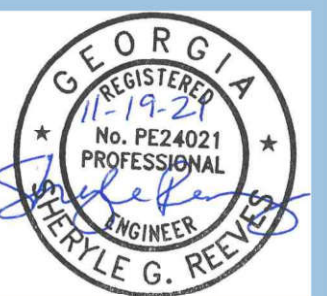
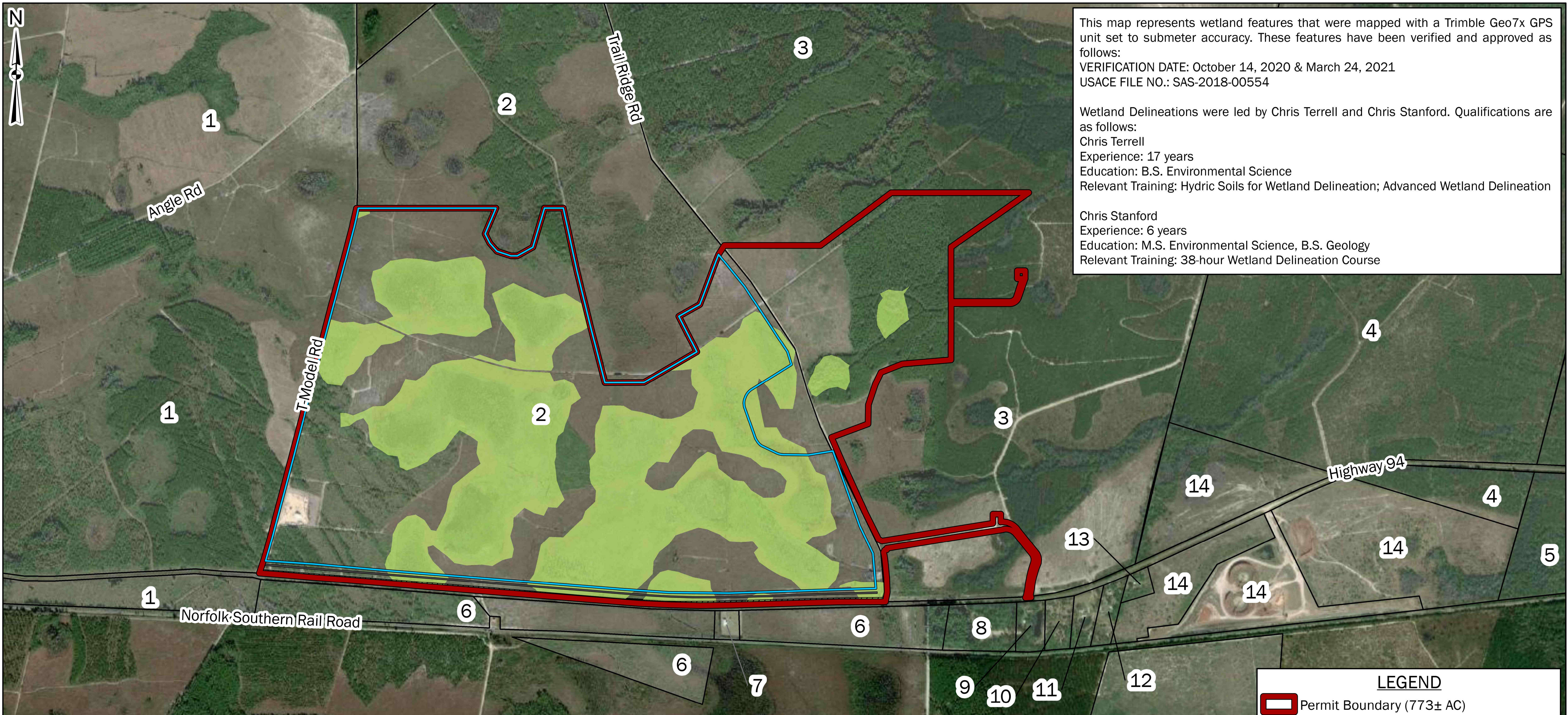


**SHEET 1: COVER SHEET - SAUNDERS DEMONSTRATION MINE**  
**TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)**  
**ST. GEORGE, CHARLTON COUNTY, GEORGIA**

INSET BASEMAP: Open Street Map; BASEMAP: National Geographic World Map (See Service Layer Credits).

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 25,000 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

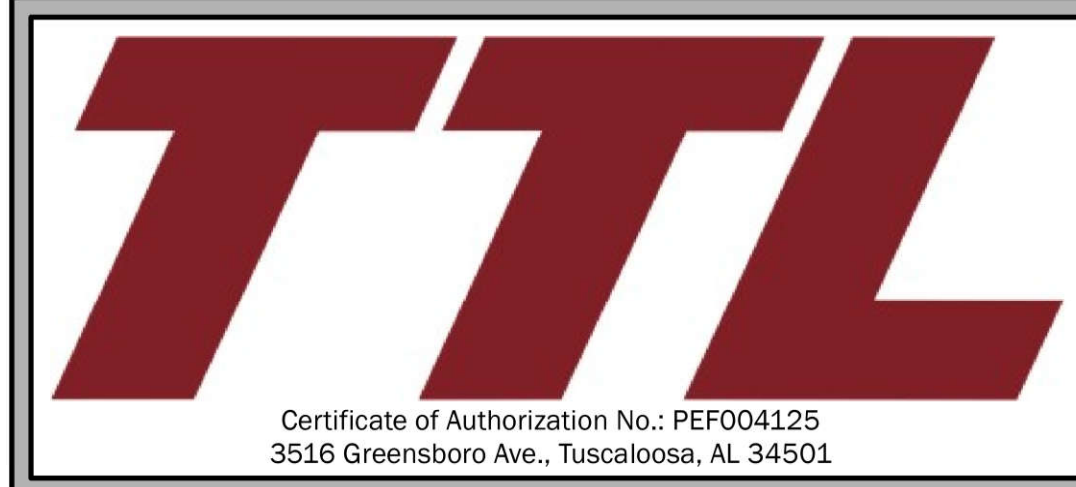
Chris Stanford  
 Experience: 6 years  
 Education: M.S. Environmental Science, B.S. Geology  
 Relevant Training: 38-hour Wetland Delineation Course

