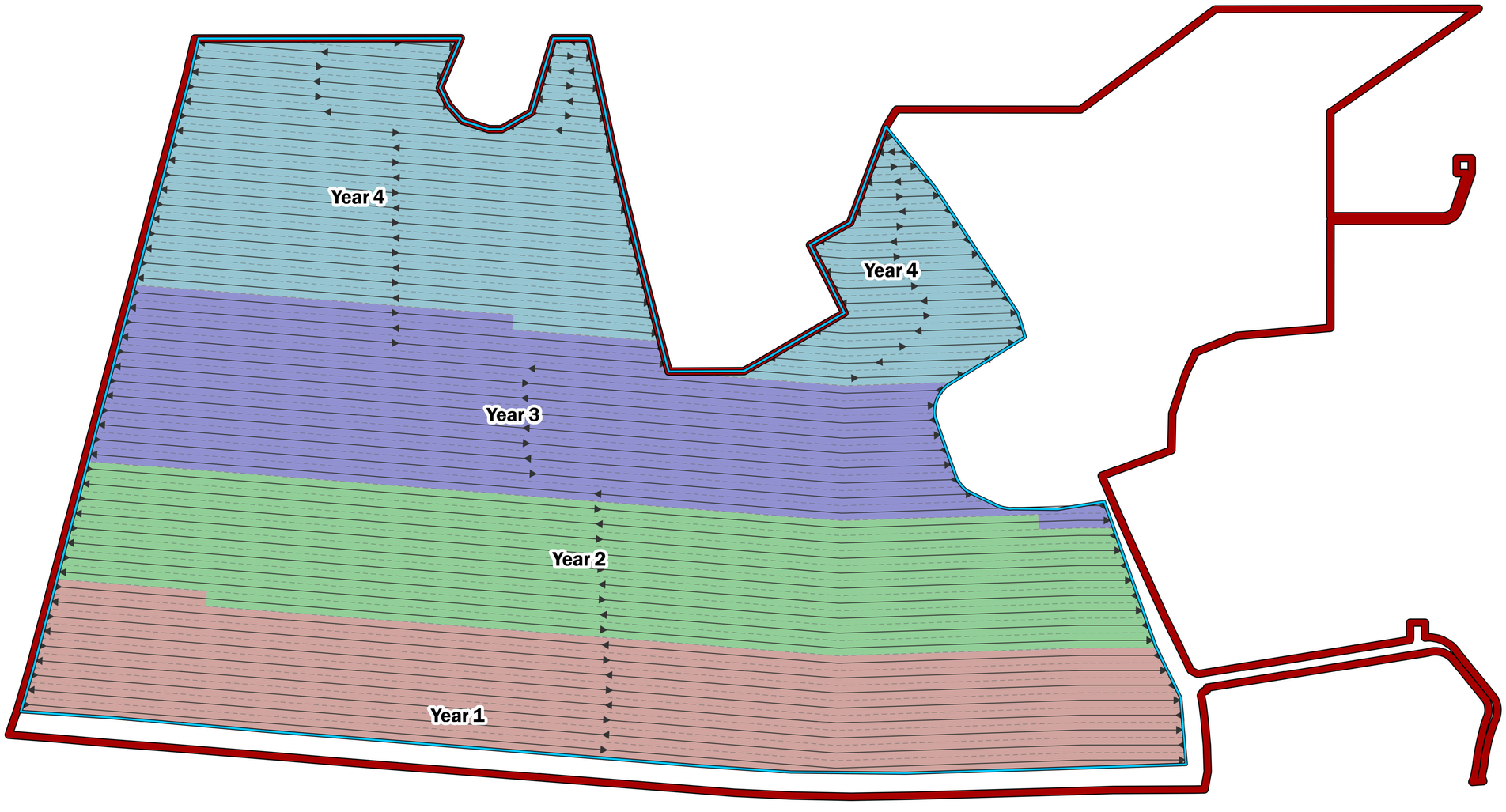
TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar Technologies, Vivid Imagery, 5/7/2021 (0.5 m Resolution).

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: 1 in = 600 ft

NOTES:
- Estimated timing is based on a mining progress rate of 10-15 acres per month. The illustration represents the average of those values (170 feet per day). Actual timing for extraction of heavy mineral sands is expected to take 4 years.
- See Sheet 5 for plan view, cross-sections and details of the typical dragline mining operation.
- Tails stockpile and conveyors will move in accordance with the moving mine pit and are not permanent features.
- See Sheet 7 for information regarding dust control.
- See Sheet 14 for additional information regarding flood prone areas and threatened and endangered species locations.



N

0 400 800 1,600
Feet

LEGEND

- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- Year 1
- Year 2
- Year 3
- Year 4
- East-to-West Dragline Center
- West-to-East Dragline Center
- Edge of Dragline Pass

GEORGIA REGISTERED No. PE24021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

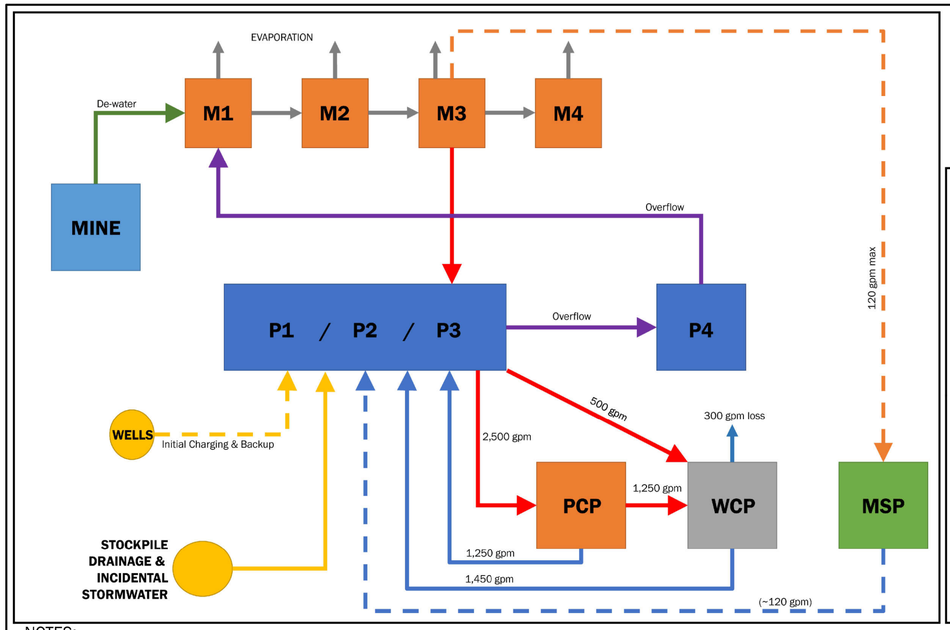
TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 4: MINING PLAN SHEET - ESTIMATED PROGRESSION OF MINING

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

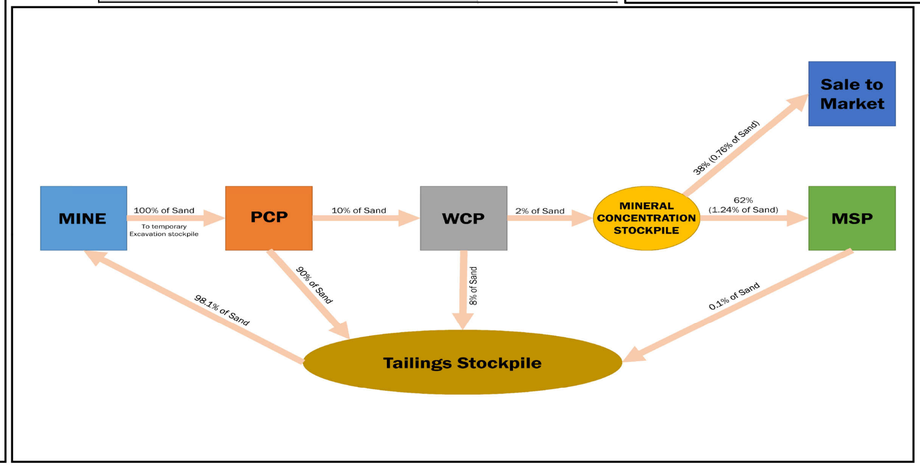
ST. GEORGE, CHARLTON COUNTY, GEORGIA

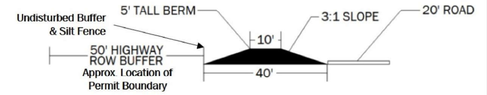
DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: 1 in = 400 ft



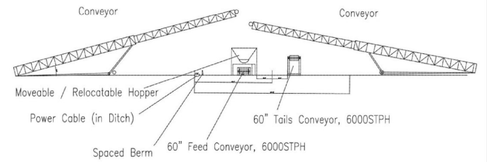
	Max Allowable
Mine Pit Sidewall Slope	34°
Mine Pit Depth	50 ft
Topsoil Stockpile Slope (Mine Pit Side)	3:1
Topsoil Stockpile Slope (Upgradient Side)	4:1
Topsoil Stockpile Height	Variable

NOTES
- Dragline advancement will be 100 to 200 feet per day; backfilling shall proceed 500 feet or less (i.e. 5 to 7 days) behind the progressing mine pit.
- See Sheet 15 for a more in-depth narrative regarding the mining process.

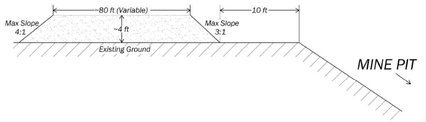




EXCAVATION PERIMETER & SAFETY BERM (Typ.)
NOT TO SCALE



CONVEYOR DETAIL (Typical)

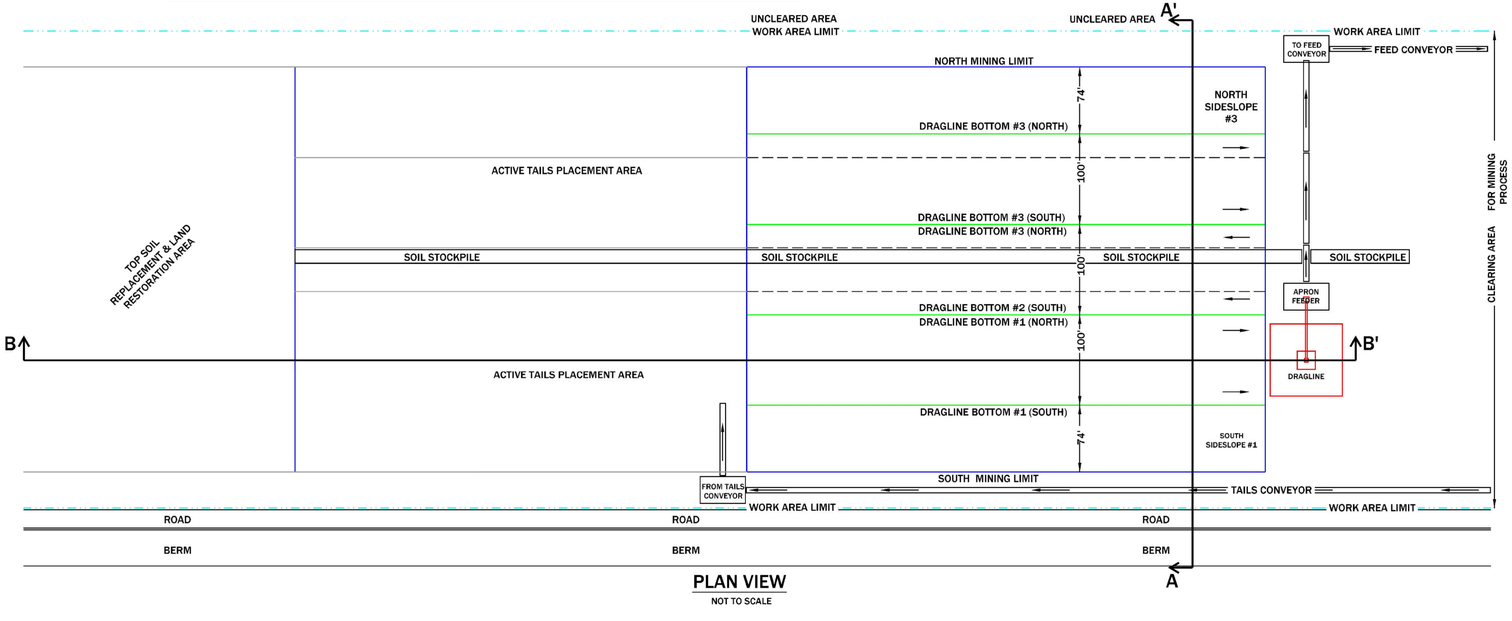


TOPSOIL STOCKPILE DUE TO MINING (Typical)

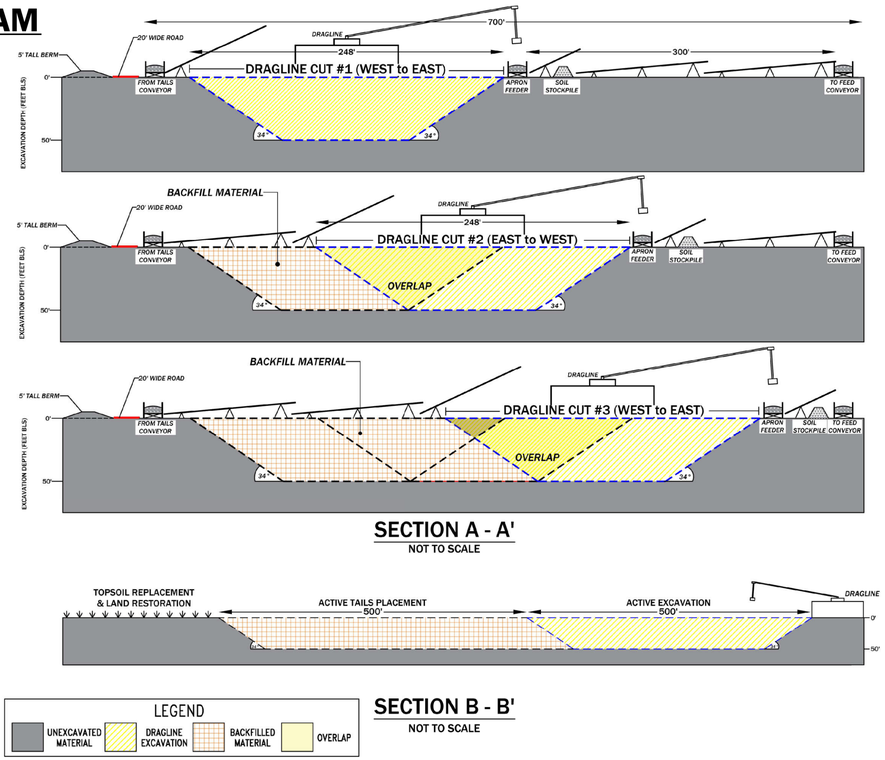
NOTES:
1. All material shall be hauled, utilizing trucks, between the permitted mine, wet processing areas, and Mineral Separation Plant (MSP) south of Highway 94.
2. Process water shall be piped to the Mineral Separation Plant from water management pond M3. Any wastewater from the Mineral Separation Plant shall be hauled, by tanked trucks, to the processing ponds for re-use.

MINING WATER PROCESS FLOW DIAGRAM

MINING SAND PROCESS FLOW DIAGRAM



PLAN VIEW
NOT TO SCALE



SECTION A - A'
NOT TO SCALE

SECTION B - B'
NOT TO SCALE

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 5: MINING PLAN SHEET - PROCESS FLOW DIAGRAM, DETAILS & TYPICAL PROFILE/CROSS-SECTION

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

GEORGIA REGISTERED No. PE24021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: N.T.S.

STORMWATER DRAINAGE OUTFALLS					
ID	LATITUDE	LONGITUDE	ID	LATITUDE	LONGITUDE
001	30.517381	-82.110128	005	30.528021	-82.124600
002	30.518087	-82.121451	006	30.530052	-82.108792
003	30.519178	-82.127356	007	30.529024	-82.099545
004	30.520431	-82.102924	008	30.531834	-82.101202

N

Sd1-S
Bf-U
Sd1-BB
005
Du / Tp / Ds2
Sd1-S
Sd1-BB
006
008
Du
Tp
Ds2
007
M1
M2
M3
M4
Du
Du / Tp / Ds2
Sd1-S
Du
P4
P3
P1
P2
Sd1-S
Bf-U
Du / Tp / Ds2
Sd1-BB
004
Du / Tp / Ds2
Du
003
Sd1-BB
002
Du
Ds2/Ds3
Bf-U
Sd1-S
001
Du
Ds2/Ds3
Bf-U
Co
Du
Co

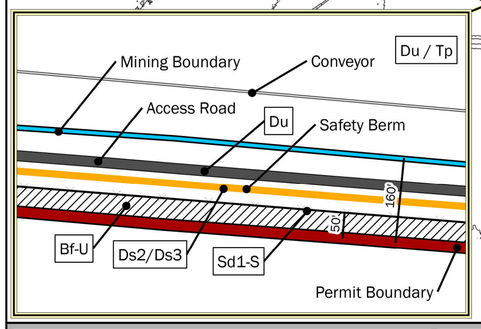
NOTE: Erosion and Sediment Control Plan for construction of the Water Management Ponds is provided on Sheets C-400 through C-425.

SITE KEY
(See Sheet 7 for notes and details)
Bf-U = Undisturbed Buffer
Co = Construction Exit
DS2 = Disturbed Area Stabilization - Temporary Seeding
DS3 = Disturbed Area Stabilization - Permanent Seeding
Du = Dust Control
Sd1-BB = Sediment Control - Brush Barrier
Sd1-S = Sediment Control - Silt Fence
Tp = Topsoil

LEGEND

- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- 20' Wide Access/Haul Road
- Proposed Safety Berm
- Drainage Divide
- Flow Direction
- PCP/WCP Pre-Concentration Plant / Wet Concentration Plant
- 5 ft Elevation Contour (See Survey Source Information on Sheet 3)
- Stormwater Drainage Outfall Location

0 500 1,000 2,000 Feet



GEORGIA REGISTERED No. PE024021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 6: EROSION & SEDIMENT CONTROL PLAN

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: 1 in = 500 ft

GEORGIA
UNIFORM CODING SYSTEM
FOR SOIL EROSION AND SEDIMENT CONTROL PRACTICES
GEORGIA SOIL AND WATER CONSERVATION COMMISSION

STRUCTURAL PRACTICES

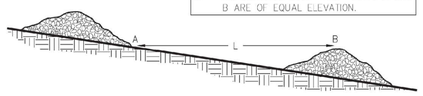
CODE	PRACTICE	DETAIL	MAP SYMBOL	DESCRIPTION
Cd	CHECKDAM			A small temporary barrier or dam constructed across a swale, drainage ditch or area of concentrated flow.
Ch	CHANNEL STABILIZATION			Improving, constructing or stabilizing an open channel, existing stream, or ditch.
Co	CONSTRUCTION EXIT		Co (LABEL)	A crushed stone pad located at the construction site exit to provide a place for removing mud from tires thereby protecting public streets.
Sd1	SEDIMENT BARRIER		(INDICATE TYPE)	A barrier to prevent sediment from leaving the construction site. It may be sandbags, bales of straw or hay, brush, logs and poles, gravel, or a silt fence.
Sd3	TEMPORARY SEDIMENT BASIN		Sd3 (LABEL)	A basin created by excavation or a dam across a waterway. The surface water runoff is temporarily stored allowing the bulk of the sediment to drop out.
Sk	FLOATING SURFACE SKIMMER		Sk (LABEL)	A buoyant device that releases/drains water from the surface of sediment ponds, traps, or basins at a controlled rate of flow.
St	STORMDRAIN OUTLET PROTECTION		St	A paved or short section of riprap channel at the outlet of a storm drain system preventing erosion from the concentrated runoff.

VEGETATIVE PRACTICES

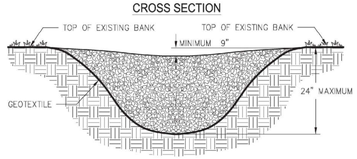
CODE	PRACTICE	DETAIL	MAP SYMBOL	DESCRIPTION
Ds1	DISTURBED AREA STABILIZATION (WITH MULCHING ONLY)		Ds1	Establishing temporary protection for disturbed areas where seedlings may not have a suitable growing season to produce an erosion retarding cover.
Ds2	DISTURBED AREA STABILIZATION (WITH TEMP SEEDING)		Ds2	Establishing a temporary vegetative cover with fast growing seedings on disturbed areas.
Ds3	DISTURBED AREA STABILIZATION (WITH PERM SEEDING)		Ds3	Establishing a permanent vegetative cover such as trees, shrubs, vines, grasses, or legumes on disturbed areas.
Ds4	DISTURBED AREA STABILIZATION (SODDING)		Ds4	A permanent vegetative cover using sods on highly erodable or critically eroded lands.
Du	DUST CONTROL ON DISTURBED AREAS		Du	Controlling surface and air movement of dust on construction site, roadways and similar sites.

STONE CHECK DAM
SPACING BETWEEN CHECK DAMS

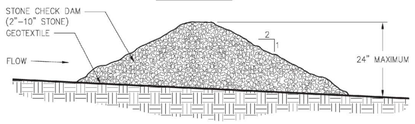
A = THE TOE OF THE UPSTREAM CHECK DAM.
B = TOP OF THE DOWNSTREAM CHECK DAM.
L = THE DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION.



STONE CHECK DAM
CROSS SECTION

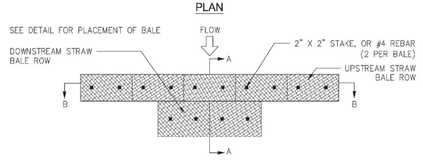


PROFILE VIEW

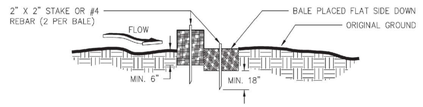


NOTES:
1. CHECK DAMS ARE TO BE USED ONLY IN SMALL OPEN CHANNELS (THEY ARE NOT TO BE USED IN LIVE STREAMS).
2. THE DRAINAGE AREA FOR STONE CHECK DAMS SHALL NOT EXCEED TWO ACRES.
3. THE CENTER OF THE CHECK DAM MUST BE AT LEAST 9 INCHES LOWER THAN THE OUTER EDGES.
4. THE DAM HEIGHT SHOULD BE A MAXIMUM OF 2 FEET FROM CENTER TO RIM EDGE.
5. THE SIDE SLOPES OF THE CHECK DAM SHALL NOT EXCEED A 2:1 SLOPE.
6. GEOTEXTILE SHALL BE USED TO PREVENT THE MITIGATION OF SUBGRADE SOIL PARTICLES INTO THE STONES (REFER TO AASHTO M288-96, SECTION 7.3, TABLE 3).

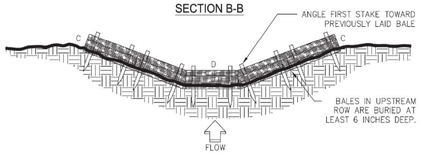
TYPICAL STRAW BALE CHECK DAM
PLAN



SECTION A-A



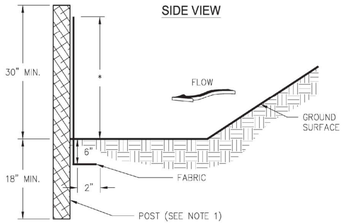
SECTION B-B



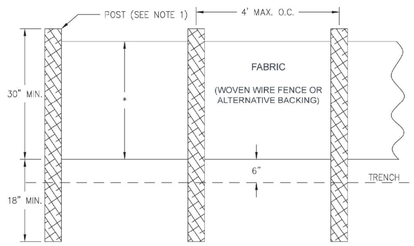
NOTES:
1. BALES SHOULD BE BOUND WITH WIRE OR NYLON STRING AND SHOULD BE PLACED IN ROWS WITH BALE ENDS TIGHTLY ABUTTING THE ADJACENT BALES.
2. REMOVE #4 REBAR AFTER STRAW BALES ARE NO LONGER IN PLACE.
3. POINT C OF SECTION B-B SHOULD ALWAYS BE HIGHER THAN POINT D.
4. STRAW-BALE CHECK DAMS SHALL NOT BE USED WHERE THE DRAINAGE AREA EXCEEDS ONE ACRE.

Sd1-S SILT FENCE - TYPE C

SIDE VIEW

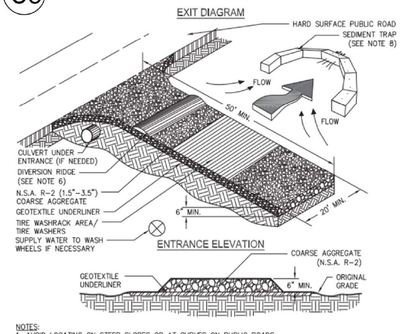


FRONT VIEW



NOTES:
1. USE STEEL OR WOOD POSTS OR AS SPECIFIED BY THE EROSION, SEDIMENTATION, AND POLLUTION CONTROL PLAN.
2. HEIGHT (*) IS TO BE SHOWN ON THE EROSION, SEDIMENTATION, AND POLLUTION CONTROL PLAN.

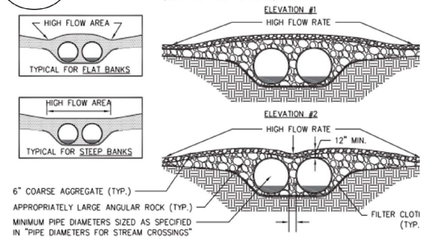
Co CRUSHED STONE CONSTRUCTION EXIT
EXIT DIAGRAM



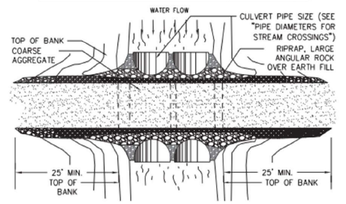
ENTRANCE ELEVATION

NOTES:
1. AVOID LOCATING ON STEEP SLOPES OR AT CURVES ON PUBLIC ROADS.
2. REMOVE ALL VEGETATION AND OTHER UNSUITABLE MATERIAL FROM THE FOUNDATION AREA, GRADE, AND CROWN FOR POSITIVE DRAINAGE.
3. AGGREGATE SIZE SHALL BE IN ACCORDANCE WITH NATIONAL STONE ASSOCIATION R-2 (1.5"-3.5" STONE).
4. A GRAVEL PAD SHALL HAVE A MINIMUM THICKNESS OF 6".
5. PAD WIDTH SHALL BE EQUAL FULL WIDTH AT ALL POINTS OF VEHICULAR EGRESS, BUT NO LESS THAN 20'.
6. A DIVERSION RIDGE SHOULD BE CONSTRUCTED WHEN GRADE TOWARD PAVED AREA IS GREATER THAN 2%.
7. INSTALL PIPE UNDER THE ENTRANCE IF NEEDED TO MAINTAIN DRAINAGE DITCHES.
8. WHEN WASHING IS REQUIRED, IT SHOULD BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN (DIVERT ALL SURFACE RUNOFF AND DRAINAGE FROM THE ENTRANCE TO A SEDIMENT CONTROL DEVICE).
9. WASHRACKS AND/OR TIRE WASHERS MAY BE REQUIRED DEPENDING ON SCALE AND CIRCUMSTANCE. IF NECESSARY, WASHRACK DESIGN MAY CONSIST OF ANY MATERIAL SUITABLE FOR TRUCK TRAFFIC THAT REMOVE MUD AND DIRT.
10. MAINTAIN AREA IN A WAY THAT PREVENTS TRACKING AND/OR FLOW OF MUD ONTO PUBLIC RIGHTS-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.

Sr-C CONFIGURATION OF TEMPORARY CULVERT CROSSINGS
(SECTIONS - NOT TO SCALE)

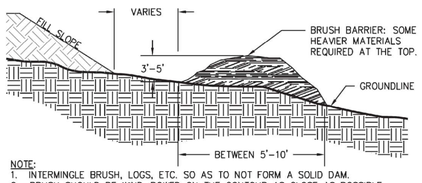


TYPICAL CULVERT CROSSING PLAN (NOT TO SCALE)



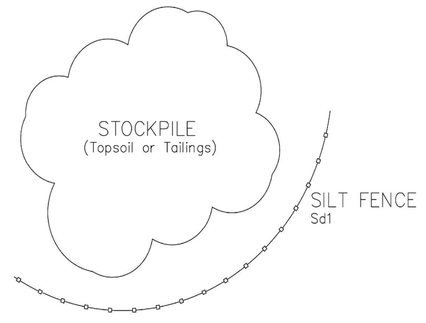
NOTES:
1. THIS TYPE OF CROSSING CAN BE INSTALLED IN BOTH A WET OR DRY WEATHER STREAM CONDITION WHERE THE DRAINAGE AREA EXCEEDS 10 ACRES.
2. REMOVE DURING CLEANUP.

Sd1-BB SEDIMENT BARRIERS
BRUSH BARRIER SECTION



NOTE:
1. INTERMINGLE BRUSH, LOGS, ETC. SO AS TO NOT FORM A SOLID DAM.
2. BRUSH SHOULD BE WIND-ROWED ON THE CONTOUR AS CLOSE AS POSSIBLE.
3. MINIMUM BASE WIDTH FOR BARRIER SHALL BE 5 FEET AND SHOULD BE NO WIDER THAN 10 FEET. THE HEIGHT OF THE BARRIER SHOULD BE BETWEEN 3' AND 5'.
4. A COMMERCIALLY AVAILABLE FILTER FABRIC MAY BE PLACED ON THE SIDE OF THE BRUSH BARRIER RECEIVING SEDIMENT-LADEN RUNOFF FOR ADDED FILTER CAPACITY (LOWER EDGE MUST BE BURIED IN A 6 INCH DEEP TRENCH AND THE UPPER EDGE MUST BE FASTENED TO THE BRUSH BARRIER).

STOCKPILE BMP (Typical)



NOTE: Silt fence will be placed on the down-gradient side of the stockpiles located outside of the PCP/WCP area.

EROSION CONTROL NOTES

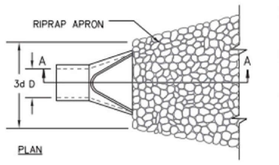
EROSION & SEDIMENT CONTROL MEASURES
1. BMPS WILL BE INSTALLED AS DEPICTED IN EROSION AND SEDIMENT CONTROL PLAN SHEET 6 PRIOR TO ANY OTHER CONSTRUCTION OR MINING ACTIVITY AND WILL BE MAINTAINED UNTIL PERMANENT GROUND COVER IS ESTABLISHED.
2. EROSION CONTROL NOTES:
   a. THE ESCAPE OF SEDIMENT FROM THE SITE WILL BE PREVENTED BY THE INSTALLATION OF EROSION CONTROL MEASURES AND PRACTICES PRIOR, OR CONCURRENT WITH LAND DISTURBING ACTIVITIES.
   b. EROSION CONTROL MEASURES WILL BE MAINTAINED AT ALL TIMES. IF FULL IMPLEMENTATION OF THE APPROVED PLAN DOES NOT PROVIDE FOR EFFECTIVE EROSION CONTROL, ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES WILL BE IMPLEMENTED TO CONTROL OR TREAT THE SEDIMENT SOURCE.
   c. ANY DISTURBED AREA LEFT EXPOSED FOR A PERIOD GREATER THAN 14 DAYS WILL BE STABILIZED WITH MULCH OR TEMPORARY SEEDING.
   d. ALL EROSION AND SEDIMENT CONTROL MEASURES WILL CONFORM WITH THE GUIDELINES OF THE "MANUAL FOR EROSION AND SEDIMENT CONTROL."
   e. DURING CONSTRUCTION AND MINING ACTIVITIES, TPM WILL MAINTAIN CAREFUL SCHEDULING AND PERFORMANCE TO ENSURE THAT LAND STRIPPED OF ITS NATURAL GROUND COVER IS EXPOSED ONLY IN SMALL QUANTITIES, AND PROTECTION IS ESTABLISHED.
   f. SEDIMENT AND EROSION CONTROL MEASURES MUST BE CHECKED AFTER EACH RAIN EVENT. EACH DEVICE IS TO BE MAINTAINED OR REPLACED IF SEDIMENT ACCUMULATION HAS REACHED HALF THE CAPACITY OF THE DEVICE. ADDITIONAL DEVICES MUST BE INSTALLED IF NEW CHANNELS HAVE DEVELOPED.
   g. DUST WILL BE CONTROLLED BY APPLYING WATER TO HAUL ROADS AND OTHER HIGH-TRAFFIC AREAS.
   h. TPM WILL INSPECT EROSION CONTROL MEASURES AT THE END OF EACH WORKING DAY TO ENSURE PROPER FUNCTIONING.

AUXILIARY EROSION & SEDIMENT CONTROL MEASURES
1. AUXILIARY BMPS INCLUDING DIVERSIONS, DIKES, OR BERMS WILL BE CONSTRUCTED TO RETAIN, DIRECT, AND CONTROL SURFACE WATER RUNOFF FROM AFFECTED AREAS INTO DESIGNED SEDIMENT CONTROL STRUCTURES. SURFACE WATER DISCHARGE WILL BE CONTROLLED AND RELEASED IN A NON-EROSIVE VELOCITY ONTO STABILIZED AREAS OR INTO STABILIZED CHANNELS.
2. CONTAINMENT BERMS WILL BE DESIGNED TO PROVIDE A MINIMUM OF 3 FEET OF FREEBOARD.
3. THE BERM ALONG THE SOUTHERN SITE BOUNDARY WILL BE CONSTRUCTED AS DEPICTED IN TYPICAL CROSS-SECTIONS (SHEET 5). CRESTS WILL BE SLOPED TO DIVERT STORMWATER TOWARD THE MINE AREA. THE TOP AND EXTERIOR SLOPE AND TOE OF ALL BERMS WILL BE GRASSED WITH QUICK-GROWING/GERMINATED GRASSES. SILT FENCING WILL BE INSTALLED ALONG THE EXTERIOR TOE OF THE OUTER BERMS, AND IN ALL AREAS WHERE DEEMED NECESSARY FOR EROSION CONTROL. SILT FENCING WILL BE ARMORED WITH STACKED HAY BALES ABUTTING THE FENCE PERPENDICULAR TO THE DIRECTION OF STORMWATER FLOW, WHERE NECESSARY.
4. AUXILIARY BMPS WILL BE SEEDED WITH APPROPRIATE GRASSES (BASED ON PLANTING SEASON) AS SOON AS POSSIBLE. EFFORT WILL BE MADE TO UTILIZE NATURAL EXISTING VEGETATION IN THOSE AREAS WHERE BUFFERS ARE PROPOSED OR WHERE PRACTICAL.

TEMPORARY AND PERMANENT VEGETATION
1. DISTURBED AREAS LEFT EXPOSED FOR A PERIOD GREATER THAN 14 DAYS WILL BE STABILIZED WITH MULCH OR TEMPORARY SEEDING.
2. SEEDBED PREPARATION - WHEN A HYDRAULIC SEEDER IS USED, SEEDBED PREPARATION IS NOT REQUIRED. WHEN USING CONVENTIONAL OR HANDSEEDING, SEEDBED PREPARATION IS NOT REQUIRED IF THE SOIL MATERIAL IS LOOSE AND NOT SEALED BY RAINFALL. WHEN SOIL HAS BEEN SEALED BY RAINFALL OR CONSISTS OF SMOOTH CUT SLOPES, THE SOIL WILL BE PITTED, TRENCHED OR OTHERWISE SCARIFIED TO PROVIDE A PLACE FOR SEED TO LODGE AND GERMINATE.
3. LIME AND FERTILIZER - AGRICULTURAL LIME IS REQUIRED UNLESS SOIL TESTS INDICATE OTHERWISE. APPLY AGRICULTURAL LIME AT A RATE OF ONE TON PER ACRE. FERTILIZER SHOULD BE APPLIED BEFORE LAND PREPARATION AND INCORPORATED WITH A DISK, RIPPER OR CHISEL.
4. TEMPORARY VEGETATION SPECIES WILL BE PLANTED IN ACCORDANCE WITH TABLE 6-4.1 - TEMPORARY COVER OR COMPANION COVER CROPS, IN THE MANUAL FOR SEDIMENT AND EROSION CONTROL IN GEORGIA, 2016.
5. MEASURES WILL BE TAKEN TO PROTECT TOPSOIL, TO INCLUDE SCARIFYING THE GROUND SURFACE.

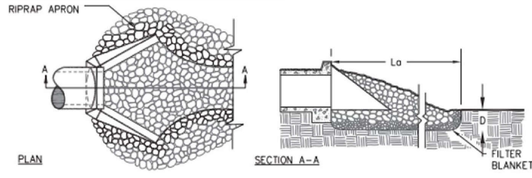
NPDES NOTES
1. FOR STORMWATER DISCHARGES OFF-SITE, THE FACILITY WILL OPERATE UNDER A DNR-EPD GENERAL PERMIT NO. GARO50000 STORMWATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITIES.
2. IN ADDITION TO SILT FENCE CONTROL, A BERM WILL BE CONSTRUCTED AROUND THE STOCKPILE FOR THE PRE-PROCESSING PLANT AND THE WET PROCESSING PLAN. THIS BERM IS NOT BEING INSTALLED AS A SEDIMENT OR STORMWATER CONTROL MEASURE BUT TO CAPTUR WATER DRAINING FROM THE WET MATERIAL OF THE STOCKPILE. THE BERM WILL INCIDENTALLY CAPTURE SOME STORMWATER, WHICH WILL BE PUMPED TO THE PROCESS WATER PONDS ALONG WITH ANY WATER DRAINING FROM WET MATERIAL.

St RIPRAP OUTLET PROTECTION
PIPE OUTLET TO FLAT AREA -- NO WELL DEFINED CHANNEL



NOTES:
1. Lo IS THE LENGTH OF THE RIPRAP APRON.
2. D = 1.5 TIMES THE MAXIMUM STONE DIAMETER BUT NOT LESSTHAN 6".
3. IN A WELL-DEFINED CHANNEL, EXTEND THE APRON UP THE CHANNEL BANKS TO AN ELEVATION OF 6" ABOVE THE MAXIMUM TAILWATER DEPTH OR TO THE TOP OF THE BANK (WHICHEVER IS LESS).
4. A FILTER BLANKET OR FILTER FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND THE SOIL FOUNDATION.

PIPE OUTLET TO WELL DEFINED CHANNEL



TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 7: EROSION & SEDIMENT CONTROL NOTES & DETAILS
TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)
ST. GEORGE, CHARLTON COUNTY, GEORGIA

GEORGIA REGISTERED No. PE024021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: N.T.S.

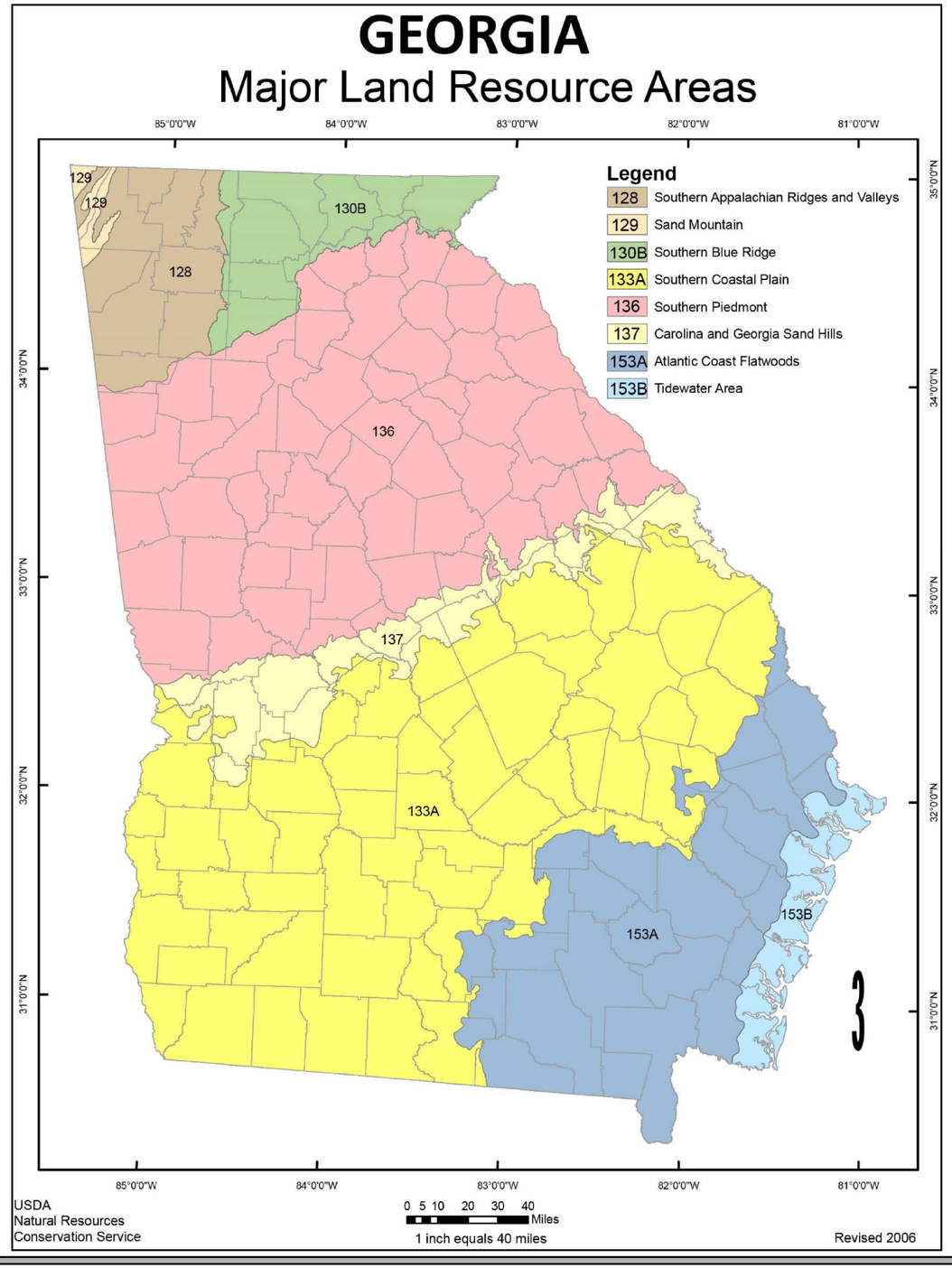
TABLE 6-4.1: Temporary Cover or Companion Crops Plant, Planting Rate and Planting (Manual for Sediment and Erosion Control, Georgia 2016)