**LEGEND**

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

0 600 1,200 2,400 Feet

LABEL	PIN	OWNER	ADDRESS	LABEL	PIN	OWNER	ADDRESS
1	0036001	TIAA TIMBERLANDS, LLC	1500 S FIRST AVE, STE 1150, PORTLAND, OR 97201	8	0060007	WALTER & DEBRA SCHEIDERER	8024 HWY 94, ST GEORGE, GA, 31562
2	0059001002	TRAIL RIDGE LAND, LLC	2100 SOUTHBRIDGE PKWY, BIRMINGHAM, AL 35209	9	0060006	RANDAL DUKES	8208 HWY 94, ST GEORGE, GA 31562
3	0058001	TRAIL RIDGE LAND, LLC	2100 SOUTHBRIDGE PKWY, BIRMINGHAM, AL 35209	10	0060004	FINLEY W WOLFE	8242 HWY 94, ST GEORGE, GA 31562
4	0084001	JOHN, VERNON GOWEN	315 AGNES ROAD, FOLKSTON, GA 31537	11	0060004001	KIRK W WOLFE	8296 HWY 94, ST GEORGE, GA 31562
5	0061002	W L OLIVER/CHARLTON, LLC	P.O. BPX 161139, MOBILE, AL 36616	12	0060005	ERNST HARDEN	SUITE 107, JACKSONVILLE, FL 32211
6	0060009	TRAIL RIDGE LAND, LLC	2100 SOUTHBRIDGE PKWY, BIRMINGHAM, AL 35209	13	0084003001	FRED & MARLENE WINECOFF	8422 HWY 94, ST GEORGE, GA 31562
7	0060003	CHARLTON COUNTY FORREST	FOLKSTON, GA 31537	14	0084003	SHARON BELL & ELI L. PADGETT	10624 HILLSIDE DR, MACCLENNY, FL 32063



**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, Vivid Imagery, 11/20/2019 (West, 0.5 m Resolution) & 3/24/2018 (East, 0.46 m Resolution).

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
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).