Species	Broadcast Rates		Resource Area[1]	Planting Dates by Resource Area (Solid lines indicate optimum dates, dotted lines indicate permissible but marginal dates.) J F M A M J J A S O N D	Remarks
	Rate Per Acre[2]	Pure Live Seed (PLS) Per 1000 sqft			
BARLEY *Hordeum vulagre*					
alone	3 bu. (144 lbs)	3.3 lbs	M-L		14,000 seed per pound. Winter hardy. Use on productive soils.
in mixture	1/2 bu. (24lbs)	0.6 lb	P		
			C		
LESPEDEZA, ANNUAL *Lespedeza striata*					
alone	40 lbs	0.9 lb	M-L		200,000 seed per pound. May volunteer for several years. Use inoculant EL.
in mixture	10 lbs	0.2 lb	P		
			C		
LOVEGRASS, WEEPING *Eragrostis curvula*					
alone	4 lbs	0.1 lb	M-L		1,500,000 seed per pound. May last for several years. Mix with *Sericea lespedeza.*
in mixture	2 lbs	0.05 lb	P		
			C		
MILLET, BROWNTOP *Panicum fasciculatum*					
alone	40 lbs	0.9 lb	M-L		137,000 seed per pound. Quick dense cover. Will provide excessive competion in mixtures if seeded at high rate.
in mixture	10 lbs	0.2 lb	P		
			C		
MILLET, PEARL *Pennesetum glaucum*					
alone	50 lbs	1.1 lbs	M-L		88,000 seed per pound. Quick dense cover. May reach 5 feet in height. Not recommended for mixtures.
			P		
			C		
OATS *Avena sativa*					
alone	4 bu. (128 lbs)	2.9 lbs	M-L		13,000 seed per pound. Use on productive soils. Not as a winter hardy as rye or barley.
in mixture	1 bu. (32 lbs)	0.7 lb	P		
			C		
RYE *Secale cereale*					
alone	3 bu. (168 lbs)	3.9 lbs	M-L		18,000 seed per pound. Quick cover. Drought tolerant and winter hardy.
in mixture	1/2 bu. (28 lbs)	0.6 lb	P		
			C		
RYEGRASS, ANNUAL *Lolium temulentum*					
alone	40 lbs	0.9 lb	M-L		227,000 seed per pound. Dense cover. Very competitive and is <u>not</u> to be used in mixtures.
			P		
			C		
SUDANGRASS *Sorghum sudanese*					
alone	60 lbs	1.4 lbs	M-L		55,000 seed per pound. Good on droughty sites. <u>Not</u> recommended for mixtures.
			P		
			C		
TRITICALE *X-Triticosecale*					
alone	3 bu. (144 lbs)	3.3 lbs	C		Use on lower part of Southern Coastal Plain and in Atlantic Coastal Flatwoods only.
in mixture	1/2 bu. (24 lbs)	0.6 lb			
WHEAT *Triticum aestivum*					
alone	3 bu. (180 lbs)	4.1 lbs	M-L		15,000 seed per pound. Winter hardy.
in mixture	1/2 bu. (30 lbs)	0.7 lb	P		
			C		

[1]Temporary cover crops are very competitive and will crowd out perennials if seeded too heavily

[2]Reduce seeding rates by 50% when drilled.

[3]M-L represents the Mountain; Blue Ridge; and Ridges and Valleys MLRAs
P represents the Southern Piedmont MLRA
C represents Southern Coastal Plan; Sand Hills; Black Lands; and Atlantic Coast Flatwoods MLRAs



GEORGIA REGISTERED No. PE24021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

TTL

Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 8: TEMPORARY VEGETATION SCHEDULE TABLE

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/19/2021
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: N.T.S.

RECLAMATION OBJECTIVE

THE RECLAMATION OBJECTIVE IS TO RESTORE THE LAND SURFACE AND GROUNDWATER APPROXIMATELY TO PRE-MINING LEVELS, AND TO REVEGETATE THE SITE WITH PLANT COMMUNITIES ASSOCIATED WITH PINE FLATWOODS OR DEPRESSIONAL WETLANDS.

MINING & RECLAMATION SCHEDULE

UPON PERMIT APPROVAL, TPM ESTIMATES IT WILL TAKE 6 TO 12 MONTHS TO SET-UP FACILITIES AND PREPARE THE SITE PRIOR TO INITIATION OF MINING. MINING OF THE 582 ACRES OF THE DEMONSTRATION MINE SITE IS EXPECTED TO TAKE 4 YEARS. RECLAMATION WILL BE COMPLETED WITHIN 24 MONTHS AFTER MINING IS COMPLETED. THE TOTAL LIFE OF THE MINE, FROM SET UP TO COMPLETE RECLAMATION, IS ANTICIPATED TO BE 7 TO 8 YEARS.

RECLAMATION PROCEDURES & METHODS

SURFACE TOPOGRAPHY WILL BE RESTORED BY USING POST-PROCESSED SANDS AND MINE TAILINGS (SAND AND HUMATE) TO BACK-FILL THE EXCAVATION PIT. TOP SOIL WILL BE STOCKPILED PRIOR TO MINING AND REPLACED AFTER THE EXCAVATION IS BACK-FILLED.

GROUNDWATER LEVELS ARE EXPECTED TO RETURN NATURALLY AFTER THE DRAGLINE HAS MOVED AT LEAST 1,000 FEET TO THE NORTH. TO ENSURE GROUNDWATER HYDROLOGY IS NOT AFFECTED BY THE HOMOGENIZATION OF SOILS, A LOW PERMEABILITY LAYER WILL BE PLACED AS DESCRIBED IN THE SOIL AMENDMENT PLAN. GROUNDWATER LEVELS WILL BE MONITORED, AND THE ADAPTIVE MANAGEMENT PLAN WILL BE FOLLOWED TO ADDRESS ANY UNEXPECTED OCCURRENCES.

1 – ONCE THE MINE PIT REACHES APPROXIMATELY 500 FEET IN LENGTH, TAILINGS FROM THE WET CONCENTRATION PLANT WILL BE PLACED WITHIN THE PIT. AS THE MINE PIT PROGRESSES, TAILINGS DEPOSITION (BACKFILLING) WILL OCCUR CONTINUOUSLY, CONCURRENT WITH THE RATE OF MINING.

2 – PITS WILL BE FILLED TO THE APPROXIMATE PRE-MINING TOPOGRAPHY AND GRADES – LESS THE DEPTH OF TOPSOIL. HEAVY EQUIPMENT WITH ONBOARD GPS TECHNOLOGY OR A PEDESTRIAN SURVEY CREW UTILIZING GPS TECHNOLOGY WILL VERIFY RECLAIMED ELEVATIONS.

3 – TOPSOIL WILL BE REPLACED AND FINAL GRADING WILL MIMIC THE PRE-MINING SURFACE. TOP SOIL WILL BE REPLACED AFTER THE DRAG LINE HAS PROGRESSED AT LEAST ONE TRANSECT TO THE NORTH OF THE TRANSECT BEING RESTORED. (THIS DISTANCE IS NECESSARY TO ENSURE THE TOP SOIL IS NOT REMOVED WHEN THE ADJACENT TRANSECT IS EXCAVATED.)

4 – GROUNDWATER LEVELS WILL BE RESTORED NATURALLY ONCE THE DRAGLINE HAS MOVED AT LEAST 1,000 FEET TO THE NORTH. MONITORING WELLS WILL BE CHECKED AT SUCH TIME TO ENSURE GROUNDWATER LEVELS HAVE BEEN RESTORED AND/OR TO INITIATE APPROPRIATE ADAPTIVE MANAGEMENT.

5 – REVEGETATION WILL BEGIN WITH THE REPLACEMENT OF TOP SOIL. TEMPORARY VEGETATION/SEEDING (SHEETS 6, 7 & 8) WILL BE USED AS NEEDED AND REQUIRED FOR EROSION CONTROL. EROSION CONTROL MEASURES WILL REMAIN IN PLACE UNTIL ADEQUATE VEGETATIVE COVER HAS BEEN ESTABLISHED.

6 – NATURAL PLANT COMMUNITIES ARE EXPECTED TO DEVELOP FROM THE SEEDBANK IN THE TOPSOIL, WHICH WILL BE PRESERVED AND REPLACED. THEREFORE, NO SUPPLEMENTAL PLANTING OF HERBACEOUS OR SHRUB VEGETATION IS ANTICIPATED. TREES WILL BE PLANTED 1 TO 2 YEARS AFTER THE START OF MINING IN THE APPROPRIATE SEASONS ACCORDING TO THE PRE-MINING HABITAT CLASSIFICATIONS DESCRIBED BELOW AND SHOWN ON SHEET 10. THE GROWING SEASON, AS INDICATED BY NRCS AgACIS WETS TABLE (WETS STATION: FOLKSTON 9 SW GA. YEARS: 1971-2000) FOR THE PROBABILITY OF TEMPERATURES ABOVE 28 DEGREES FARHENHEIT, IS BETWEEN FEBRUARY 12 AND DECEMBER 20. STABLE GROWTH WILL BE DETERMINED WHEN PLANTED VEGETATION MAINTAINS A SURVIVABILITY RATE OF 50 PERCENT. FORESTED SYSTEMS WILL REQUIRE DECADES TO REACH MATURITY.

MESIC PINE FLATWOODS (UPLAND & NON-JURISDICTIONAL WETLAND)

- MESIC PINE FLATWOODS WILL BE PLANTED WITH LONGLEAF PINE (PINUS PALUSTRIS) AND/OR SLASH PINE (PINUS ELLIOTTI).
- PLANTING WILL OCCUR IN LATE FALL/WINTER AS SITE AND WEATHER/CLIMATIC CONDITIONS ALLOW.
- NO FERTILIZERS WILL BE UTILIZED.
- RECLAMATION WILL BE DEEMED SUCCESSFUL WHERE TREE VEGETATION MAINTAINS A SURVIVABILITY RATE OF 50 PERCENT.

WET PINE FLATWOODS (NON-JURISDICTIONAL WETLAND)

- WET PINE FLATWOODS WILL BE PLANTED SLASH PINE.
- PLANTING WILL OCCUR IN LATE FALL/WINTER AS SITE AND WEATHER/CLIMATIC CONDITIONS ALLOW.
- NO FERTILIZERS WILL BE UTILIZED.
- RECLAMATION WILL BE DEEMED SUCCESSFUL WHERE TREE VEGETATION MAINTAINS A SURVIVABILITY RATE OF 50 PERCENT.

DEPRESSIONAL WETLANDS (NON-JURISDICTIONAL)

- DEPRESSIONAL WETLANDS WILL BE PLANTED WITH POND CYPRESS (TAXODIUM ASCENDENS), SWAMP TUPELO (NYSSA BIFLORA), POND PINE (PINUS SEROTINA), AND/OR SLASH PINE. SUPPLEMENTAL SAPLINGS INCLUDING LOBLOLLY BAY (GORDONIA LASIANTHUS), SWAMP BAY (PERSEA PALUSTRIS), SWEETBAY (MAGNOLIA VIRGINIANA) MAY BE ADDED TO THE PLANTING SUITE AS INDICATED BY OBSERVED HABITAT CONDITIONS.
- PLANTING WILL OCCUR IN LATE FALL/EARLY SPRING AS SITE AND WEATHER/CLIMATIC CONDITIONS ALLOW.
- NO FERTILIZERS WILL BE UTILIZED.
- RECLAMATION WILL BE DEEMED SUCCESSFUL WHERE TREE VEGETATION MAINTAINS A SURVIVABILITY RATE OF 50 PERCENT.

7 – ALTHOUGH RECLAIMED HABITATS AND THE ASSOCIATED PLANTINGS ARE ANTICIPATED TO FOLLOW THE SCHEDULE OUTLINED IN #4 AND AS SHOWN ON SHEET 10, ACTUAL TREE SPECIES TO BE PLANTED WILL DEPEND ON NATURAL HERBACEOUS/SHRUB RECRUITMENT AND DIRECT OBSERVATION OF HYDROLOGY AND TARGET SPECIES AS OUTLINED IN THE TABLE BELOW. PRIOR TO PLANTING, THE PREVIOUSLY MINED AREA WILL BE MAPPED BASED ON NATURALLY RE-ESTABLISHING PLANT COMMUNITIES. ON-SITE VEGETATION COMMUNITIES WILL BE IDENTIFIED AND MAPPED TO ROUGHLY FOLLOW THE GUIDE TO THE NATURAL COMMUNITIES OF FLORIDA (2010 EDITION).

HABITAT SUMMARY AND PROPOSED PLANTINGS BY TARGET SPECIES OBSERVED DURING VEGETATION MAPPING

HABITAT	PLANTINGS	TARGET SPECIES OBSERVATIONS
MESIC PINE FLATWOODS	LONGLEAF PINE, SLASH PINE	BUNCHGRASSES (*ARISTIDA SP., ANDROPOGON SP., SPOROBOLUS SP., DICHANTHELIUM SP.*), SAW PALMETTO (*SERENOA REPENS*), GALLBERRY (*ILEX GLABRA*), FETTERBUSH (*LYONIA LUCIDA*), AND DWARF LIVE OAK (*QUERCUS MINIMA*).
WET PINE FLATWOODS	SLASH PINE	BUNCHGRASSES (*ARISTIDA SP., ANDROPOGON SP., CTENIUM AROMATICUM, MUHLENBERGII SP., SPOROBOLUS SP., RHYNCHOSPORA SP.*), LARGE GALLBERRY (*ILEX CORIACEA*), FETTERBUSH, SWEETBAY, SAW PALMETTO
DEPRESSIONAL WETLAND – DOME/DEPRESSION SWAMP	POND CYPRESS, SWAMP TUPELO	VIRGINIA CHAIN FERN (*ANCHISTIA VIRGINICA*), ROYAL FERN (*OSMUNDA REGALIS*), CINNAMON FERN (*OSMUNDA CINNAMOMEA*), MAIDENCANE (*PANICUM HEMITOMON*), REDROOT (*LACHNANTHES CAROLINIANA*), BEAKSEDGES (*RHYNCHOSPORA SP.*), AND SEDGES (*CAREX SP.*).
DEPRESSIONAL WETLAND – SHRUB BOG	POND PINE, SLASH PINE	TITI (*CYRILLA RACEMIFLORA*,) BLACK TITI (*CLIFTONIA MONOPHYLLA*), SWEET PEPPERBUSH (*CLETHRA ALNIFOLIA*), FETTERBUSH, LARGE GALLBERRY, AND LAUREL GREENBRIER (*SMILAX LAURIFOLIA*).
DEPRESSIONAL WETLAND – BAYGALL	LOBLOLLY BAY, SWAMP BAY, SWEETBAY	LOBLOLLY BAY, SWAMP BAY, SWEETBAY, FETTERBUSH, DAHOON (*ILEX CASSINE*), LARGE GALLBERRY, TITI, BLACK TITI, WAX MYRTLE (*MYRICA CERIFERA*), DOGHOBBLE (*LEUCOTHOE SP.*), SWEETSPIRE (*ITEA VIRGINICA*).

8 – RECLAMATION AREAS WILL BE MONITORED FOR TWO YEARS FOLLOWING PLANTING PENDING RELEASE OF THE MINE FROM THE RECLAMATION ACTIVITIES.

PERFORMANCE CRITERIA FOR RECLAMATION

SPECIFIC REQUIREMENTS THAT TPM WILL ADHERE TO FOR THIS RECLAMATION PLAN ARE:

A. GRADE ALL PEAKS, RIDGES, AND VALLEYS RESULTING FROM SURFACE MINING AND BACKFILL ALL PITS AND TRENCHES RESULTING FROM SAME IN A MANNER TO MINIMIZE ANY HAZARDOUS EFFECTS OF MINING ADJACENT TO ANY STATE OR COUNTY MAINTAINED PUBLIC ROAD.

B. BACKFILL ALL AFFECTED LANDS AS STATED IN THE RECLAMATION PROCEDURES OF THIS PLAN UTILIZING POST-PROCESSED SANDS, MINE TAILINGS (SAND AND HUMATE), AND/OR BORROW FROM AFFECTED (PERMITTED) LAND UNLESS APPROVAL FROM THE DIVISION IS OBTAINED TO UTILIZE OTHER MATERIALS. SOUND ENGINEERING PRINCIPLES SHALL BE APPLIED TO ENSURE THAT AFFECTED LANDS, AS RECLAIMED, MEET THE INTENDED USE.

C. APPLY EROSION CONTROL MEASURES TO PROTECT THE TOPSOIL COVER UNTIL AN ADEQUATE VEGETATIVE COVER IS ESTABLISHED. EROSION CONTROL MEASURES MAY INCLUDE SCARIFYING THE LAND SURFACE PARALLEL TO CONTOURS.

D. NO HIGHWALLS WILL REMAIN ON SITE.

E. ALL AFFECTED LAND WILL BE GRADED TO MIMIC PRE-MINING TOPOGRAPHY AND BLENDED INTO THE EXISTING LANDSCAPE, UNLESS OTHERWISE AMENDED.

F. CONSTRUCTED SLOPES WILL NOT EXCEED THREE HORIZONTALS TO ONE VERTICAL (3:1) EXCEPT WHERE MAY BE APPROVED OTHERWISE IN THIS PLAN. FILL AND CUT SLOPES SHALL BE DESIGNED AND CONSTRUCTED TO PROHIBIT SLUMPING OR SHEAR FAILURES. PRIOR TO FINAL GRADING, ALL SLOPES WILL BE BLENDED IN WITH THE ORIGINAL EXISTING TOPOGRAPHY. SLOPE GRADES SHALL BE UNIFORM. MECHANICAL OR VEGETATIVE OR BOTH STABILIZATION MEASURES SHALL BE EMPLOYED AS SOON AS PRACTICAL TO PREVENT EROSION.

G. SPOIL OR REFUSE, WHEN USED AS BACKFILL MATERIAL, FOR BERM OR OTHER CONSTRUCTION, WILL BE SEGREGATED AS NECESSARY, EMPLACED AND COMPACTED IN ACCORDANCE WITH SOUND ENGINEERING PRACTICES TO PROVIDE FOR THE PURPOSE INTENDED. ALL NEW LANDFORM STRUCTURES CREATED WITH THE USE OF SPOIL OR REFUSE MATERIALS SHALL BE CONSTRUCTED IN A MANNER TO PROTECT AGAINST FAILURE, SUBSIDENCE AND/OR EROSION AND WILL BE PERMANENTLY STABILIZED UPON COMPLETION OF CONSTRUCTION.

H. NO LAKES OR PONDS ARE PROPOSED AS PART OF THE RECLAMATION PLAN.

I. DECOMMISSIONING OF THE PONDS WILL OCCUR IN THE FOLLOWING MANNER:

1. AS MINING OPERATIONS CEASE, EVAPORATORS WILL BE USED TO DRAW DOWN THE WATER MANAGEMENT PONDS AS MUCH AS POSSIBLE IN PREPARATION FOR CLOSURE.
2. WATER REMAINING IN THE PROCESS WATER PONDS (P1 – P4) WILL BE PUMPED TO WATER MANAGEMENT POND M1.
3. THE WATER MANAGEMENT PONDS WILL BE DRAINED SEQUENTIALLY STARTING WITH M1, WHICH WILL BE DRAINED INTO POND M2. POND M2 WILL THEN BE DRAINED INTO POND M3, AND POND M3 WILL BE DRAINED IN POND M4.
4. WATER REAMINING IN POND M4 THAT CANNOT BE EVAPORATED WILL BE HAULED OFF-SITE.
5. AFTER EACH POND IS DRAINED, ITS ACCUMULATED SEDIMENTS AND LINER WILL BE REMOVED, BUT THE BERMS WILL BE LEFT IN PLACE. ONCE THE LAST WATER HAS BEEN REMOVED AND THE FINAL LINER HAS BEEN HAULED OFF-SITE, THE SOIL USED TO CONSTRUCT THE BERMS WILL BE SPREAD OVER THE SITE TO THE FINAL GRADES.
6. ADDITIONAL INFORMATION CAN BE FOUND IN THE WATER USE MANAGEMENT PLAN (EXHIBIT L) AND ON DRAWING C-801.
7. TWIN PINES MINERALS, LLC RESERVES THE RIGHT TO REQUEST THAT THE PONDS REMAIN IN PLACE FOR POTENTIAL REUSE. DURING SUCH TIME, ALL PONDS LEFT IN PLACE WILL BE MAINTAINED IN A MANNER CONSISTENT WITH THAT REQUIRED BY PERMIT DURING THE OPERATION OF THE MINE.