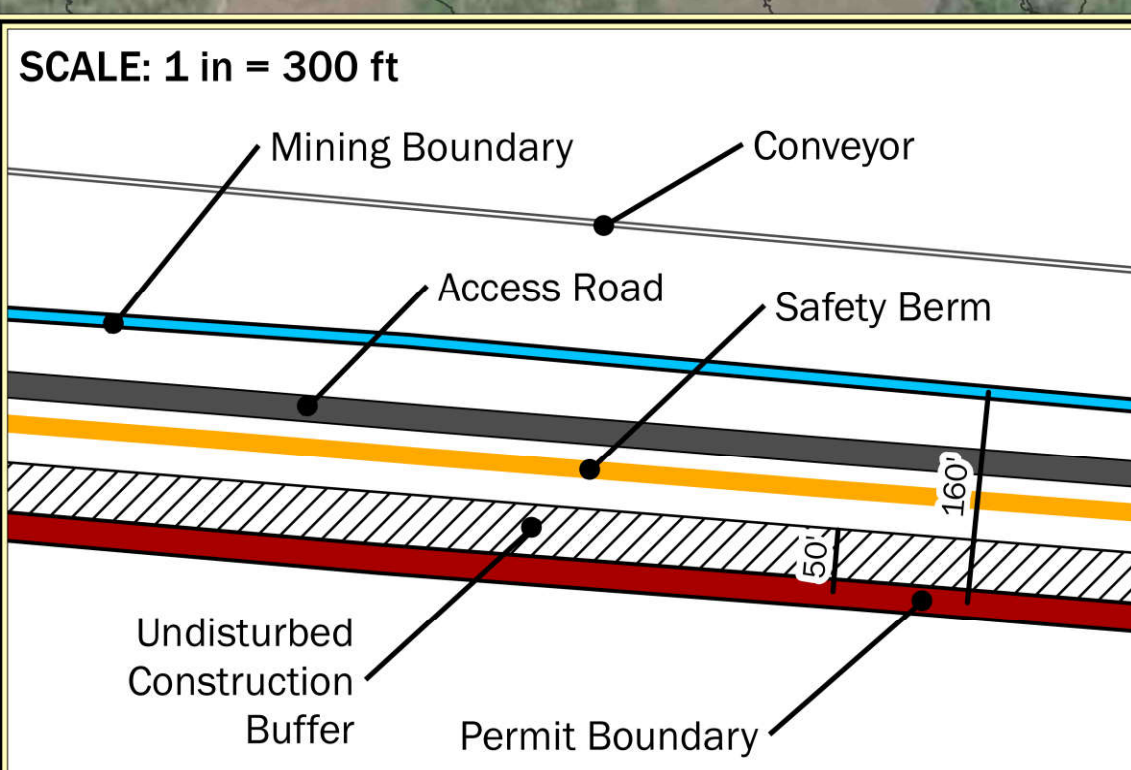
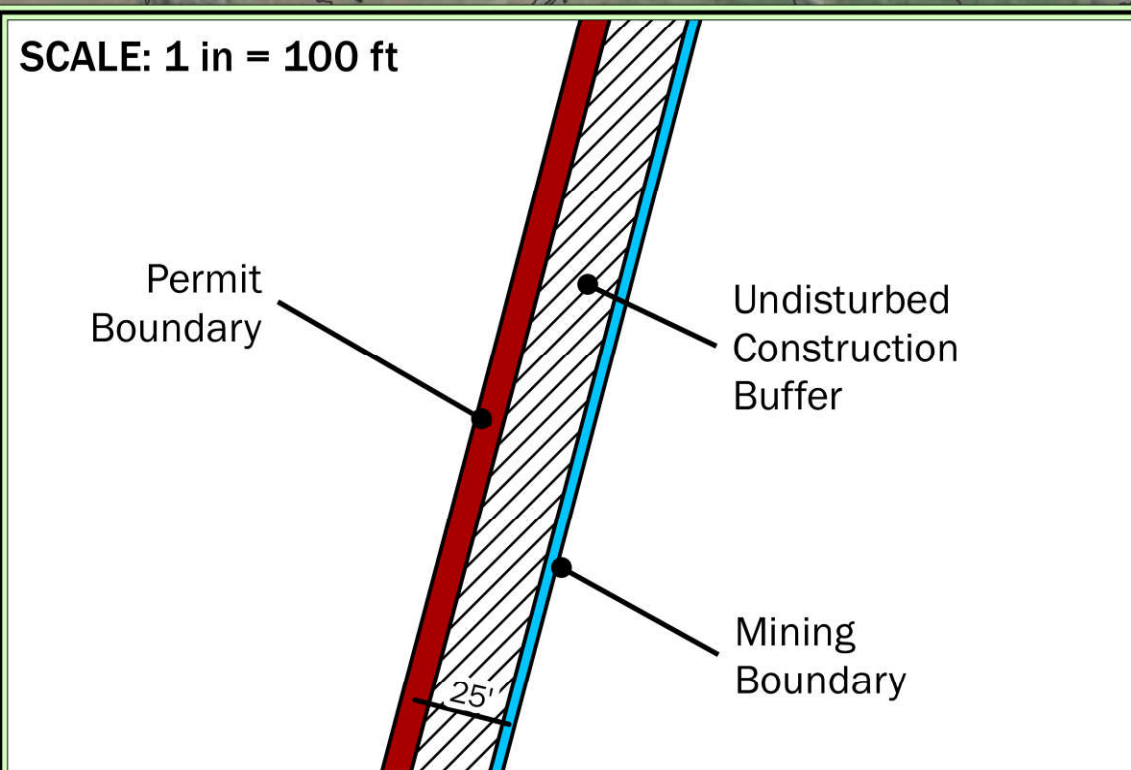
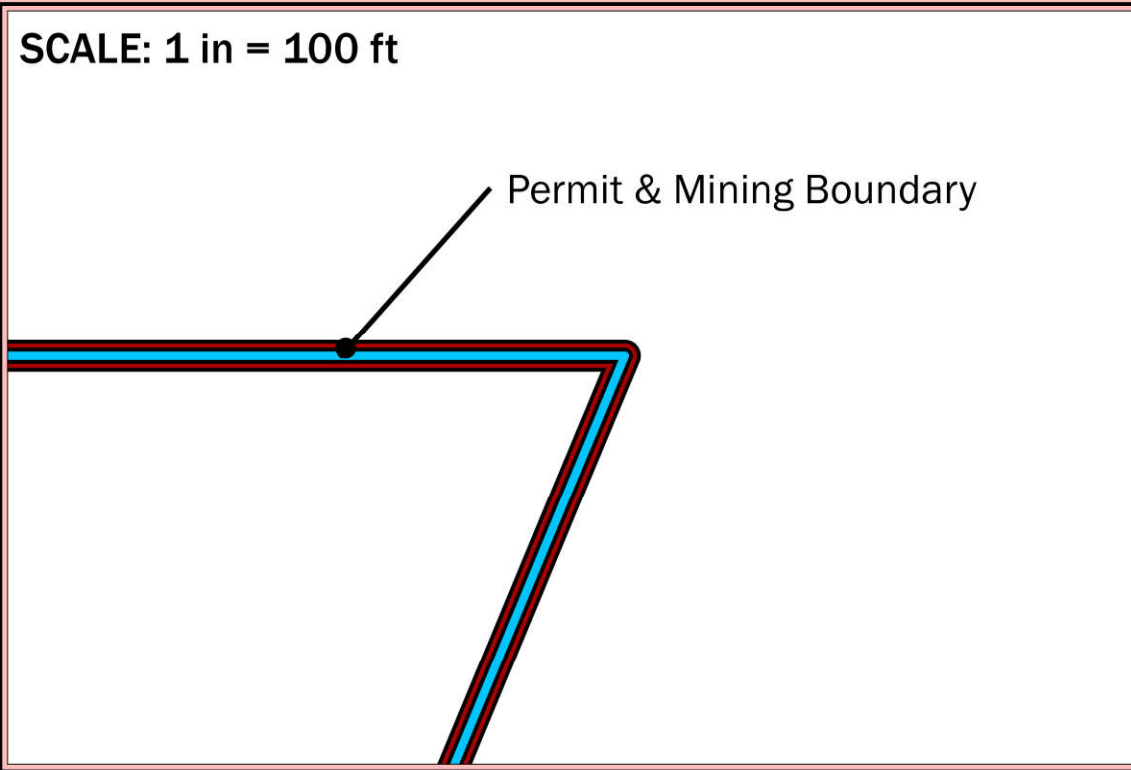
Site Survey Control		
Type	Identifier	Location
Property Boundary	Fence Post/Stake - Red	Property Corners
Mining Permit Boundary	Fence Post/Stake - Green	Approx. 200-foot intervals*
Buffer Boundary	Fence Post/Stake - Blue	Approx. 200-foot intervals*
Mining Pit Boundary	Fence Post/Stake - Orange	Approx.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

\*Intervals may be adjusted based on site conditions.

**LEGEND**

- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- USACE Verified Non-Jurisdictional Wetland
- 20' Wide Access Road
- Safety Berm
- Undisturbed Construction Buffer
- Stormwater Management/Process Water 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



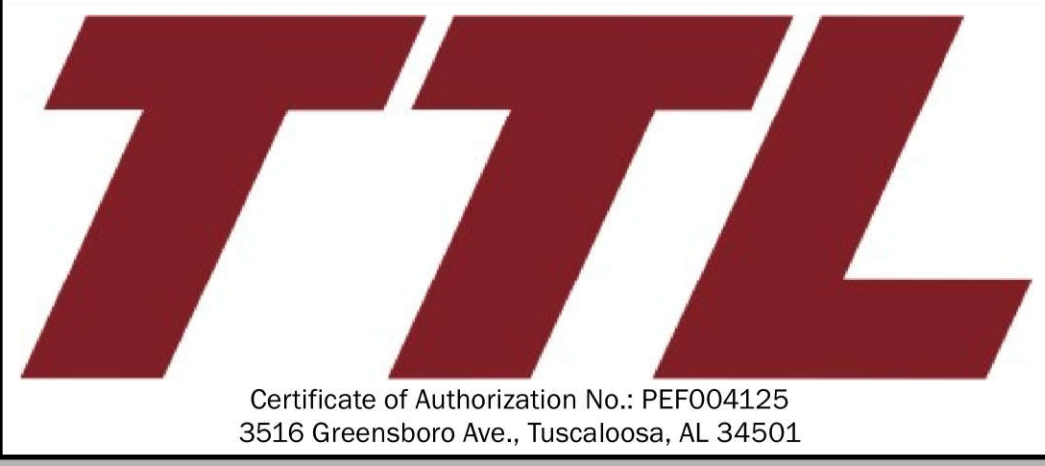
[OPERATOR'S NAME]  
 [MINE NAME]  
 [PERMIT NUMBER]  
 [CONTACT INFORMATION]

IDENTIFICATION SIGN (Typical)



**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 the southernmost well (FPW-01). Any wastewater from the Mineral Separation Plant will be hauled, by tanked trucks, to the Wet Concentration Plant for re-use. See Sheet 7 for pond details.

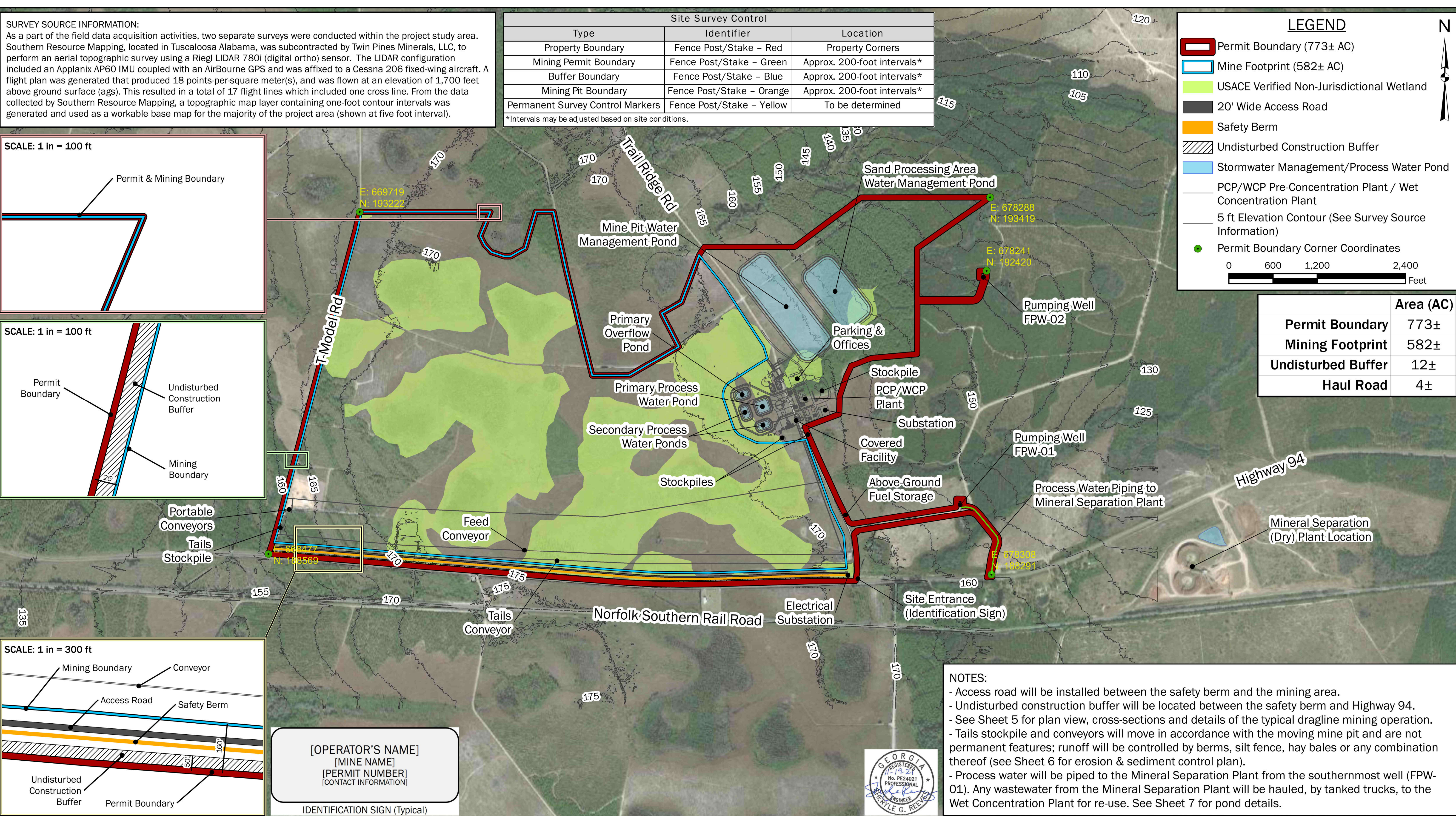


**SHEET 3: MINING PLAN SHEET - SITE LAYOUT**  
 TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

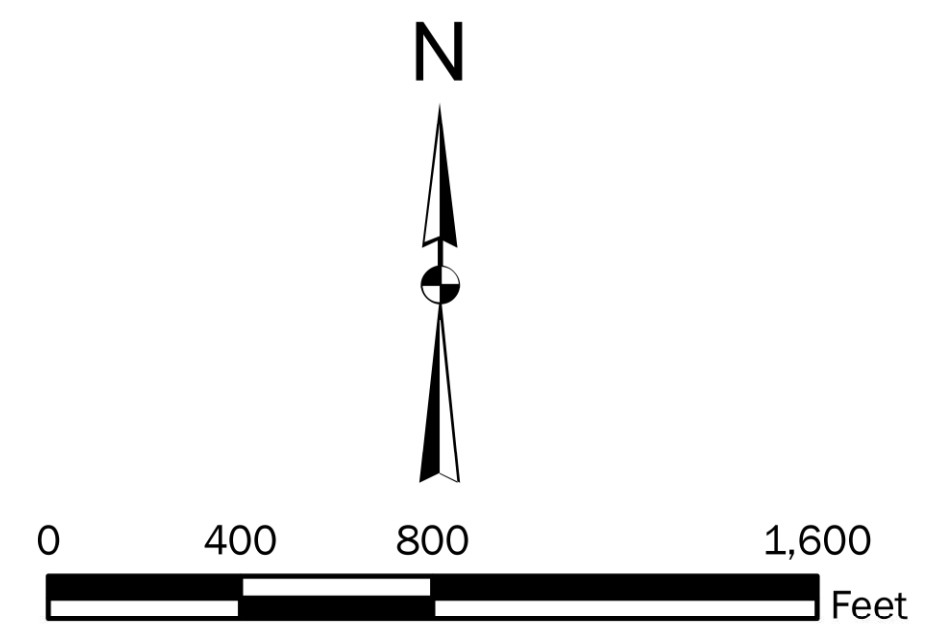
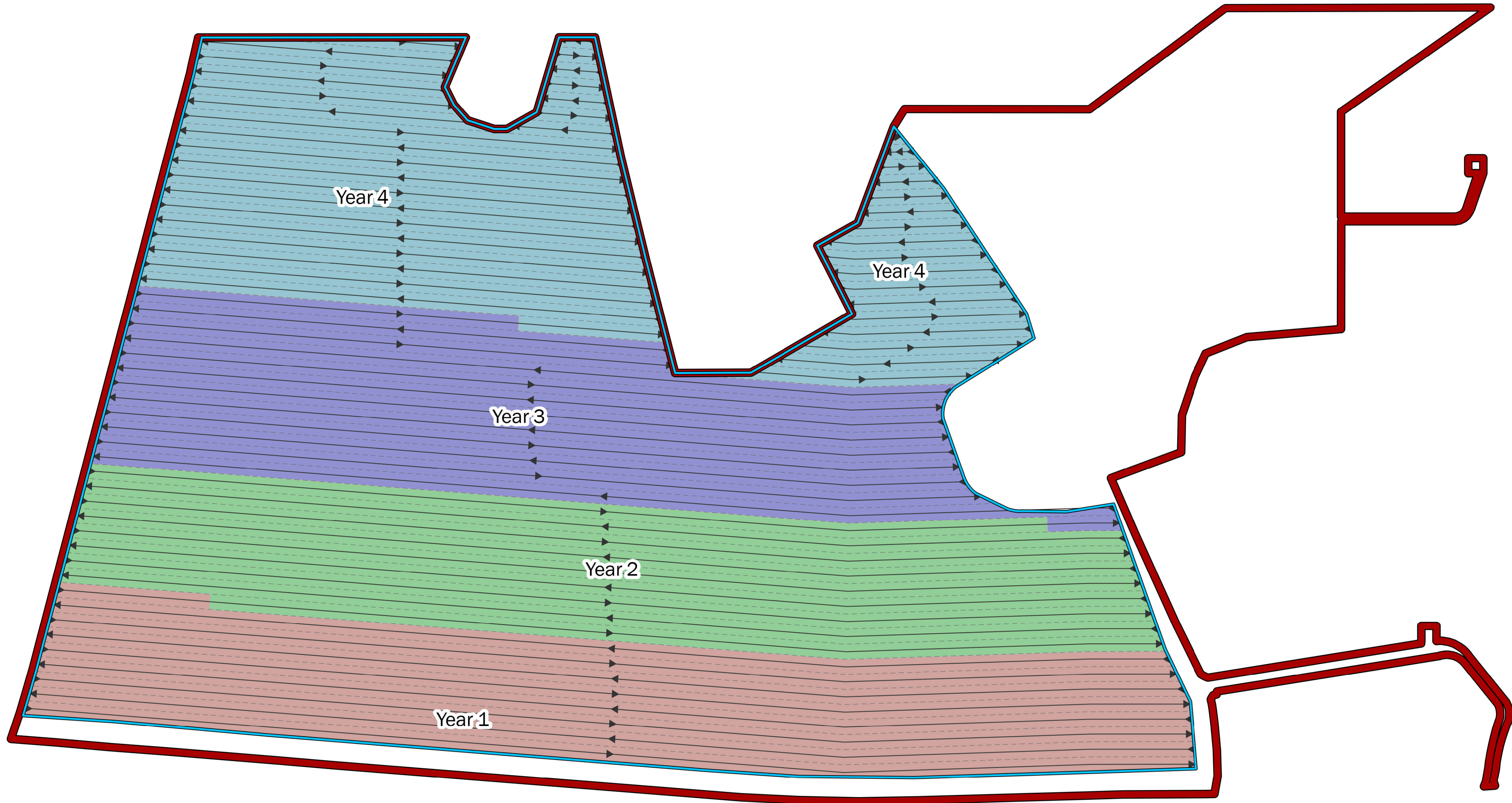
BASEMAP: Maxar, Vivid Imagery, 11/20/2019 (West, 0.5 m Resolution) & 3/24/2018 (East, 0.46 m Resolution).

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 600 ft