J. THE OPERATOR WILL PREPARE AND FILE A FINAL RECLAMATION REPORT AND REQUEST FOR RELEASE UPON COMPLETION OF RECLAMATION RESPONSIBILITIES ON AFFECTED ACREAGE.

1. SOIL AMENDMENT PLAN

A SOIL AMENDMENT LAYER OF 10.9% BENTONITE WILL BE APPLIED IN A ~3-FOOT-THICK LAYER. THE PURPOSE OF THIS LAYER IS TO MIMIC THE HYDRAULIC CONDUCTIVITY OF THE CONSOLIDATED BLACK SANDS THAT UNDERLAY PORTIONS OF THE SITE AND TO ENSURE THAT THE HOMOGENIZATION OF SOILS DUE TO MINING DOES NOT AFFECT OR ALTER EXISTING GROUNDWATER DIVIDE.

1.1 PROCEDURES FOR APPLICATION OF THE BENTONITE LAYER

THE FOLLOWING PROCEDURES WILL BE USED TO INSTALL THE LOW-PERMEABILITY LAYER:

- A COVERED FACILITY WILL BE CONSTRUCTED NEAR WHERE SAND TAILINGS EXIT THE PLANT AND ARE LOADED ONTO THE TAILINGS CONVEYOR. THE BENTONITE AND SAND WILL BE LOADED INTO HOPPERS THAT WILL FEED THE CORRECT BLEND (89.1% SAND/10.9% BENTONITE) TO A MIXING BOX. ONCE BLENDED, THE AMENDED SOIL MIXTURE WILL BE LOADED ONTO THE MAIN TAILINGS CONVEYOR SYSTEM AND TRANSPORTED TO THE OPEN PIT.
- THE MIXING PROCESS AND TRANSPORT ON THE MAIN TAILINGS CONVEYOR WILL ONLY TAKE PLACE DURING CERTAIN PERIOD(S) OF THE DAY TO ENSURE THE BENTONITE-SAND BLEND IS NOT DILUTED WITH THE SAND-ONLY TAILINGS.
- PRIOR TO PLACEMENT OF THE SOIL AMENDMENT LAYER, THE PIT WILL BE BACKFILLED TO A LEVEL APPROXIMATELY THREE FEET BELOW THE TOP OF THE HUMATE-CEMENTED CONSOLIDATED BLACK SAND AS MAPPED IN SECTION 1.2.
- ONCE THE BLENDED SAND/BENTONITE MATERIAL REACHES THE END OF THE TAILINGS CONVEYOR, IT WILL BE TRANSFERRED TO A PORTABLE CONVEYOR/STACKER THAT WILL CAST THE BLENDED MATERIAL INTO THE OPEN PIT. THE BLENDED SAND/BENTONITE MATERIAL WILL BE PLACED AT A DEPTH THAT COINCIDES, AS CLOSE AS POSSIBLE, WITH THE TOP THREE FEET OF THE MAPPED HUMATE-CEMENTED CONSOLIDATED BLACK SAND (SEE SECTION 1.2). BASED ON EXISTING DATA FROM ON-SITE BORINGS, THE DEPTHS TO THE TOP OF THE HUMATE-CEMENTED CONSOLIDATED BLACK SAND ARE VARIABLE AND ARE ANTICIPATED TO RANGE FROM 8 TO 25 FEET BGS.
- BECAUSE THE SAND/BENTONITE MIXTURE IS VERY COHESIVE, IT CAN BE CAST INTO THE OPEN PIT WHETHER IT IS WET OR DRY, WITHOUT SEPARATING. BECAUSE BACKFILLING WILL OCCUR WITHIN 500 FEET OF THE LEADING EDGE OF THE DRAG LINE, HOWEVER, GROUNDWATER WILL NOT HAVE TIME TO COMPLETELY FILL THE PIT, AND MOST WATER WILL BE ABSORBED BY THE TAILINGS MATERIAL, WHICH WILL BE VERY DRY AND ABSORBENT. IF GROUNDWATER RISES ABOVE THE ELEVATION WHERE THE SAND/BENTONITE MIXTURE WILL BE PLACED, THE MINE PIT WILL TEMPORARILY BE DEWATERED TO ALLOW PLACEMENT OF THE BLENDED SAND/BENTONITE MATERIAL. WATER WITHDRAWN FROM THE ACTIVE MINING PIT WILL BE PUMPED TO THE MINE PIT WATER MANAGEMENT POND M1 AND SUBSEQUENTLY REUSED BY THE FACILITY.
- THE ELEVATION OF THE TOP OF THE BLENDED MATERIAL WILL BE SURVEYED FOLLOWING EACH SOIL AMENDMENT PLACEMENT EVENT.
- SAND-ONLY TAILINGS WILL BE PLACED ABOVE THE SAND/BENTONITE MIXTURE.
- A TOPSOIL LAYER WILL THEN BE PLACED ON TOP OF THE SAND TAILINGS.
- PLACEMENT OF THE SAND/BENTONITE LAYER WITHIN THE MINE PIT WILL BE OBSERVED BY A GEORGIA-LICENSED PROFESSIONAL ENGINEER OR GEOLOGIST. CERTIFIED REPORTS WILL BE SUBMITTED TO EPD QUARTERLY.

1.2 MAPPING THE HUMATE-CEMENTED CONSOLIDATED BLACK SANDS

TO PROVIDE INFORMATION THAT MAY BE NEEDED FOR ANY FUTURE ADAPTIVE MANAGEMENT RESPONSE, THE PRESENCE OR ABSENCE OF THIS SOIL TYPE WILL BE DOCUMENTED AS THE MINING PROGRESSES.

SOIL BORINGS WILL BE PLACED IN A 200-FOOT BY 200-FOOT GRID. ONE SAMPLE WILL BE COLLECTED FROM THE APPROXIMATE CENTER OF EACH GRID CELL BEFORE THE CELL IS EXCAVATED. THE PRESENCE OR ABSENCE OF HUMATE-CEMENTED BLACK SANDS WILL BE NOTED AND DOCUMENTED.

1.2.1. FIELD IDENTIFICATION OF BLACK SANDS

THE FOLLOWING BLACK HUMATE-STAINED SOIL LAYERS HAVE BEEN IDENTIFIED WITHIN THE MINE SITE:

1. UNCONSOLIDATED BLACK SANDS,
2. SEMI-CONSOLIDATED BLACK TO DARK BROWN SANDS, AND
3. CONSOLIDATED BLACK SANDS

THE CONSOLIDATED BLACK SANDS ARE EASILY DISTINGUISHED FROM THE HIGHER PERMEABILITY UNCONSOLIDATED AND SEMI-CONSOLIDATED BLACK SAND LAYERS DUE TO THE FIRM OR STIFF, CEMENTED CHARACTERISTICS OF THE SAND GRAINS (SEE PHOTOGRAPH 1). RESULTS OF LABORATORY PERMEABILITY TESTING OF HUMATE-CEMENTED CONSOLIDATED BLACK SANDS COLLECTED FROM THE SITE INDICATED VERTICAL HYDRAULIC CONDUCTIVITIES RANGING FROM 10^{-7} TO 10^{-6} CENTIMETERS PER SECOND (CM/S). DIFFERENCES IN THE APPEARANCE OF THE CONSOLIDATED, SEMI-CONSOLIDATED AND UNCONSOLIDATED BLACK SANDS ARE SHOWN IN THE PHOTOGRAPHS PROVIDED BELOW:

PHOTOGRAPH 1. LOW PERMEABILITY HUMATE-CEMENTED CONSOLIDATED BLACK SAND

PHOTOGRAPH 2. SEMI-CONSOLIDATED BLACK SAND

PHOTOGRAPH 3. UNCONSOLIDATED BLACK SAND

AS SHOWN ABOVE, CONSOLIDATED SANDS ARE EASILY RECOGNIZED IN THE FIELD BASED ON THE FOLLOWING CHARACTERISTICS:

1. BLACK OR VERY DARK BROWN COLOR
2. FIRM OR STIFF CORE SAMPLES THAT MAINTAIN A CYLINDRICAL SHAPE WHEN RETRIEVED FROM THE BOREHOLE (SIMILAR IN APPEARANCE TO PHOTOGRAPH 1, AS COMPARED TO PHOTOGRAPHS 2 AND 3 ABOVE).
3. OFTEN DISPLAY A GREASY APPEARANCE ON THE CORE SURFACE UPON REMOVAL FROM THE SAMPLER

1.2.2. DRILLING PROCEDURES

DRILLING WILL BE PERFORMED BY TPM. A SONIC, GEOPROBE, HOLLOW-STEM AUGER OR EQUIVALENT TYPE DRILL RIG WILL BE USED TO COLLECT SOIL SAMPLES CONTINUOUSLY FROM BOREHOLES IN ADVANCE OF THE MINING. THE BORINGS WILL BE DRILLED ALONG THE CENTER LINES OF THE MINING CUTS AND EXTEND TO THE MAXIMUM DEPTH OF MINING (ABOUT 50 FEET BELOW LAND SURFACE). THE FOLLOWING INFORMATION WILL BE RECORDED AT EACH BOREHOLE BY A GEORGIA-LICENSED PROFESSIONAL GEOLOGIST:

1. UNIQUE BORING IDENTIFIER
2. DATE OF DRILLING (START/END DATE)
3. SURVEYED BORING LOCATION AND ELEVATION DATA
4. DEPTH TO SATURATED SOILS AS MEASURED IN THE BOREHOLE OR AS IDENTIFIED IN THE CORE
5. LITHOLOGIC DESCRIPTIONS OF SUBSURFACE SOIL TO INCLUDE:
   a. SOIL TYPE (UNIFIED SOIL CLASSIFICATION SYSTEM)
   b. PERCENTAGE OF CLAY VERSUS SAND (VISUAL ESTIMATE)
   c. HUMATE PRESENT AND RELATIVE PERCENT (I.E. LOW, MEDIUM, HIGH; VISUAL ESTIMATE)
   d. DEGREE OF CONSOLIDATION OF SANDS (UNCONSOLIDATED, SEMI-CONSOLIDATED, OR CONSOLIDATED)
   e. SORTING OF SAND
   f. DESCRIPTION OF FINE, MEDIUM, COARSE GRAINS PER SANDY SOIL TYPE
   g. COLOR DESCRIPTION USING A MUNSELL OR GSA ROCK COLOR CHART
6. BORING TERMINATION DEPTH
7. PHOTOGRAPHS OF EACH DRILL SAMPLE RETURN INTERVAL. PHOTOGRAPHS WILL BE REFERENCED WITH THE BORING IDENTIFIER, DATE, AND SAMPLE DEPTH INTERVAL

THE BORING DATA WILL BE COMPILED INTO A DATABASE SYSTEM AND USED TO GENERATE SUBSURFACE BORING LOGS AND CROSS SECTIONS.

1.2.3. GROUNDWATER-LEVEL MONITORING PLAN

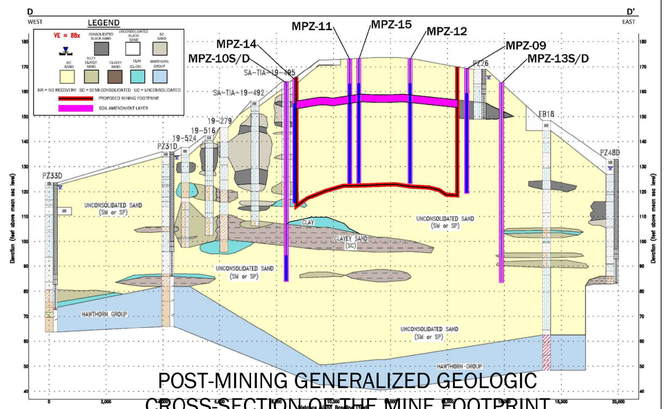
A GROUNDWATER-LEVEL MONITORING PLAN, ACTION LEVELS FOR COMPLIANCE, AND AN ADAPTIVE MANAGEMENT (OR CONTINGENCY) PLAN IF GROUNDWATER LEVELS ARE NOT RESTORED IS INCLUDED IN SECTION 2, SHEET 11 OF THE GROUNDWATER AND SURFACE WATER MONITORING PLAN OF THE SURFACE MINING LAND USE PLAN.

1.2.4. PROCEDURES FOR DISCONTINUING THE SOIL AMENDMENT

TPM WILL SUBMIT THE RESULTS (E.G., SOIL BORING LOGS, CROSS-SECTIONS, ISOPACH MAPS, ETC.) OF THE SUBSURFACE MAPPING OF THE HUMATE-CEMENTED, CONSOLIDATED BLACK SANDS TO EPD. IF THE MAPPING DEMONSTRATES THE ABSENCE OF HUMATE-CEMENTED, CONSOLIDATED BLACK SAND WITHIN AN AREA YET TO BE MINED, TPM WILL REQUEST EPD'S AUTHORITY TO PROCEED WITHOUT THE ADDITION OF THE SOIL AMENDMENT LAYER IN THOSE SPECIFIED AREAS. THE BENTONITE LAYER RECREATING THE HUMATE-CEMENTED, CONSOLIDATED BLACK SAND WILL BE CONTINUOUS UNLESS TPM RECEIVES EPD APPROVAL TO DISCONTINUE APPLICATION OF THE SOIL AMENDMENT LAYER IN THOSE SPECIFIED AREAS.

IT IS IMPORTANT TO NOTE THAT IF THE HUMATE-CEMENTED, CONSOLIDATED BLACK SANDS ARE NOT CONTINUOUS AS DEMONSTRATED BY TPM'S PRIOR INVESTIGATIONS, THE ADDITION OF A CONTINUOUS SOIL AMENDMENT LAYER MAY ADVERSELY IMPACT THE LOCAL GROUNDWATER SYSTEM. POTENTIAL IMPACTS INCLUDE:

- ARTIFICIALLY RAISING THE WATER TABLE ABOVE THE LAND SURFACE LEADING TO PONDING OR INCREASED SURFACE WATER RUNOFF,
- REDUCING DOWNWARD FLOW TO DEEPER PARTS OF THE SURFICIAL AQUIFER,
- REDUCING GROUNDWATER DISCHARGE TO THE WEST AND TO THE EAST OF TRAIL RIDGE.



POST-MINING GENERALIZED GEOLOGIC CROSS-SECTION OF THE MINE FOOTPRINT

JAMES R. SMITH — GEORGIA REGISTERED PROFESSIONAL GEOLOGIST — No. PG001877 — 11-28-22

GEORGIA REGISTERED No. PE24021 PROFESSIONAL ENGINEER — SHERYLE G. REEVES — 11-28-22

TTL

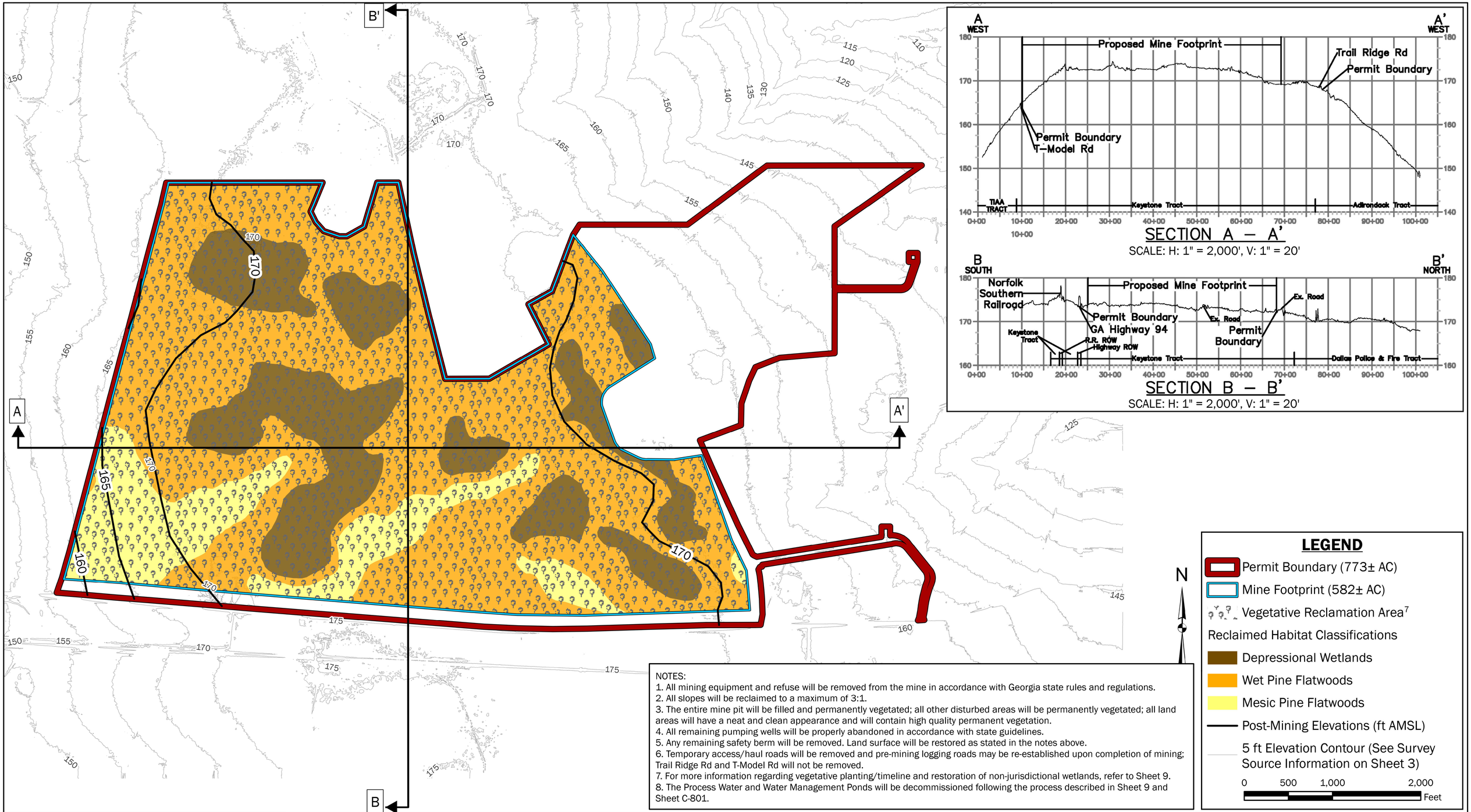
Certificate of Authorization No.: PEF00415
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 9: POST-MINING RECLAMATION PLAN (1)

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY:	DEK
CHECKED BY:	SGR
DRAWING DATE:	11/13/2020
REVISION DATE:	11/28/2022
TTL JOB NO.:	18-02-00804.00
APPROX. SCALE:	N/A



SECTION A – A'

SCALE: H: 1" = 2,000', V: 1" = 20'

SECTION B – B'

SCALE: H: 1" = 2,000', V: 1" = 20'

LEGEND

- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- Vegetative Reclamation Area[7]

Reclaimed Habitat Classifications

- Depressional Wetlands
- Wet Pine Flatwoods
- Mesic Pine Flatwoods
- Post-Mining Elevations (ft AMSL)
- 5 ft Elevation Contour (See Survey Source Information on Sheet 3)

NOTES:

1. All mining equipment and refuse will be removed from the mine in accordance with Georgia state rules and regulations.
2. All slopes will be reclaimed to a maximum of 3:1.
3. The entire mine pit will be filled and permanently vegetated; all other disturbed areas will be permanently vegetated; all land areas will have a neat and clean appearance and will contain high quality permanent vegetation.
4. All remaining pumping wells will be properly abandoned in accordance with state guidelines.
5. Any remaining safety berm will be removed. Land surface will be restored as stated in the notes above.
6. Temporary access/haul roads will be removed and pre-mining logging roads may be re-established upon completion of mining; Trail Ridge Rd and T-Model Rd will not be removed.
7. For more information regarding vegetative planting/timeline and restoration of non-jurisdictional wetlands, refer to Sheet 9.
8. The Process Water and Water Management Ponds will be decommissioned following the process described in Sheet 9 and Sheet C-801.

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 10: POST-MINING RECLAMATION PLAN (2)

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

GEORGIA REGISTERED No. PE024021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: 1 in = 500 ft

GROUNDWATER- AND SURFACE-WATER MONITORING PLAN

THIS PLAN IS DESIGNED TO MONITOR THE IMPACT OF THE MINING ACTIVITIES ON WATER LEVELS AND WATER QUALITY IN THE VICINITY OF THE MINE (DURING MINING AND POST-MINING), INCLUDING ANY POTENTIAL IMPACTS TO THE OKEFENOKEE SWAMP.