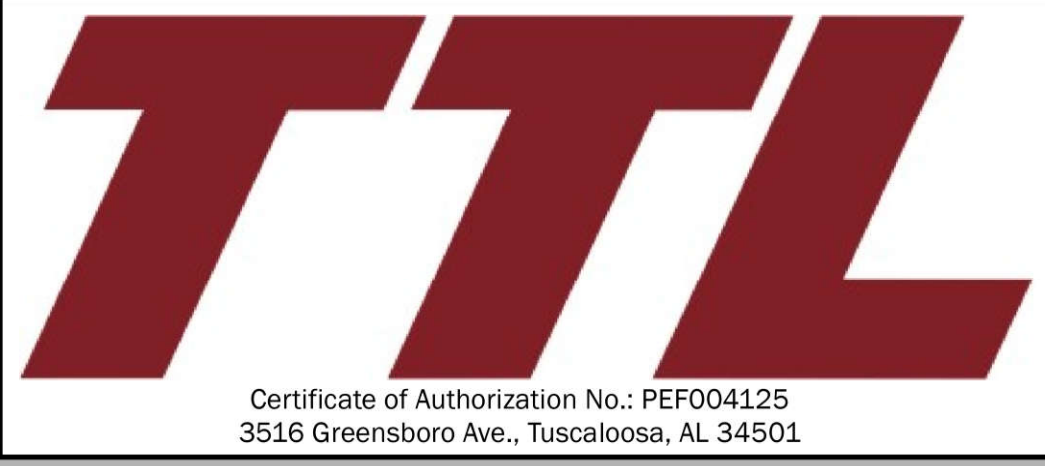
	Area (AC)
Permit Boundary	773±
Mining Footprint	582±
Undisturbed Buffer	12±
Haul Road	4±



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 range from 4 to 5 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 9 for information regarding dust control.  
 - See Sheet 16 for additional information regarding flood prone areas and threatened and endangered species locations.

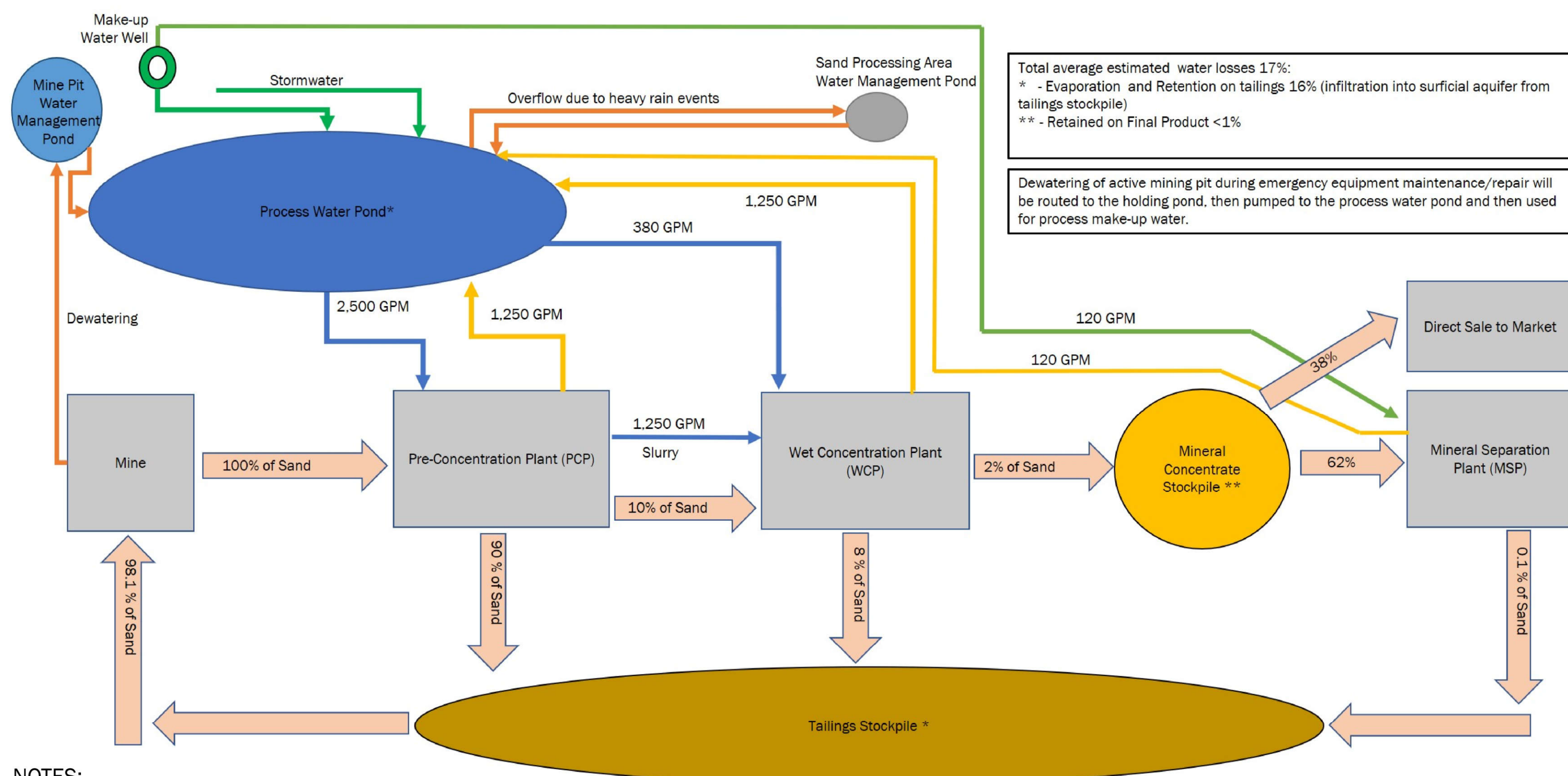


LEGEND	
	Permit Boundary (773± AC)
	Mine Footprint (582± AC)
	Year 1
	Year 2
	Year 3
	Year 4
	East-to-West Dragline Center
	West-to-East Dragline Center
	Edge of Dragline Pass



**SHEET 4: MINING PLAN SHEET - ESTIMATED PROGRESSION OF MINING**  
 TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