1. LOCATION OF MONITORING STATIONS

1.1 PIEZOMETERS

1.1.1 EXISTING PIEZOMETERS

SIXTY-NINETY (69) PIEZOMETERS ARE CURRENTLY INSTALLED WITHIN THE MINE AND SURROUNDING TPM OWNED PROPERTIES OUTSIDE THE MINE FOOTPRINT. THE LOCATIONS ARE SHOWN ON SHEET 12. TWIN PINES MINERALS, LLC (TPM) NO LONGER HAS ACCESS TO THE TIAA-OWNED PROPERTY WEST OF THE MINE.

ALL PIEZOMETERS ARE EQUIPPED WITH IN-SITU, INC. RUGGED TROLL 200 NON-VENTED DATA LOGGER/CABLE COMBINATIONS. THESE PIEZOMETERS WERE INSTALLED BETWEEN JANUARY AND MAY 2019, AND THUS HAVE BEEN RECORDING BACKGROUND GROUNDWATER-LEVEL DATA FOR A MINIMUM OF TWO YEARS.

1.1.2 NEW PIEZOMETERS

A) LOCATION

TWENTY-FOUR (24) ADDITIONAL PIEZOMETERS WILL BE INSTALLED PRIOR TO THE BEGINNING OF MINING.

- EIGHTEEN (18) PIEZOMETERS WILL BE INSTALLED TO DEPTHS OF ABOUT 50 FEET BELOW GROUND SURFACE (BGS) AND USED TO MONITOR WATER LEVELS AND/OR WATER QUALITY ACROSS THE MAXIMUM VERTICAL EXTENT OF THE MINE.
- SIX (6) ADDITIONAL PIEZOMETERS WILL BE INSTALLED TO DEPTHS OF ABOUT 80 FEET BGS IN ORDER TO MONITOR WATER LEVELS AND/OR WATER QUALITY OF THE SURFICIAL AQUIFER BELOW THE MAXIMUM MINING DEPTH.

THESE 24 SHALLOW AND DEEP PIEZOMETERS (50-FOOT AND 80-FOOT DEEP) ARE DESIGNATED AS FOLLOWS:

TABLE 1.1.2. PROPOSED NEW PIEZOMETERS					
MPZ-01S	MPZ-04	MPZ-07	MPZ-10D	MPZ-13D	MPZ-16D
MPZ-01D	MPZ-05S	MPZ-08	MPZ-11	MPZ-14	MPZ-17S
MPZ-02	MPZ-05D	MPZ-09	MPZ-12	MPZ-15	MPZ-17D
MZP-03	MPZ-06	MPZ-10S	MPZ-13S	MPZ-16S	MPZ-18

SHALLOW PIEZOMETERS MPZ-01S, MPZ-02, MPZ-03, MPZ-04, MPZ-05S, MPZ-06, MPZ-07, MPZ-08, MPZ-09, MPZ-10S, MPZ-11, MZP-12, MPZ-13S, MPZ-14, MPZ-15, MPZ-16S MPZ-17S, AND MPZ-18 WILL BE DRILLED TO DEPTHS OF ABOUT 50 FEET BGS AND CONSTRUCTED WITH 40 FEET OF 0.010-INCH SLOTTED SCREEN. THE SCREENED INTERVAL OF THESE PIEZOMETERS WILL BE FROM 10 TO 50 FEET BGS. DEEP PIEZOMETERS MPZ-01D, MPZ-05D, MPZ-10D, MPZ-13D, MPZ-16D, AND MPZ17D WILL BE DRILLED TO DEPTHS OF ABOUT 80 FEET BGS AND CONSTRUCTED WITH 10 FEET OF 0.010-INCH SLOTTED SCREEN. THE SCREENED INTERVAL OF THESE PIEZOMETERS WILL BE FROM 70 TO 80 FEET BGS.

A NEW SHALLOW PIEZOMETER WILL BE INSTALLED APPROXIMATELY EVERY 2,000 FEET IN AN EAST-WEST DIRECTION AND EVERY 1,000 FEET IN THE NORTH-SOUTH DIRECTION. THE SPACING WILL PROVIDE FOUR ROWS OF PIEZOMETERS (APPROXIMATELY 18 PIEZOMETERS), COVERING AN AREA OF ROUGHLY 575 ACRES, OR APPROXIMATELY ONE PIEZOMETER EVERY 32 ACRES. THE APPROXIMATE LOCATIONS OF THE NEW PIEZOMETERS ARE DEPICTED ON SHEET 12, WHICH WILL BE UPDATED AFTER THE NEW PIEZOMETERS ARE INSTALLED. A GENERALIZED CROSS SECTION DEPICTING THE MINING AREA, PROPOSED SHALLOW AND DEEP PIEZOMETERS, AND THE TOP OF THE HAWTHORN GROUP IS SHOWN ON SHEET 13.

ALL PIEZOMETERS WILL BE EQUIPPED WITH IN-SITU, INC. RUGGED TROLL 200 NON-VENTED DATA LOGGER/CABLE COMBINATIONS FOR WATER-LEVEL MONITORING DURING ACTIVE MINING AND THE POST-MINING PERIODS.

B) CONSTRUCTION DETAILS – NEW PIEZOMETERS

PIEZOMETERS MPZ-01S, MPZ-02, MPZ-03, MPZ-04, MPZ-05S, MPZ-06, MPZ-07. MPZ-08, MPZ-09, MPZ-10S, MPZ-11, MZP-12, MPZ-13S, MPZ-14, MPZ-15, MPZ-16S MPZ-17S, AND MPZ-18 WILL BE DRILLED AND CONSTRUCTED TO A DEPTH OF APPROXIMATELY 50 FEET BGS. THESE PIEZOMETERS WILL BE USED TO MONITOR WATER QUALITY ACROSS THE MAXIMUM VERTICAL EXTENT OF THE MINE. DEEP PIEZOMETERS MPZ-01D, MPZ-05D, MPZ-10D, MPZ-13D, MPZ-16D AND MPZ-17D WILL BE DRILLED AND CONSTRUCTED TO A DEPTH OF APPROXIMATELY 80 FEET BGS USING A SONIC DRILL RIG. THE DEEP PIEZOMETERS WILL BE USED TO MONITOR WATER LEVELS AND WATER QUALITY BENEATH THE MINE FOOTPRINT. DURING INSTALLATION OF THE NEW PIEZOMETERS, CONTINUOUS SOIL CORES WILL BE COLLECTED AND DESCRIBED BY AN ON-SITE GEOLOGIST. BORING AND WELL CONSTRUCTION LOGS WILL BE PREPARED FOR EACH NEWLY CONSTRUCTED PIEZOMETER.

PIEZOMETERS MPZ-01S, MPZ-02, MPZ-03, MPZ-04, MPZ-05S, MPZ-06, MPZ-07. MPZ-08, MPZ-09, MPZ-10S, MPZ-11, MZP-12, MPZ-13S, MPZ-14, MPZ-15, MPZ-16S MPZ-17S, AND MPZ-18 WILL BE CONSTRUCTED WITH 40 FEET OF 0.010-INCH SLOTTED SCREEN, 2-INCH DIAMETER, THREADED-JOINT, SCHEDULE 40 PVC WITH A SCREENED INTERVAL FROM A DEPTH OF 10 TO 50 FEET BGS. FROM THE TOP OF THE SCREEN TO APPROXIMATE LAND SURFACE WILL BE CASED WITH SOLID 2-INCH DIAMETER, SCHEDULE 40 PVC RISER. A FILTER PACK OF 20/40 GRADED FILTER SAND WILL BE PLACED AROUND AND TWO FEET ABOVE THE SCREEN TO A DEPTH OF APPROXIMATELY EIGHT FEET BGS. A TWO-FOOT-THICK BENTONITE PELLET SEAL WILL BE PLACED ABOVE THE TOP OF THE FILTER SAND. THE REMAINING ANNULAR SPACE ABOVE THE BENTONITE SEAL (ABOUT SIX FEET) WILL BE GROUTED TO LAND SURFACE USING A CEMENT/BENTONITE GROUT. A METAL, FLUSH-MOUNT, BOLT-DOWN, PROTECTIVE COVER WILL BE INSTALLED OVER THE PIEZOMETER AT LAND SURFACE TO INCLUDE A 2-FOOT X 2-FOOT X 4-INCH-THICK CONCRETE PAD. A TYPICAL SHALLOW PIEZOMETER CONSTRUCTION DETAIL IS SHOWN ON SHEET 13.

DEEP PIEZOMETERS MPZ-01D, MPZ-05D, MPZ-10D, MPZ-13D, MPZ-16D AND MPZ-17D WILL BE CONSTRUCTED WITH 10 FEET OF 0.010-INCH SLOTTED SCREEN, 2-INCH DIAMETER, THREADED-JOINT, SCHEDULE 40 PVC WITH A SCREENED INTERVAL FROM A DEPTH OF 70 TO 80 FEET BGS. FROM THE TOP OF THE SCREEN TO APPROXIMATE LAND SURFACE WILL BE CASED WITH SOLID 2-INCH DIAMETER, SCHEDULE 40 PVC RISER. A FILTER PACK OF 20/40 GRADED FILTER SAND WILL BE PLACED AROUND AND TWO FEET ABOVE THE SCREEN TO A DEPTH OF APPROXIMATELY 68 FEET BGS. A TWO-FOOT-THICK BENTONITE PELLET SEAL WILL BE PLACED ABOVE THE TOP OF THE FILTER SAND. THE REMAINING ANNULAR SPACE ABOVE THE BENTONITE SEAL (ABOUT 66 FEET) WILL BE GROUTED TO LAND SURFACE USING A CEMENT/BENTONITE GROUT. A METAL, FLUSH-MOUNT, BOLT-DOWN, PROTECTIVE COVER WILL BE INSTALLED OVER THE PIEZOMETER AT LAND SURFACE TO INCLUDE A 2-FOOT X 2-FOOT X 4-INCH-THICK CONCRETE PAD. A TYPICAL DEEP PIEZOMETER CONSTRUCTION DETAIL IS SHOWN ON SHEET 13.

EACH PIEZOMETER WILL BE DEVELOPED UNTIL THE COLUMN OF WATER IN THE WELL IS RELATIVELY FREE OF VISIBLE SEDIMENT, AND THE PH, TEMPERATURE, TURBIDITY, AND SPECIFIC CONDUCTIVITY HAVE STABILIZED. EACH PIEZOMETER WILL THEN BE FITTED WITH A RUGGED TROLL 200 NON-VENTED DATA LOGGER/CABLE COMBINATION IN ORDER TO CONTINUOUSLY MONITOR GROUNDWATER LEVELS.

C) SEQUENCING OF NEW PIEZOMETER INSTALLATION RELATIVE TO PROGRESSION OF MINING

ONCE INITIATED, MINING WILL ADVANCE AT AN ESTIMATED RATE OF ABOUT 100 TO 200 FEET PER DAY, AND PIEZOMETERS WITHIN THE MINE FOOTPRINT WILL PERIODICALLY BE EXCAVATED AND REINSTALLED DURING THE MINING PROGRESSION. THE GENERAL PROCEDURES FOR THE REMOVAL AND REINSTALLATION OF PIEZOMETERS ARE DISCUSSED BELOW:

- WITHIN ONE OR TWO DAYS OF THE ADVANCING MINE FACE REACHING A PIEZOMETER, THE TRANSDUCER WILL BE REMOVED, AND THE PIEZOMETER WILL SUBSEQUENTLY BE EXCAVATED BY THE ADVANCING DRAG-LINE EXCAVATOR,
- WITHIN APPROXIMATELY FIVE TO SEVEN DAYS OF MINING, THE OPEN EXCAVATION PIT WILL BE BACKFILLED WITH POST-PROCESSED SOILS,
- WITHIN APPROXIMATELY 30 DAYS OF BACKFILLING THE EXCAVATION, A REPLACEMENT PIEZOMETER WILL BE INSTALLED NEAR THE APPROXIMATE LOCATION OF THE ABOVE-REFERENCED EXCAVATED PIEZOMETER. THE REPLACEMENT PIEZOMETER SHOULD BE INSTALLED AT A LOCATION THAT WILL NOT BE RE-EXCAVATED DURING THE NEXT ADJACENT NORTHERN DRAG LINE CUT.
- THE REPLACEMENT PIEZOMETERS WILL BE RESURVEYED AFTER INSTALLATION AND BEFORE WATER-LEVEL MEASUREMENTS ARE COLLECTED.

REPLACEMENT PIEZOMETERS WILL BE DEVELOPED AND FITTED WITH THE RUGGED TROLL TRANSDUCERS THAT WERE REMOVED FROM THE PREVIOUS PIEZOMETERS IN ORDER TO CONTINUE MONITORING OF GROUNDWATER LEVELS.

THESE PROCEDURES WERE DESIGNED TO ENSURE THAT A FULL COMPLEMENT OF PIEZOMETERS WILL BE MAINTAINED TO MONITOR GROUNDWATER LEVEL DATA AS MINING PROGRESSES AND RECLAMATION TAKES PLACE.

1.2 STAFF GAUGES

SIX (6) EXISTING STAFF GAUGES WILL BE USED TO MONITOR SURFACE WATER LEVELS (SEE SHEET 12):

TABLE 1.2. SURFACE WATER-LEVEL MONITORING LOCATIONS	
SG02	SG24
SG11	SG26
SG22	SG27

EACH STAFF GAUGE LOCATION IS EQUIPPED WITH IN-SITU, INC. RUGGED TROLL 200 NON-VENTED DATA LOGGER/CABLE COMBINATIONS FOR RECORDING WATER ELEVATIONS.

EACH STAFF GAUGE SEGMENT MEASURES APPROXIMATELY 3.3 FEET IN LENGTH AND IS MOUNTED TO EITHER A METAL POST OR A PRESSURE-TREATED WOOD POST SO THAT THE BASE OF THE GAUGE IS POSITIONED AT GROUND SURFACE. DATA LOGGERS HAVE BEEN INSTALLED AT EACH STAFF GAUGE WITH THE TRANSDUCERS TIP POSITIONED AT THE APPROXIMATE GROUND SURFACE. EACH DATA LOGGER/CABLE COMBINATION HAS BEEN RECORDING BACKGROUND SURFACE-WATER LEVEL DATA FOR A PERIOD OF BETWEEN 1 TO 2+ YEARS. THESE STAFF GAUGES WILL CONTINUE TO BE USED FOR RECORDING SURFACE WATER ELEVATIONS THROUGHOUT MINING AS WELL AS DURING THE POST MINING PERIOD.

1.3 WEATHER STATIONS

TPM PERSONNEL INSTALLED THREE HOBO RAIN GAUGE DATA LOGGERS AT THE SITE IN NOVEMBER 2018. THE THREE RAIN GAUGE LOCATIONS (RG01, RG02, AND RG03) WERE INSTALLED IN THE NORTHERN, CENTRAL, AND SOUTHERN PORTIONS OF THE TPM OWNED PROPERTIES (SHEET 12). THE DATA LOGGERS FOR EACH RAIN GAUGE RECORD THE ACCUMULATION OF PRECIPITATION IN UNITS OF HUNDREDTHS OF AN INCH EVERY 15-MINUTES.

2. GROUNDWATER-LEVEL MONITORING AND ADAPTIVE MANAGEMENT PLAN

2.1 FREQUENCY OF WATER-LEVEL MONITORING

WATER-LEVEL DATA WILL BE RECORDED USING RUGGED TROLL DATA LOGGERS. DATA LOGGERS WILL BE PROGRAMMED TO RECORD DAILY WATER-LEVEL MEASUREMENTS AT EACH OF THE 69 EXISTING (PZ) AND 24 NEW (MPZ) PIEZOMETERS WITHIN THE MINE FOOTPRINT AND ADJACENT TPM-OWNED PROPERTY (SEE TABLE 2.1 AND SHEET 12).

TABLE 2.1. GROUNDWATER-LEVEL MONITORING LOCATIONS					
PZ01S	PZ11	PZ20S	PZ28S	PZ46	PZ56S
PZ01D	PZ12S	PZ20D	PZ28D	PZ47	PZ56D
PZ02	PZ12D	PZ21	PZ38	PZ48S	PZ57S
PZ03S	PZ13	PZ22S	PZ39S	PZ48D	PZ57D
PZ03D	PZ14	PZ22D	PZ39D	PZ49	PZ58S
PZ04	PZ15	PZ23	PZ40	PZ50	PZ58D
PZ05	PZ16S	PZ24	PZ41	PZ51S	OWB1BS
PZ06	PZ16D	PZ25S	PZ42	PZ51D	OWB1S
PZ07	PZ17S	PZ25D	PZ43	PZ52	OWB1D
PZ08	PZ17D	PZ26	PZ44	PZ53	
PZ09	PZ18	PZ27S	PZ45S	PZ55S	
PZ10	PZ19	PZ27D	PZ45D	PZ55D	
MPZ-01S	MPZ-04	MPZ-07	MPZ-10D	MPZ-13D	MPZ-16D
MPZ-01D	MPZ-05S	MPZ-08	MPZ-11	MPZ-14	MPZ-17S
MPZ-02	MPZ-05D	MPZ-09	MPZ-12	MPZ-15	MPZ-17D
MZP-03	MPZ-06	MPZ-10S	MPZ-13S	MPZ-16S	MPZ-18

THE DAILY WATER-LEVEL MEASUREMENTS RECORDED WITH THE DATA LOGGERS WILL BE DOWNLOADED MONTHLY TO EVALUATE WATER-LEVEL DATA WITHIN AND ADJACENT TO THE MINE. THE FREQUENCY OF DATA DOWNLOADING MAY BE ADJUSTED (INCREASED OR DECREASED) AS NEEDED DURING THE LIFE OF THE MINE.

2.2 FREQUENCY OF RAIN GAUGE MONITORING

DATA FROM THE THREE ON-SITE RAIN GAUGES WILL BE MANUALLY DOWNLOADED IN THE FIELD BY TPM REPRESENTATIVES OR TPM'S CONSULTANTS ON A MONTHLY BASIS.

2.3 DATA ANALYSIS

FOR THE PURPOSE OF COMPARING PRE- AND POST-MINING GROUNDWATER LEVELS, HOWEVER, SUFFICIENT TIME MUST ELAPSE AFTER THE DRAGLINE EXCAVATOR HAS PASSED TO ENSURE THE POST-MINING DATA IS NOT INFLUENCED BY THE ON-GOING MINING TO THE NORTH. TPM ESTIMATES THAT GROUNDWATER IMPACTS WILL EXTEND APPROXIMATELY 1,000 FEET FROM THE EDGE OF THE MINING PIT. THEREFORE, THE COMPARISON OF PRE- AND POST-MINING GROUNDWATER LEVELS WILL BE MADE AFTER THE DRAGLINE EXCAVATOR HAS MOVED APPROXIMATELY 1,000 FEET TO THE NORTH OF A MINED TRANSECT (SEE SHEET 12).

AFTER THE DRAGLINE EXCAVATOR HAS MOVED THE REQUIRED DISTANCE, POST-MINING GROUNDWATER-LEVEL DATA IN THE PIEZOMETERS 1,000 FEET SOUTH OF THE MOVING MINE WILL BE COMPARED TO PRE-MINING WATER-LEVEL DATA. THE POST-MINING GROUNDWATER-LEVEL DATA WILL BE USED TO CALCULATE THE DAILY GROUNDWATER DEVIATION FROM NORMAL, WHICH WILL BE ADDED TO THE HISTORICAL HYDROGRAPH DATA SHOWN ON SHEET 13. THE CRITERIA IN PART 2.4 WILL BE USED TO DETERMINE IF GROUNDWATER HAS BEEN RESTORED, OR IF ADAPTIVE MANAGEMENT IS REQUIRED.

2.4 ACTION LEVELS FOR ADAPTIVE MANAGEMENT

POST-MINING GROUNDWATER LEVELS WILL BE CONSIDERED TO APPROXIMATE PRE-MINING LEVELS AND THE GROUNDWATER TABLE WILL BE CONSIDERED TO HAVE BEEN RESTORED IF:

1. POST-MINING GROUNDWATER-LEVELS REMAIN WITHIN THE NORMAL RANGE (2.7 FEET ABOVE OR BELOW NORMAL) ESTABLISHED IN THE HISTORICAL HYDROGRAPH DATA SHOWN ON SHEET 13; AND/OR
2. POST-MINING GROUNDWATER LEVELS FLUCTUATE UNIFORMLY IN THE NORTH, CENTRAL AND SOUTH SECTIONS;

SUPPORTING DOCUMENTATION DESCRIBING THE RATIONALE FOR RESTORATION OF PRE-MINING GROUNDWATER LEVELS AND THE ±2.7 FEET GROUNDWATER ELEVATION DEVIATION RANGE IS INCLUDED IN EXHIBIT D.

2.5 ADAPTIVE MANAGEMENT AND CONTINGENCY PLANNING

IF THE CONDITIONS DESCRIBED IN PART 2.4 ARE NOT ACHIEVED, TPM WILL NOTIFY THE DIRECTOR WITHIN 30 DAYS OF DETERMINING AN IMPACT CONDITION EXISTS. SUCH NOTICE WILL INCLUDE THE MONITORING DATA ALONG WITH RELEVANT INFORMATION.