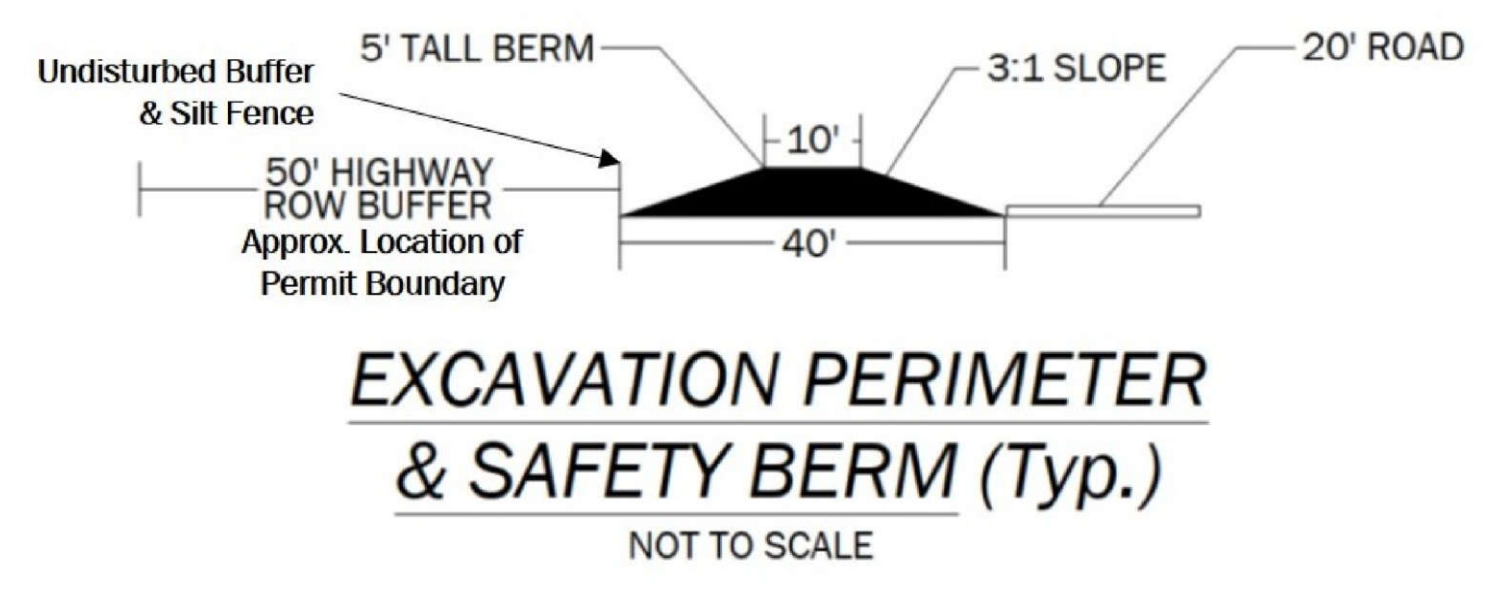
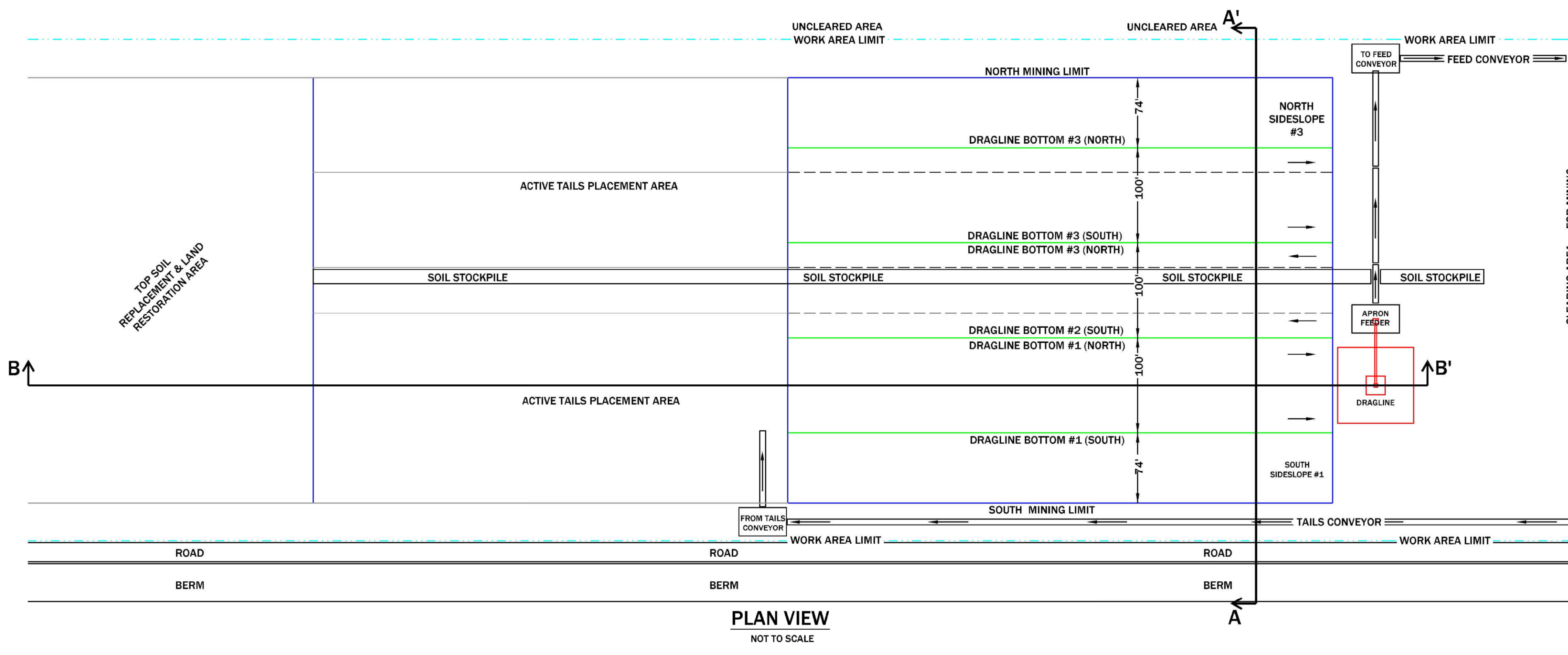
DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 400 ft



**NOTES:**

- All material will be hauled, utilizing trucks, between the permitted mine wet processing areas, and Mineral Separation Plant south of Highway 94.
- Process water will be piped to the Mineral Separation Plant from the southernmost well (FPW-01). Any wastewater from the Mineral Separation Plant will be hauled, by tanked trucks, to the Wet Concentration Plant for re-use.