NO FURTHER ACTION WILL BE REQUIRED IF THE UNEXPECTED CONDITION CAN BE ATTRIBUTED TO FACTORS UNRELATED TO THE MINING ACTIVITY. IF OTHER CAUSES FOR THE CHANGE IN WATER-LEVEL CONDITIONS CANNOT BE IDENTIFIED, HOWEVER, TPM WILL CONDUCT FURTHER INVESTIGATIONS TO DETERMINE THE SIGNIFICANCE OF THE CHANGE, POTENTIAL CAUSES, AND POTENTIAL SOLUTIONS. A CONTINGENCY PLAN WILL BE INITIATED IN THE EVENT THAT POST-MINING CONDITIONS WILL BE PREPARED AND SUBMITTED TO EPD FOR ITS REVIEW AND APPROVAL PRIOR TO IMPLEMENTATION.

THE CONTINGENCY PLAN WILL PROPOSE ENGINEERED SOLUTIONS POTENTIALLY INCLUDING THE FOLLOWING:

1. IF GROUNDWATER LEVELS ABOVE NORMAL ARE CAUSING GROUNDWATER TO POND ABOVE THE LAND SURFACE, AND IF THESE CONDITIONS CANNOT BE EXPLAINED BY FACTORS UNRELATED TO MINING, THE PROPOSED SOLUTION MAY BE TO PIERCE THE EXISTING BENTONITE LAYER OR OTHERWISE INCREASE ITS HYDRAULIC CONDUCTIVITY, AND/OR TO CEASE OR MODIFY THE SOIL AMENDMENT PLAN GOING FORWARD.
2. IF GROUNDWATER LEVELS ARE BELOW NORMAL, AND IF THE CONDITION CANNOT BE EXPLAINED BY FACTORS UNRELATED TO MINING, THE PROPOSED SOLUTION MAY BE TO INCREASE THE PERCENTAGE OF BENTONITE ADDED TO THE LOW-PERMEABILITY LAYER GOING FORWARD, AND, IF NECESSARY AND APPROPRIATE, TO INJECT ADDITIONAL BENTONITE SLURRY WITHIN A DISCRETE SUBSURFACE SOIL INTERVAL (I.E., 7 TO 10 FEET BELOW LAND SURFACE). TPM MAY ALSO PROPOSE OTHER FEASIBLE ENGINEERED SOLUTIONS.

3. WATER-QUALITY MONITORING AND ADAPTIVE MANAGEMENT PLAN

3.1 BACKGROUND DATA

AN IMPORTANT CONSIDERATION IN THE DEVELOPMENT OF THIS MONITORING PLAN IS THAT THE MINING AND BENEFICIATION FACILITIES WILL NOT USE OR ADD CONTAMINANTS WHICH COULD THEN IMPACT THE SITE GROUNDWATER AND SURFACE WATERS FROM EITHER THE MINING OR THE BENEFICIATION PROCESSES. ALSO, THE SITE WILL NOT BE SUBJECT TO ANY OF THE TRADITIONAL/TYPICAL CONTAMINANT MONITORING PROGRAMS SUCH AS RCRA, CERCLA, ETC.

EXTENSIVE SITE CHARACTERIZATION ACTIVITIES, INCLUDING GROUNDWATER AND SURFACE WATER QUALITY MONITORING HAS BEEN PERFORMED IN MARCH 2019 AND FEBRUARY, MARCH-APRIL, MAY, JULY, AUGUST, SEPTEMBER, OCTOBER 2020, JANUARY AND APRIL 2021. THIS DATA AND FUTURE WATER QUALITY MONITORING PERFORMED PRE-MINING, DURING MINING, AND POST-MINING WILL BE USED TO ASSESS WATER QUALITY IMPACTS AS A RESULT OF MINING ACTIVITIES.

3.2 MONITORING LOCATIONS AND FREQUENCY DURING MINING

GROUNDWATER MONITORING LOCATIONS

BASED ON REVIEWS OF GROUNDWATER FLOW DATA IN THE MINING AREA, THE FOLLOWING MONITORING LOCATIONS AND SAMPLING FREQUENCY WILL BE ESTABLISHED TO MONITOR GROUNDWATER QUALITY OF THE SURFICIAL AQUIFER BENEATH THE MINING AREA (SHEET 12).

TABLE 3.2-1 GROUNDWATER MONITORING STATION		SAMPLING FREQUENCY AND DURATION[1]	
		DURING MINING[2]	POST MINING[3,4]
MPZ-01S/D MPZ-02 MPZ-03 MPZ-04 MPZ-05S/D MPZ-06	MPZ-10S/D MPZ-13S/D MPZ-14 MPZ-16S/D MPZ-17S/D MPZ-18	QUARTERLY	SEMI-ANNUAL

1. BASED ON THE RESULTS OF WATER QUALITY SAMPLING AND THE PROGRESSION OF THE MINE, THE FREQUENCY OF WATER QUALITY SAMPLING AND NUMBER OF MONITORING LOCATIONS MAY PERIODICALLY BE ADJUSTED (I.E. INCREASED OR DECREASED) DURING THE LIFE OF THE MINE (I.E. IF INCREASING CONCENTRATIONS ARE OBSERVED, SAMPLING FREQUENCY MAY BE INCREASED TO BETTER DEFINE THE TREND).
2. BEGINNING ONE MONTH AFTER MINING BEGINS
3. POST-MINING MONITORING WILL BEGIN AT THE END OF ACTIVE MINING AND CONTINUE FOR A PERIOD OF APPROXIMATELY FIVE YEARS
4. EPD MAY REQUIRE AN EXTENSION OF THE MONITORING PLAN IF NECESSARY

GROUNDWATER CONSTITUENTS OF POTENTIAL CONCERN (COPC)

REVIEW OF EXISTING PRE-MINING GROUNDWATER QUALITY DATA WAS USED TO DEVELOP A CONCISE LIST OF COPCS FOR THE SITE'S MONITORING PROGRAM. THE GROUNDWATER COPCS ARE LISTED IN TABLE 3.2-2 BELOW.

TABLE 3.2-2. WATER QUALITY PARAMETERS AND COPCS TO BE MEASURED IN GROUNDWATER SAMPLES	
PARAMETER / COPC	LABORATORY METHOD
PH	FIELD MEASURED
SPECIFIC CONDUCTIVITY	FIELD MEASURED
WATER TEMPERATURE	FIELD MEASURED
OXIDATION-REDUCTION POTENTIAL (ORP)	FIELD MEASURED
TURBIDITY	FIELD MEASURED
ARSENIC, TOTAL AND DISSOLVED	EPA 200.8
LEAD, TOTAL AND DISSOLVED	EPA 200.8
GROSS ALPHA	EPA 900.0
RADIUM-226 + RADIUM-228	EPA 904.0 & 903.1
ALUMINUM, TOTAL AND DISSOLVED	EPA 200.8
IRON, TOTAL AND DISSOLVED	EPA 200.8
MANGANESE, TOTAL AND DISSOLVED	EPA 200.8
TOTAL DISSOLVED SOLIDS (TDS)	SM2540C OR FIELD MEASURED
ZINC, TOTAL AND DISSOLVED	EPA 200.8

SURFACE WATER MONITORING LOCATIONS

THREE EXISTING MONITORING LOCATIONS LISTED BELOW AND SHOWN ON SHEET 12 ARE PROPOSED TO MONITOR WATER QUALITY IN SURFACE WATERS WHICH MAY RECEIVE RUNOFF FROM THE MINING AREA.

TABLE 3.2-3 SURFACE WATER MONITORING STATION	SAMPLING FREQUENCY AND DURATION[1]	
	DURING MINING[2]	POST MINING[3,4]
MSW-BG04 MSW-BG05 MSW-BG06	QUARTERLY	SEMI-ANNUAL

1. BASED ON THE RESULTS OF WATER QUALITY SAMPLING AND THE PROGRESSION OF THE MINE, THE FREQUENCY OF WATER QUALITY SAMPLING AND NUMBER OF MONITORING LOCATIONS MAY PERIODICALLY BE ADJUSTED (I.E. INCREASED OR DECREASED) DURING THE LIFE OF THE MINE (I.E. IF INCREASING CONCENTRATIONS ARE OBSERVED, SAMPLING FREQUENCY MAY BE INCREASED TO BETTER DEFINE THE TREND).
2. BEGINNING ONE MONTH AFTER MINING BEGINS
3. POST-MINING MONITORING WILL BEGIN AT THE END OF ACTIVE MINING AND CONTINUE FOR A PERIOD OF APPROXIMATELY FIVE YEARS
4. EPD MAY REQUIRE AN EXTENSION OF THE MONITORING PLAN IF NECESSARY

REVIEW OF EXISTING PRE-MINING BACKGROUND SURFACE WATER QUALITY DATA WAS USED TO DEVELOP A CONCISE LIST OF CONSTITUENTS OF POTENTIAL CONCERN (COPCS) FOR THE SITE'S MONITORING PROGRAM. THE SURFACE WATER COPCS ARE LISTED IN TABLE 3.2-4 BELOW.

TABLE 3.2-4. WATER QUALITY PARAMETERS AND COPCS TO BE MEASURED IN SURFACE WATER SAMPLES		
PARAMETER / COPC		LABORATORY METHOD
PH		FIELD MEASURED
DISSOLVED OXYGEN (DO)		FIELD MEASURED
SPECIFIC CONDUCTIVITY		FIELD MEASURED
WATER TEMPERATURE		FIELD MEASURED
TURBIDITY		FIELD MEASURED
LEAD, TOTAL AND DISSOLVED		EPA 200.8
MERCURY, TOTAL		EPA 1631E
ZINC, TOTAL AND DISSOLVED		EPA 200.8
TOTAL HARDNESS		SM2340B
TOTAL ORGANIC CARBON (TOC)		EPA 200.7
TOTAL PHOSPHORUS		EPA 200.7
TOTAL NITROGEN	NITROGEN, TOTAL KJELDAHL (TKN)	EPA 351.2
	NITROGEN, NITRATE+NITRITE	EPA 353.2

NOTE: TOTAL NITROGEN = TKN + (NITRATE+NITRITE)

3.3 SAMPLE COLLECTION AND DATA ANALYSIS PROCEDURES

GROUNDWATER-SAMPLING PROCEDURES, CHAIN OF CUSTODY, FIELD PARAMETER MEASUREMENT, AND FIELD QA/QC WILL BE PERFORMED IN ACCORDANCE WITH THE REGION 4 US ENVIRONMENTAL PROTECTION AGENCY (EPA), SCIENCE AND ECOSYSTEM SUPPORT DIVISION OPERATING PROCEDURE, GROUNDWATER SAMPLING (SESDPROC-301-R4), EFFECTIVE APRIL 26, 2017. SURFACE WATER SAMPLING PROCEDURES AND FIELD QA/QC WILL BE PERFORMED IN GENERAL ACCORDANCE WITH THE REGION 4 US ENVIRONMENTAL PROTECTION AGENCY (EPA), SCIENCE AND ECOSYSTEM SUPPORT DIVISION OPERATING PROCEDURE, SURFACE WATER SAMPLING (SESDPROC-201-R4), EFFECTIVE DECEMBER 16, 2016. LOW-LEVEL MERCURY SAMPLING WILL BE PERFORMED IN ACCORDANCE WITH EPA METHOD 1669.

3.3.1 PROCEDURES

A) EQUIPMENT DECONTAMINATION PROCEDURES

ANY REUSABLE SAMPLING EQUIPMENT THAT MAY CONTACT THE INTERIOR OF THE PIEZOMETER, GROUNDWATER, OR SURFACE WATER WILL BE DECONTAMINATED IN THE FIELD IMMEDIATELY PRIOR TO USE, OR IN THE OFFICE/LAB AND PROTECTED USING PLASTIC. FOR SAMPLING EVENTS REQUIRING NON-DEDICATED SAMPLING EQUIPMENT, DECONTAMINATION PROCEDURES WILL CONSIST OF RINSING THE EQUIPMENT ONCE WITH DISTILLED OR DEIONIZED WATER, BRUSHING THE EQUIPMENT WITH A SOLUTION OF DISTILLED OR DEIONIZED WATER AND A PHOSPHATE FREE LABORATORY-QUALITY DETERGENT, AND FINALLY RINSING THE EQUIPMENT WITH DISTILLED OR DEIONIZED WATER.

B) WATER-LEVEL MEASUREMENTS (PIEZOMETERS ONLY)

PRIOR TO PURGING AND SAMPLING, WATER-LEVEL MEASUREMENTS WILL BE MADE AT EACH PIEZOMETER BY UTILIZING A DEDICATED OR PORTABLE WATER-LEVEL INDICATOR, TAPE, OR OTHER SUITABLE MEASURING DEVICE CAPABLE OF ACHIEVING AN ACCURACY OF 0.01 FOOT. THE DEPTH TO WATER IN EACH PIEZOMETER WILL BE MEASURED ON THE SAME DAY AND PRIOR TO PURGING. THE MEASURING DEVICE WILL BE USED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND/OR DIRECTIONS. MEASUREMENTS OF THE DEPTH TO WATER FROM THE TOP OF THE PIEZOMETER CASING (DESIGNATED MONITORING POINT) WILL BE TO THE NEAREST 0.01 FOOT, AND THE VALUE WILL BE RECORDED. TOTAL DEPTHS WILL BE MEASURED AT EACH PIEZOMETER AND RECORDED.

C) PIEZOMETER PURGING PROCEDURES

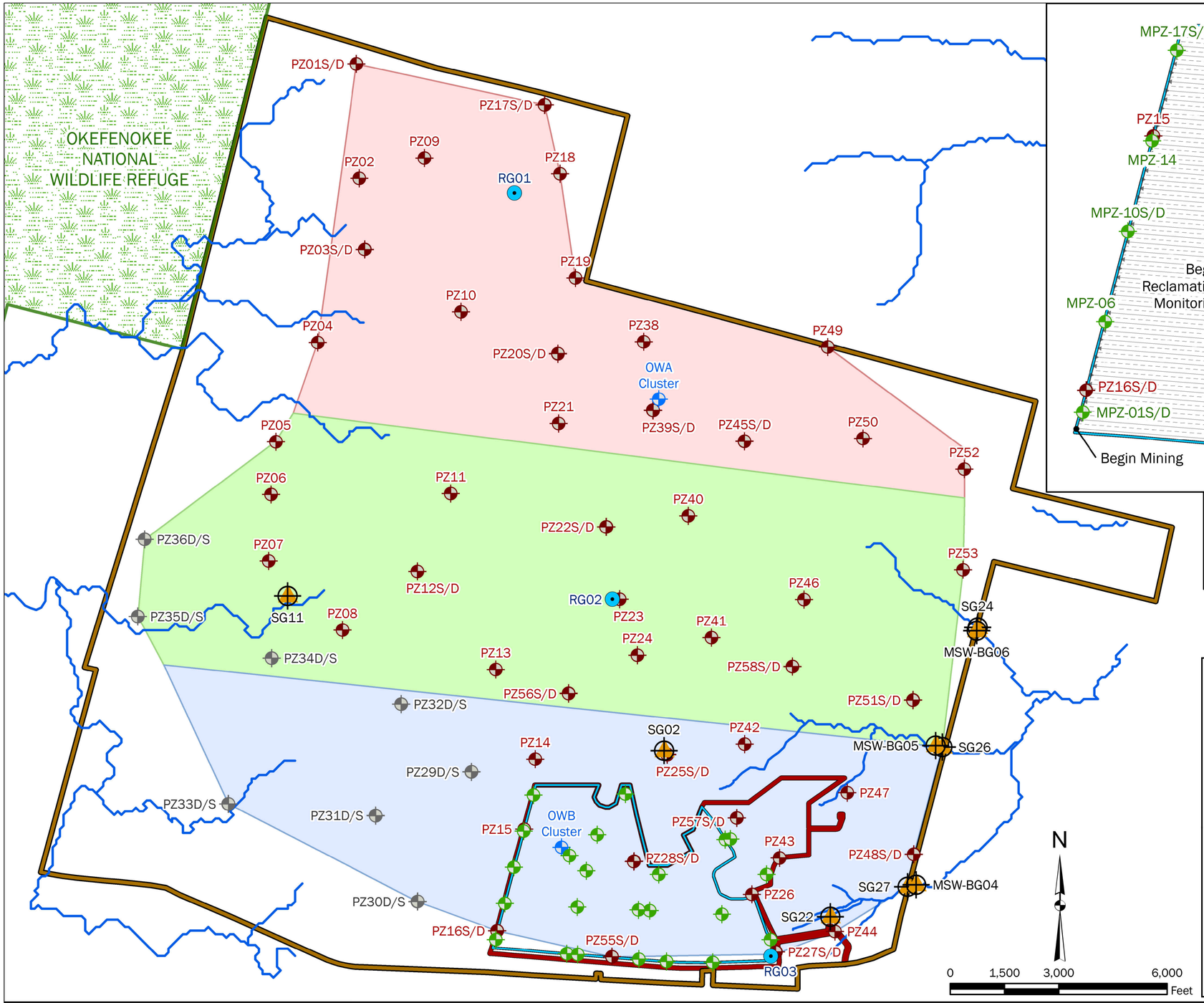
PRIOR TO THE COLLECTION OF GROUNDWATER SAMPLES, EACH PIEZOMETER WILL BE PURGED TO ENSURE THAT FRESH AQUIFER WATER IS BEING SAMPLED. PURGING OF EACH PIEZOMETER WILL BE COMPLETED USING EITHER A PERISTALTIC OR ELECTRIC SUBMERSIBLE PUMP, DUE TO THE DEPTHS OF THE PROPOSED PIEZOMETERS AND THE HIGH GROUNDWATER TABLES AT THE SITE (I.E. EXCESSIVE PURGE VOLUMES), LOW-FLOW PURGING PROCEDURES MAY BE UTILIZED. DURING LOW-FLOW PURGING, THE PUMP OR TUBING INTAKE WILL BE LOCATED WITHIN THE SCREENED INTERVAL AND AT A DEPTH THAT WILL REMAIN UNDER WATER AT ALL TIMES. DURING LOW-FLOW PURGING:

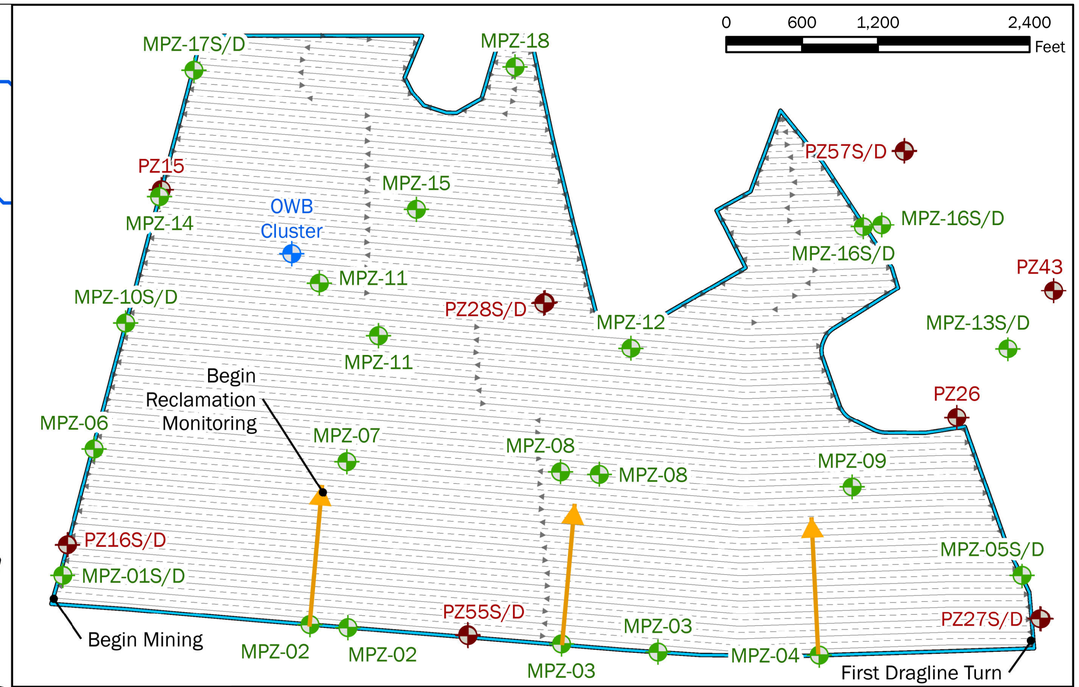
- THE PUMPING RATE WILL BE SET AT A SPEED THAT PRODUCES MINIMAL AND STABLE DRAWDOWN WITHIN THE WELL,
- THE PUMPING RATE WILL BE MEASURED USING A GRADUATED CYLINDER OR GRADUATED BUCKET AND A STOP WATCH,
- THE GROUNDWATER LEVEL, PUMPING RATE, AND FIELD PARAMETERS (PH, WATER TEMPERATURE, SPECIFIC CONDUCTIVITY, DISSOLVED OXYGEN, OXIDATION-REDUCTION POTENTIAL, AND TURBIDITY) WILL BE MONITORED AND RECORDED EVERY 5 TO 10 MINUTES (OR AS APPROPRIATE),
- THE FIELD PARAMETERS WILL BE MEASURED USING A CALIBRATED MULTI-PARAMETER INSTRUMENT AND FLOW-THROUGH CELL.
- PURGING WILL BE CONSIDERED COMPLETE AND SAMPLING WILL BEGIN WHEN THE FIELD MEASURED PARAMETERS HAVE STABILIZED. STABILIZATION IS CONSIDERED COMPLETE WHEN THREE CONSECUTIVE READINGS ARE WITHIN THE FOLLOWING LIMITS:

PARAMETER	MAXIMUM VARIATION
TURBIDITY	10% FOR VALUES GREATER THAN 10 NTU
DISSOLVED OXYGEN	0.2 MG/L OR 10% SATURATION,
OXIDATION-REDUCTION POTENTIAL	20 MILLIVOLTS,
SPECIFIC CONDUCTANCE	5%,
PH	0.1 STANDARD UNIT

D) SAMPLE COLLECTION AND PRESERVATION – GROUNDWATER

GROUNDWATER SAMPLING IS THE PROCESS OF OBTAINING, CONTAINERIZING, PRESERVING, AND SHIPMENT OF A GROUNDWATER SAMPLE AFTER THE PURGING PROCESS IS COMPLETE. APPROPRIATE DEVICES TO BE USED TO COLLECT GROUNDWATER SAMPLES FROM PIEZOMETERS INCLUDE: PERISTALTI





NOTE: Estimated average daily progress of the dragline is 170 feet per day based on the estimated mining timeline shown on Sheet 4. See Sheet 11 for a more complete description of the proposed dragline mining process.

NOTE: Access to the TIAA property is restricted. Piezometers were abandoned in October 2020.

LEGEND

- Okefenokee National Wildlife Refuge
- Project Study Area
- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- North Analysis Section
- Central Analysis Section
- South Analysis Section
- Drain Boundaries
- East-to-West Dragline Center
- West-to-East Dragline Center
- Edge of Dragline Pass
- 1,000+ ft from Piezometer**
- Weather Station
- Proposed Piezometer*
- Existing Piezometer*
- Abandoned Piezometer
- Existing Observation Well Cluster*
- Surface Water Monitor*

* See Sheet 13 for a complete list of locations that will be used for groundwater and surface water elevation and quality monitoring.

** 1,000 feet is the estimated distance for monitoring wells to be outside of the influence of the moving mine.

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 12: GROUNDWATER & SURFACE WATER MONITORING PLAN (2)

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

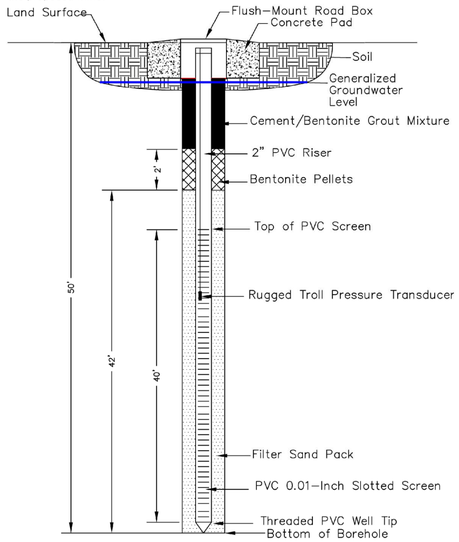
JAMES R. SMITH GEORGIA REGISTERED PROFESSIONAL GEOLOGIST No. PG001873 11-28-22

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: 1 in = 1,500 ft

GROUNDWATER MONITORING TABLE					
ID	ELEVATION	QUALITY	ID	ELEVATION	QUALITY
PZ01S	X		PZ48D	X	
PZ01D	X		PZ49	X	
PZ02	X		PZ50	X	
PZ03S	X		PZ51S	X	
PZ03D	X		PZ51D	X	
PZ04	X		PZ52	X	
PZ05	X		PZ53	X	
PZ06	X		PZ55S	X	
PZ07	X		PZ55D	X	
PZ08	X		PZ56S	X	
PZ09	X		PZ56D	X	
PZ10	X		PZ57S	X	
PZ11	X		PZ57D	X	
PZ12S	X		PZ58S	X	
PZ12D	X		PZ58D	X	
PZ13	X		OWB1BS	X	
PZ14	X		OWB1S	X	
PZ15	X		OWB1D	X	
PZ16S	X		MPZ-01S	X	X
PZ16D	X		MPZ-01D	X	X
PZ17S	X		MPZ-02	X	X
PZ17D	X		MPZ-03	X	X
PZ18	X		MPZ-04	X	X
PZ19	X		MPZ-05S	X	X
PZ20S	X		MPZ-05D	X	X
PZ20D	X		MPZ-06	X	X
PZ21	X		MPZ-07	X	X
PZ22S	X		MPZ-08	X	X
PZ22D	X		MPZ-09	X	X
PZ23	X		MPZ-10S	X	X
PZ24	X		MPZ-10D	X	X
PZ25S	X		MPZ-11	X	X
PZ25D	X		MPZ-12	X	X
PZ26	X		MPZ-13S	X	X
PZ27S	X		MPZ-13D	X	X
PZ27D	X		MPZ-14	X	X
PZ28S	X		MPZ-15	X	X
PZ28D	X		MPZ-16S	X	X
PZ38	X		MPZ-16D	X	X
PZ39S	X		MPZ-17S	X	X
PZ39D	X		MPZ-17D	X	X
PZ40	X		MPZ-18	X	X
PZ41	X		PZ45D	X	
PZ42	X		PZ46	X	
PZ43	X		PZ47	X	
PZ44	X		PZ48S	X	
PZ45S	X				

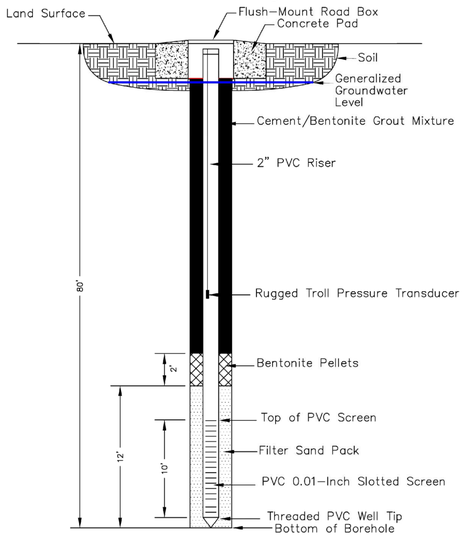
SURFACE WATER MONITORING TABLE		
ID	ELEVATION	QUALITY
SG02	X	
SG11	X	
SG22	X	
SG24	X	
SG26	X	
SG27	X	
MSW-BG04		X
MSW-BG05		X
MSW-BG06		X

Note: Eighteen piezometers (MPZ-01S, MPZ-02, MPZ-03, MPZ-04, MPZ-05S, MPZ-06, MPZ-07, MPZ-08, MPZ-09, MPZ-10S, MPZ-11, MZP-12, MPZ-13S, MPZ-14, MPZ-15, MPZ-16S MPZ-17S, and MPZ-18) will be installed to depths of about 50 feet below ground surface and used to monitor water quality across the maximum vertical extent of the proposed mine.

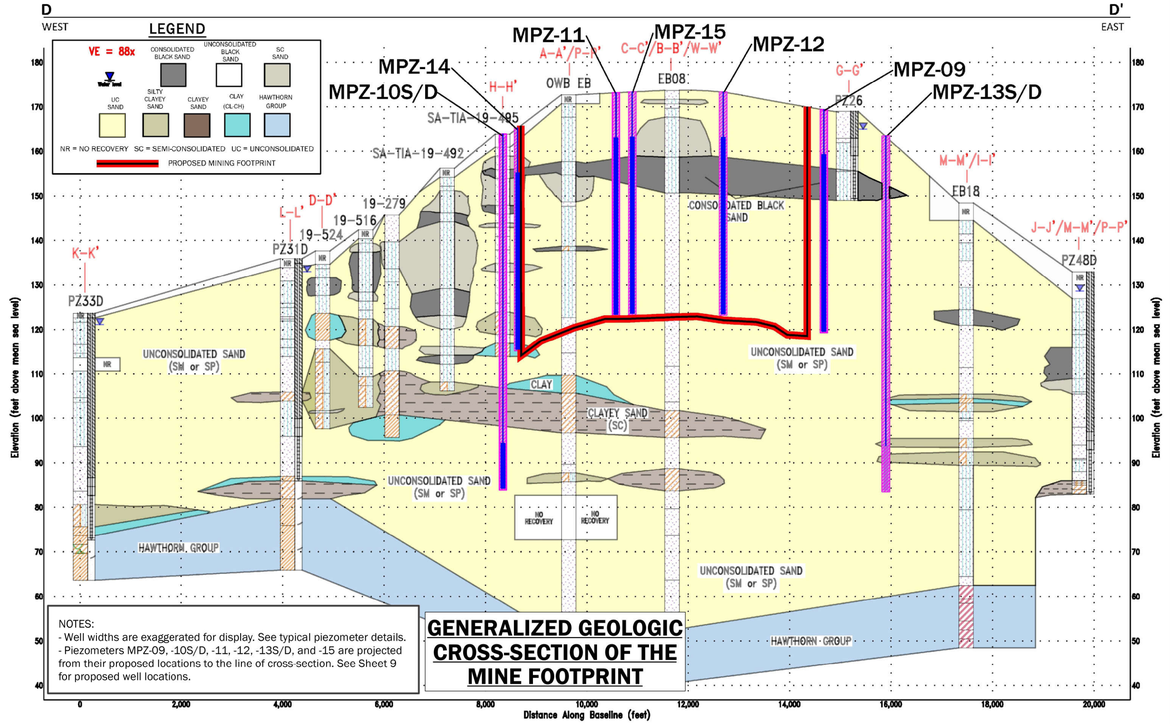


TYPICAL PIEZOMETER DETAIL (50 FEET)

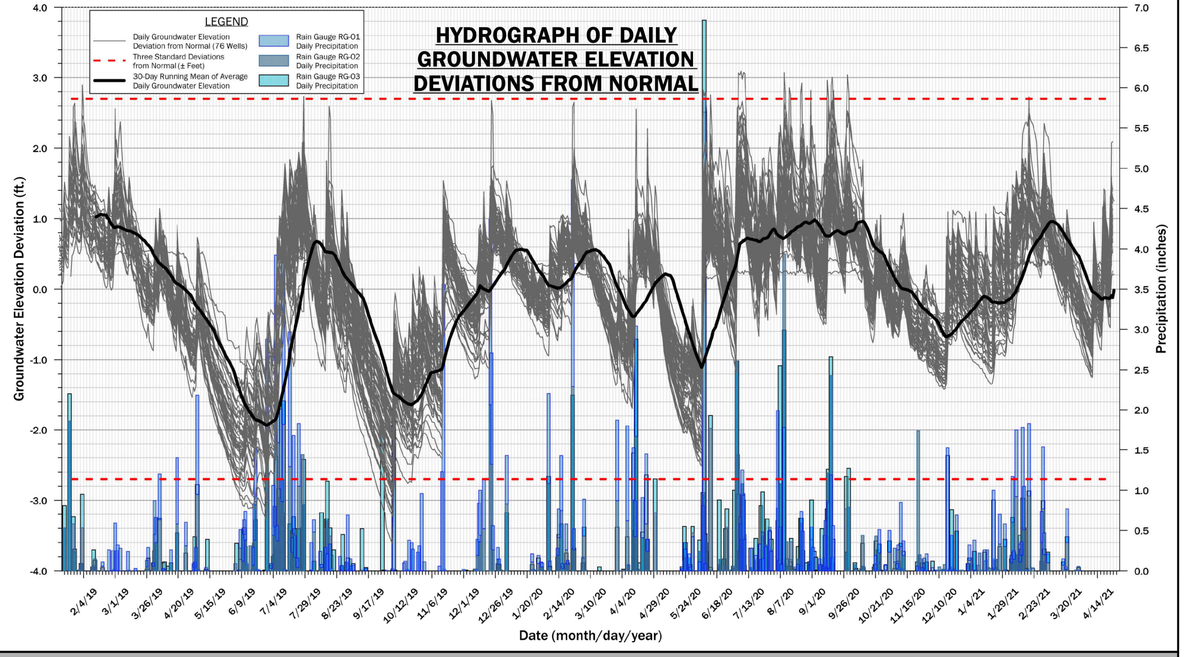
Note: Six piezometers will be installed to depths of about 80 feet below ground surface in order to monitor water levels and water quality of the Surficial Aquifer below the maximum mining depth



TYPICAL PIEZOMETER DETAIL (80 FEET)



GENERALIZED GEOLOGIC CROSS-SECTION OF THE MINE FOOTPRINT



HYDROGRAPH OF DAILY GROUNDWATER ELEVATION DEVIATIONS FROM NORMAL

TTL

Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

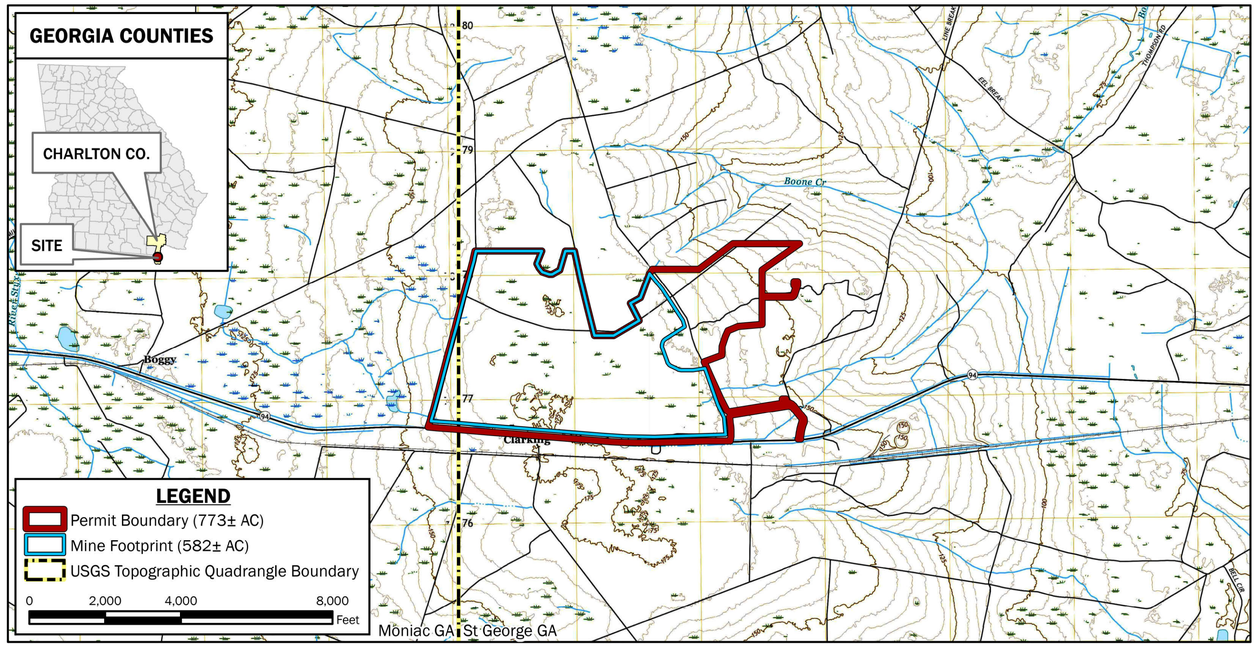
SHEET 13: GROUNDWATER & SURFACE WATER MONITORING PLAN (3)

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

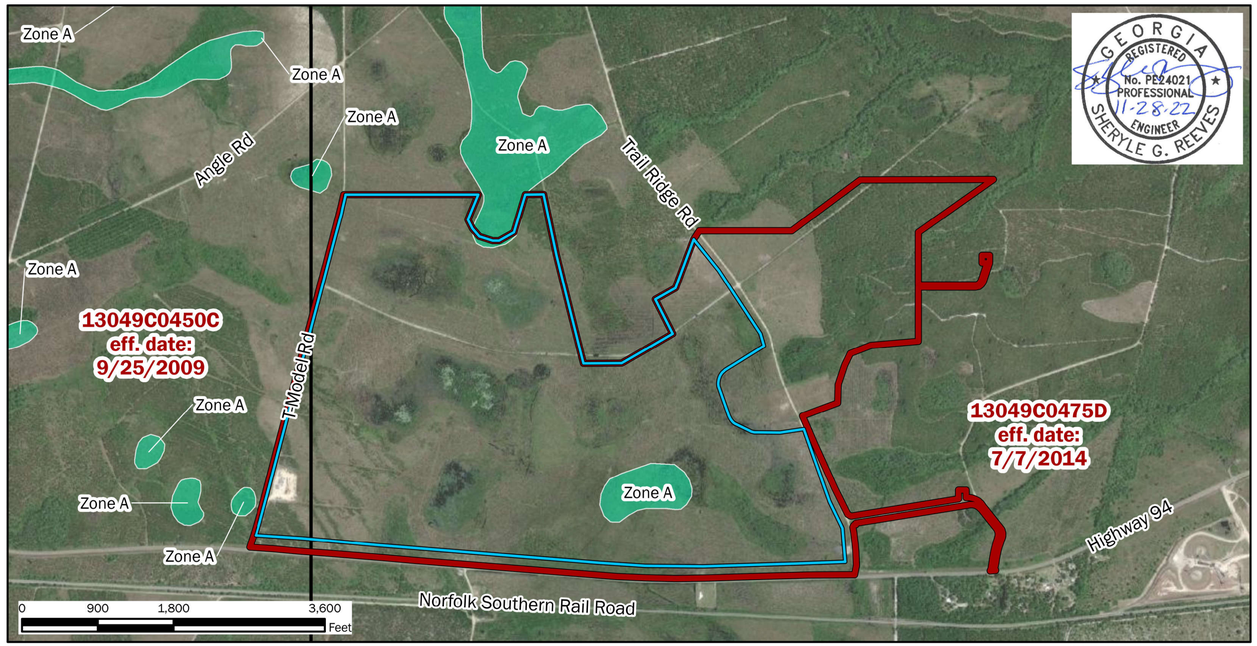
ST. GEORGE, CHARLTON COUNTY, GEORGIA

JAMES R. SMITH — GEORGIA REGISTERED PROFESSIONAL GEOLOGIST — No. PG001873 — 11-28-22

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: N.T.S.

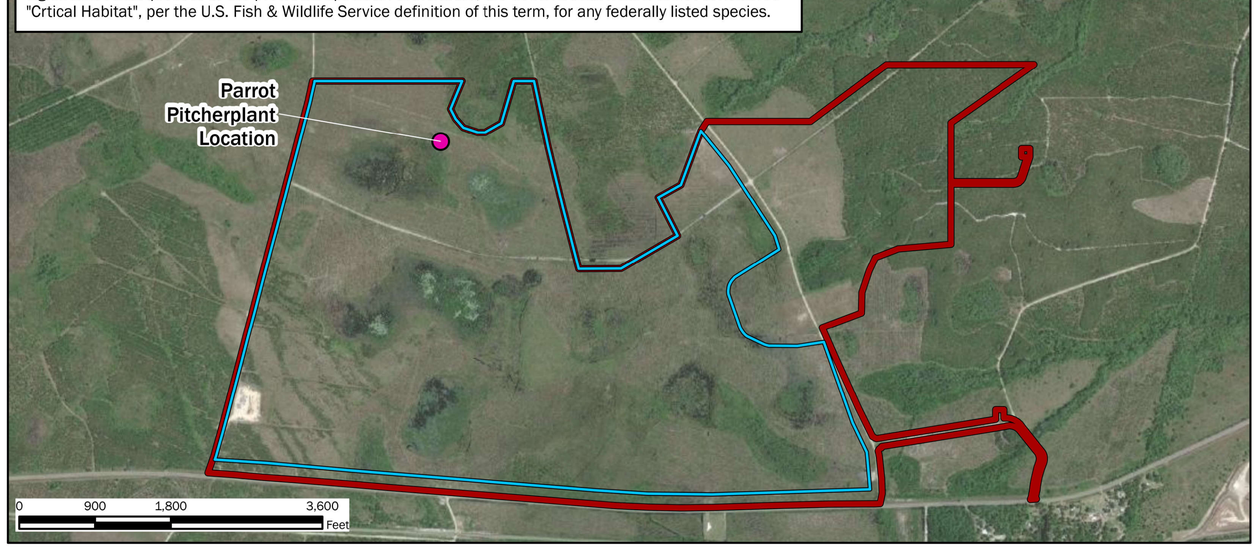


VICINITY MAP

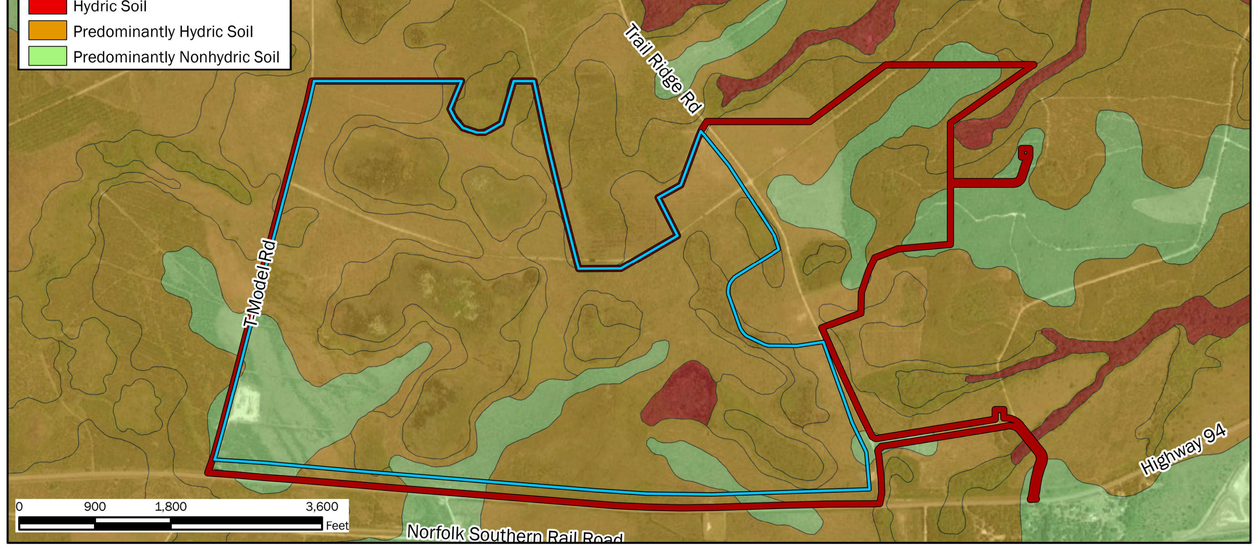


FEMA FLOOD HAZARD MAP

NOTE: Prior to mining in the location of the parrot pitcherplant, TPM will coordinate with the appropriate agencies to ensure that applicable relocation protocols are utilized to avoid impacting the specimen. The findings of the resource evaluations suggest that the activities, including rough clearing, will not have significant consequences to the protected species. Furthermore, the demonstration mine is not considered "Crtical Habitat", per the U.S. Fish & Wildlife Service definition of this term, for any federally listed species.



THREATENED & ENDANGERED SPECIES LOCATION MAP



NRCS HYDRIC SOIL RATING MAP

TTL
Certificate of Authorization No.: PEF004125
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 14: SUPPLEMENTAL INFORMATION - VICINITY MAP, FEMA FLOOD HAZARD MAP, THREATENED & ENDANGERED SPECIES MAP, NRCS SOILS MAP

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

TOPOGRAPHIC BASEMAP: Moniac (W) & Saint George (E), Georgia, USGS 7.5 Minute Quadrangle Map, 2020 (5-ft Contour Interval). AERIAL BASEMAP: Maxar Technologies, Vivid Imagery, 5/7/2021 (0.5 m Resolution).

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: See Panels

SURFACE MINING LAND USE PLAN
SAUNDERS DEMONSTRATION MINE (MINE ID NO. 2073)
SUPPLEMENTAL INFORMATION

Table of Contents

1. Introduction

The Twin Pines Minerals, LLC (TPM) Saunders Demonstration Mine in Charlton County will recover essential Heavy Mineral Sands from Trail Ridge through a safe, cost-effective, and environmentally sound process that poses no threat to surrounding lands, the Okefenokee National Wildlife Refuge, or the broader environment.

The deposits that can be recovered from Trail Ridge include the primary ores of titanium dioxide (TiO_2) and zircon ($ZrSiO_2$) — minerals the United States Government has deemed both "critical" and scarce, such that shortages threaten the national defense and/or the national economy. TiO_2 is primarily obtained from mining and processing the minerals ilmenite, rutile, and leucoxene. Leucoxene, not technically a mineral, is a higher quality derivative of ilmenite resulting from the preferential weathering and leaching of iron, increasing the percentage of TiO_2 to more than 70 percent. Zircon is recovered as a co-product from the processing of Heavy Mineral Sands deposits.

The minerals will be extracted, separated, and processed on-site and at a Mineral Separation Plant directly across Highway 94, maximizing the number of high-paying jobs that will be created and retained within Charlton County. After the Heavy Minerals Sands products have been separated, the final products will be containerized, bulk shipped or loaded onto trucks or rail dependent upon customer requirements.

The proposed project will demonstrate in practice what extensive studies have already proved: that these critical minerals can be recovered without any impact to the Okefenokee National Wildlife Refuge, the boundary of which is three miles away at its closest corner, and with negligible environmental impacts beyond the mine site.

2. Twin Pines Minerals, LLC

The Saunders Demonstration Mine is owned and operated by Twin Pines Minerals, LLC. The underlying real estate is owned by Trail Ridge Land, LLC, a wholly owned subsidiary of Twin Pines Minerals, LLC.

TPM is a privately held mining company established to develop, construct and operate mines throughout the United States and to sell output to consumers throughout the world through long-term forward purchase contracts. The management team has over 180 years of combined mining and geological experience.

3. Project Boundaries

The Permit Boundary (including undisturbed buffers and haul roads) is depicted on Sheet 2. Adjacent properties are also identified. Consistent with applicable regulations, undisturbed buffers do not include drainage features such as ditches, swales, piping, or rip-rap.

Non-jurisdictional wetlands within the Permit Boundary are shown in light green on Sheet 2. Through two Approved Jurisdictional Determinations (App. A), the United States Army Corps of Engineers has confirmed that none of the wetlands on site constitute "waters of the United States."

4. Mining Plan

The Mining Plan is illustrated in Sheets 3–5. Sheet 3 shows the site layout. Sheet 4 illustrates how the mining process will progress. Sheet 5 provides flow charts showing how excavated sands will be processed and how water will move through the site.

4.1. Acreage and Site Layout

The 773-acre Permit Area is shown on Sheets 2 and 3. The site includes the area to be excavated (the "Mining Footprint"), which consists of approximately 582 acres; the processing area consisting of a Pre-Concentration Plant (PCP) and a Wet Concentration Plant (WCP); Process Water Ponds and Water Management Ponds; and the haul road that will be used to move material from the Wet Concentration Plan to the Mineral Separation Plant directly across Highway 94.

Conveyors (rather than a haul road) will be used to convey excavated material and tailings between the mine pit and the Pre-Concentration and Wet Concentration Plants. The conveyors will be constructed for the entire east-west length of the mining corridor from near T-Model Road to near Trail Ridge Road, where they will turn to the north towards the concentration plants, located near the northeastern portion of the mining area.

The approximate center of the site is latitude 30.524023° N and longitude –82.113326, W. According to the USGS Topographic Map, surface elevation ranges from approximately 155 to 175 feet above mean sea level (amsl).

4.2. Affected Lands and Community

The mine site is not swampland. It has been used for industrial silviculture for at least 50 years. It was almost completely denuded in the West Mims Fire of 2017 and currently has the appearance of a clear-cut pine plantation that is just beginning to regrow.

The predominant land use in the vicinity of the mine is commercial silviculture. The following land use types were identified within the mining area during pre-mining field evaluations:

- Southeastern North American Temperate Forest Plantation
- Recently Logged-Herb and Grass Cover
- Southern Coastal Plain Non riverine Cypress Dome
- Developed-Roads
- Southeastern Ruderal Grassland
- Southern Coastal Plain Seepage Swamp and Baygall Woodland
- Atlantic Coastal Plain Upland Longleaf Pine Woodland
- Southern Coastal Plain Nonriverine Basin Swamp
- Southeastern Ruderal Shrubland
- Southeastern Native Ruderal Flooded & Swamp Forest

Land use types are classified in accordance with land use cover descriptions by Natureserve: *The Descriptions of Ecological Systems for Modeling of LANDFIRE Biophysical Settings, Ecological Systems* (2020). The dominant land use was managed pine silviculture (Southeastern North American Temperate Forest Plantation, Recently Logged Herb and Grass Cover), which comprises more than 88% of the existing land use.

Due to the rural nature of the surroundings and the nature of the operation itself, off-site impacts due to dust and noise are not anticipated. Dust will be managed by applying water to haul roads and other high traffic areas. Most equipment — including the dragline, conveyors, and mineral processing equipment — will be powered by electricity, substantially minimizing noise.

In a letter dated November 12, 2020, the County Administrator for Charlton County stated the mining operation is consistent with land use in the area, and that no zoning regulations would prohibit the proposed mining operation.

4.3. Mine Progression and Timeline

The progression of the mine is shown on Sheet 4. A mine pit approximately100-feet wide and 500-feet long, and no more than 50-feet deep, will move from West to East, and then East to West, in bands across the site until the entire Mining Footprint has been mined.

It will take approximately six months to a year to prepare the site and construct the necessary infrastructure after a permit is issued. Active mining will commence immediately after this work is completed.

Once the operation begins, the moving mine pit will progress at a rate of approximately 100-200 feet per day, or approximately 10 to 15 acres per month. The entire process is expected to take 4 years. Reclamation will be completed within 24 months after the mining process is completed.

Sheet 5 provides a flow diagram for the excavation and beneficiation process. The steps in this process are described further below.

4.4. Site Preparation

Prior to initiating mining activities, the project area will be delineated by survey markers, boundary markers, and flagging to indicate the locations of permanent infrastructure and mining boundaries. A pre-mining survey using LiDAR will be used to create a topographic surface to guide reclamation.

Merchantable timber will be harvested prior to the beginning of mining activities. Timber will be harvested on average 4 to 6 months prior to the initiation of mining in each area. Timber that is not merchantable and timber scraps will be removed by TPM and all areas within the limits of clearing and mining will be root raked, windrowed, and burned in compliance with Georgia Forestry Commission and/or county permits.

The first areas to be cleared will be for the processing facilities, initial mining area, and feed and tailings conveyors. Once these areas have been cleared, the permanent facilities and infrastructure will be constructed/installed along with the berms, stormwater controls, and other erosion and sediment controls detailed in Sheets 6 and 7.

With respect to the mining process, the first step will be to clear the mining corridor ahead of the dragline. The initial mining corridor will be approximately 700 feet north to south, which will allow for mining of three pit widths before relocating the feed/tailings conveyors. This clearing will extend approximately 500 feet ahead of the mining and will progress as the dragline advances. The clearing of this 700-foot north to south corridor is required to facilitate the advancement of the apron feeder and mobile conveyors as mining progresses to the east in the initial pit.

Topsoil will be removed approximately two weeks before mining. As described in the Erosion Control Plan (Sheet 7) and Reclamation Plan (Sheet 8), it will be stockpiled for reuse during the reclamation process. Topsoil stockpiles will be placed near the excavation, generally beneath or alongside the conveyor lines. Mine tailing stockpiles will not be mixed with topsoil stockpiles. Details about the topsoil stockpiles are provided on Sheet 7.

4.5. Active Mining: Excavation

Excavation of the mining cuts will commence after the topsoil is removed. TPM has developed a completely land-based heavy mineral sand mining technique using a dragline excavator, conveyor system for materials transport, and processing plants. The dragline is a large crane-like earthmoving machine equipped with a large-capacity bucket to scoop material. The bucket swings from cables on the end of the boom, scooping material that is then moved to adjacent areas. The dragline is powered by electricity.

The dragline technique is different from conventional "wet mining," which utilizes a dredge and floating concentration plant to mine and process heavy mineral-bearing sands. The dragline method is more efficient when long mining cuts can be utilized. Elongated cuts allow for excavation and backfilling to occur simultaneously in the same pit. Backfilling and rough grading to occur within 500 feet of the dragline dig face.

The excavation will be approximately 100-feet wide by 500-feet long. Its depth will vary depending on the depth of heavy minerals sands; but its maximum depth will be 50 feet deep. A profile and cross-section of the mining cut is shown in Sheet 5.

Because dragline mining is a "dry" technique, it will be necessary to remove standing water above a depth of about 8 feet. As described in the Water Use and Management Plan (App. P), water removed from the mine pit will be pumped to the Water Management Ponds, where it will be conserved for use in the beneficiation process.

4.6. Transport by Conveyor to the Pre-Concentration Plant

An electric-powered conveyor system will be used to transport excavated sands from the mine pit to the Pre-Concentration and Wet Concentration Plants.

Excavated material will initially be stockpiled near the mine pit before being transferred to an apron feeder that feeds to a screen. The screen will be used to remove roots and other large objects, which will be placed near the screen area and then returned to the mining pit during the reclamation process.
The screened material will be transferred to a pit/feed conveyor system, which feeds a mainline feed conveyor system. The mainline feed conveyor system will incline (or feed a stacker conveyor) and then feed the trommel (screen). The under-sized material from the trommel will be fed to the Pre-Concentration Plant as a slurry.

4.7. Pre-Concentration Plant and Wet Concentration Plant

In the Pre-Concentration Plant and Wet Concentration Plant, spirals will be used to separate heavy mineral sands from the lighter clays and quartz sand. From the Pre-Concentration Plant, the heavy mineral sands will be fed to the Wet Concentration Plant, which further separates the lighter minerals from heavy mineral sands. The result is a Heavy Mineral Sands concentrate that will be trucked to the off-site Mineral Separation Plant for additional processing.

Process water used in the Pre-Concentration Plant and Wet Concentration Plant will be reclaimed through a series of dewatering screens and hydrocyclones. Humates and clays will be separated from the process water as "slimes." The slimes will be separated from process water in a thickener. The underflow, which includes the slimes, from the thickener will be dewatered and temporarily stored before being transported back to and placed in the mined pit area for reclamation.

Tailings and slimes from the Pre-Concentration Plant will be stockpiled until they can be fed to the conveyor system and returned to the pit.

4.8. Mineral Separation Plant

A portion of the Heavy Mineral Sands concentrate from the Wet Concentration Plant will be packaged as finished product and shipped to customers. The remaining concentrate will be trucked to the Mineral Separation Plant across Highway 94. The locations of these plants are shown on Sheet 3. The close proximity of the Mineral Separation Plant to the Mineral Processing Plant decreases the distance and energy needed to transport materials.

The Mineral Separation Plant further separates mineral products such as zircon, titanium minerals (ilmenite, leucoxene, rutile), and staurolite etc. After products have been separated, the final products will be containerized, bulk shipped or loaded on truck or rail depending upon customer requirements.

4.9. Soil Amendments and Backfilling

As discussed above, tailings and slimes from the Pre-Concentration and Wet-Concentration Plants will be stockpiled near the processing plants. These materials will then be loaded onto a conveyor to be returned to the mine pit.

Some of the tailings will be mixed with bentonite to produce a low-permeability mixture (10.9% bentonite) that will be installed in a 3-foot layer at a variable depth calculated to replicate pre-mining hydraulic conditions. Details are provided on Sheet 9 and App. M.

After the bentonite layer has been installed, sand-only tailings will be placed on top, followed by topsoil, to recreate pre-mining grades.

5. Erosion and Sediment Control

The Erosion and Sediment Control Plan is provided on Sheets 6 and 7, which identifies best management practices (BMPs) to be employed to control sedimentation, protect adjacent watersheds, and prevent erosion on the periphery of the property. Additional Erosion and Sediment Controls for the Process Water and Water Management Ponds are provided in Sheets C-400 to C-425.

A berm will be constructed along Georgia State Highway 94 to control erosion and contain stormwater. Berms or other facilities may be constructed along T-Model and Trail Ridge Roads as necessary to control stormwater.

Silt fencing, brush barriers, and hay bales will also be utilized.

Silt fences will be placed around the topsoil storage piles. The silt fences will also preserve seed banks for native vegetation and a planting medium to be used in the reclamation process. The topsoil storage piles will be stabilized with three-to-one (3H:1V) internal slopes and four-to-one (4H:1V) external slopes. Silt fences and hay bales will be utilized along the outside of the topsoil storage piles to control post construction erosion.

6. Reclamation

The Reclamation Plan is provided on Sheets 9 and 10. The reclamation objective is to restore the land surface and groundwater elevations approximately to pre-mining levels. As discussed in Section 4.9 above, the mine pit will be backfilled with processed tailings, with a layer of bentonite added to replicate pre-mining hydraulic properties. Details are provided on Sheet 9 and in App. M. The reclaimed pit will be contoured to match pre-mining elevations before being revegetated with plant communities appropriate to pine flatwoods. Although some wetlands may be restored and/or created, no lakes will be developed.

All structures and materials associated with the mine will be removed. The process for decommissioning and removing the lined Process Water and Water Management Ponds is described in Sheet C-801.

7. Water Use and Water Management

A detailed Water Use Management Plan is set forth in Appendix P. As that document explains, the beneficiation process requires a water supply of approximately 3,000 gallons per minute ("gpm"), but only about 10% will be used consumptively. The rest will be returned and used again.

Water will be managed in four Process Water Ponds (P1–P4) and four Water Management Ponds (M1-M4). All of the ponds will be lined, and all will be above-ground. Details are provided in Sheet C-701. The Process Water Ponds will feed the Pre-Concentration and Wet Concentration Plants. The Water Management Ponds will receive water from the mine pit, and any overflow from the Process Water Ponds. The Water Management Ponds will conserve this water and feed it to the Process Water Ponds as necessary. Evaporators will be installed in the Water Management Ponds to dispose of any excess water to ensure there is no discharge to the environment.

Water will be supplied initially from two wells screened in the Upper Floridan Aquifer with a combined permitted capacity of 1,000 gpm. The primary purpose of the wells is to charge the system Process Water Ponds before active mining begins. Once the system is charged and mining has begun, most or all of the water needed for the beneficiation process will be supplied by seepage water evacuated from the mine pit, which will be conserved in the Water Management Ponds for subsequent use. The wells will continue to be available as a backup water supply if needed, however.

Evaporators capable of removing up to 1,000 gpm will be installed in the Water Management Ponds to ensure sufficient freeboard is available to store the total amount to precipitation that would be expected to accumulate during a 1,000-year, 60-day event (i.e., the total 60-day accumulation that is so extreme it is expected to be exceeded only once in a thousand years).

The process used to remove heavy minerals from excavated sands (the "beneficiation process") relies on water and centrifugal force, followed by electrostatic and magnetic separation. No chemicals are used in the process itself. The only exceptions are chemicals used to flocculate suspended solids and adjust the pH of recycled process water before it is used again. Because the water in the Process Water and Water Management Ponds will consist only of rainwater, groundwater evacuated from the mine pit, water draining from wet material held in the stockpile, and any overflow from the Process Water Ponds, there is little risk the water will be contaminated. Furthermore, as shown on Sheet 6, any water discharged from ponds for any reason will flow to the east, away from the Okefenokee National Refuge Area.

8. Groundwater and Surface Water Monitoring

Groundwater and surface water levels in the vicinity of the mine will be monitored to ensure that unexpected impacts do not occur. The groundwater and surface water monitoring plan is set forth on Sheet 11. The plan shows where piezometers and staff gauges will be installed. It also describes the action levels for adaptive management, along with the steps that will be taken if these levels occur. Water quality will also be monitored.

9. Other Permits and Approvals

In addition to authorization under the Surface Mining Act, the following permits and authorizations will be required:

- Coverage under the General Stormwater Perm it for Stormwater Discharges Associated with Industrial Activity. Permit No. GAR05000 (Issuance Date June 1, 2022);
- A Groundwater Withdrawal Permit issued pursuant to O.C.G.A. § 12-5-90.
- An Air Quality Permit issued pursuant to the Georgia Air Quality Protection Act, O.C.G.A. § 12-9-1.
- (Potentially) A Radioactive Materials License for the handling of naturally-occurring radioactive materials (NORM), if required pursuant to O.C.G.A. § 31-13-12.

10. Additional Operator Submissions

- Bonding - Bonding will be completed upon approval of this application for surface mining.
- Annual Permit Status Report - An annual status report will be prepared by the Operator and submitted to the Division as required.
- Amendments to Plan - The Operator will submit any future proposed changes in this proposed plan to the Division for approval.
- Change of Ownership of Mining Operation - Should a change in Operator ownership of this mining operation occur, the new owner(s) will submit a new application and a new bond within 60 days from the date of consummation of the ownership change.
- TPM acknowledges that additional mining operations not included in this demonstration mine will require a new set of perm its and a full permitting process.

GEORGIA REGISTERED No. PE024021 PROFESSIONAL ENGINEER SHERYLE G. REEVES 11-28-22

TTL
Certificate of Authorization No.: PEF00415
3516 Greensboro Ave., Tuscaloosa, AL 34501

SHEET 15: SUPPLEMENTAL NARRATIVE

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)

ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/28/2022
TTL JOB NO.: 18-02-00804.00
APPROX. SCALE: N/A