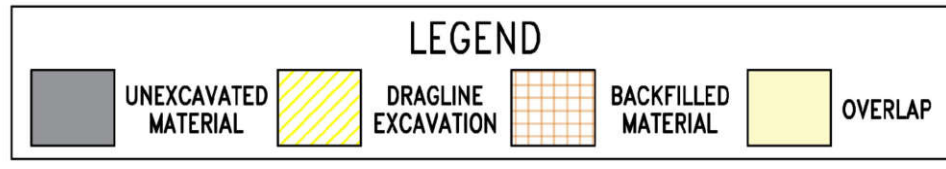
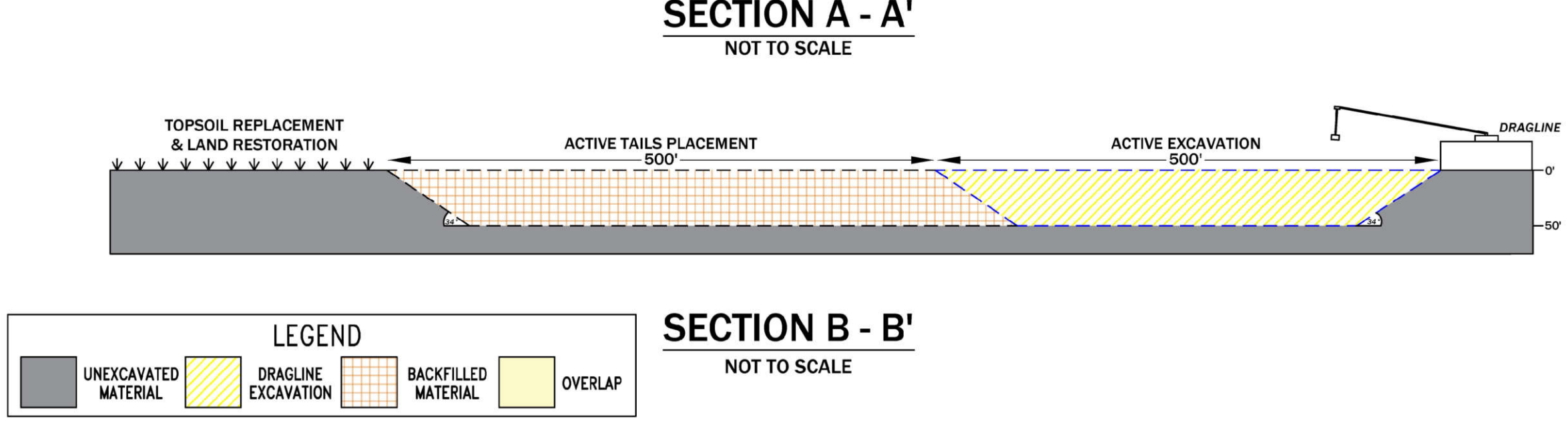
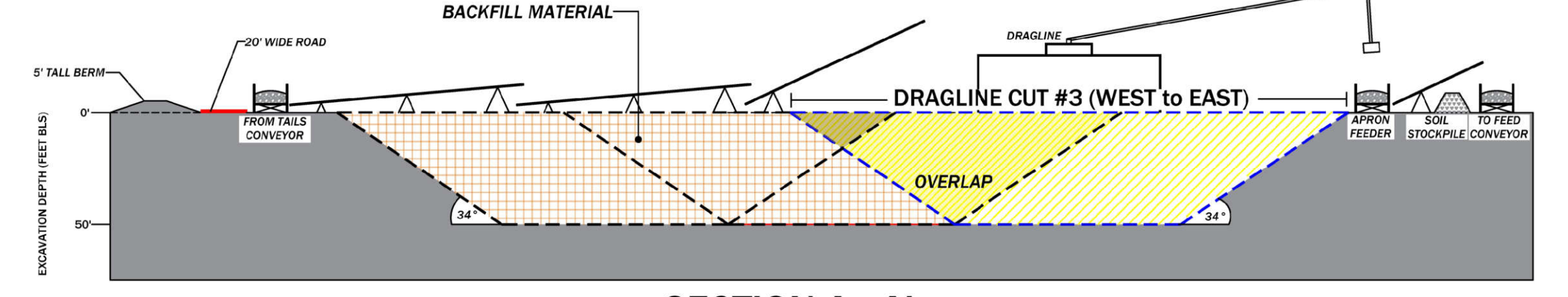
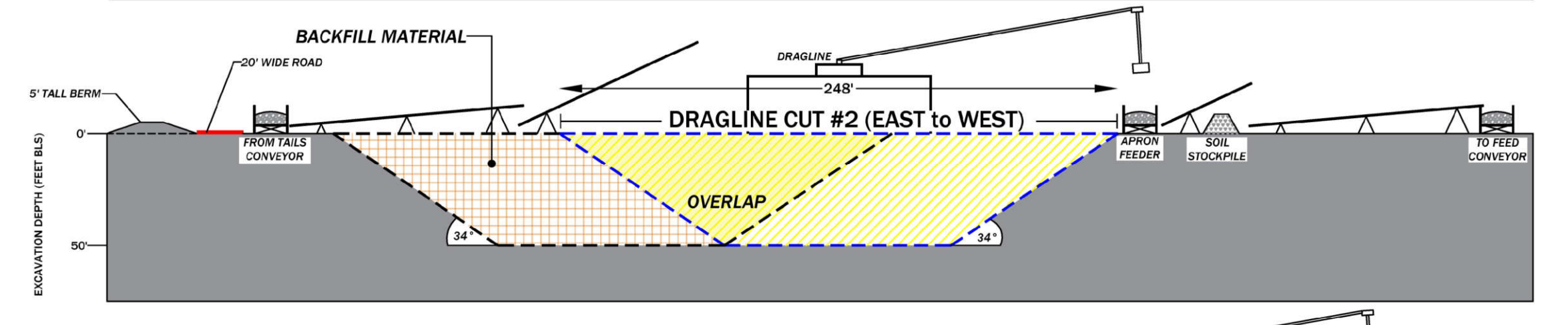
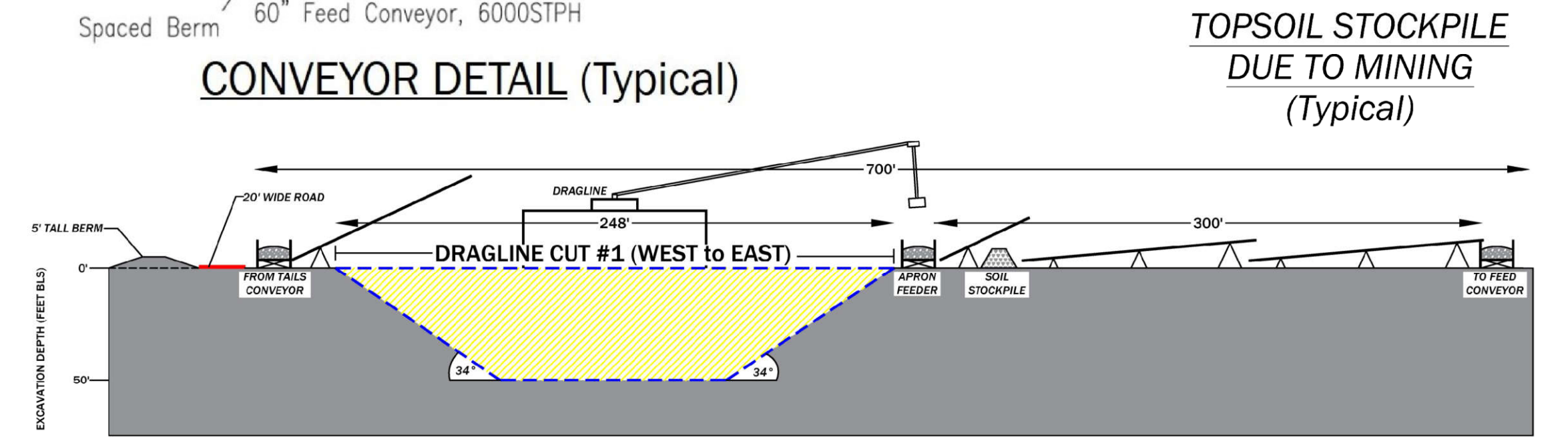
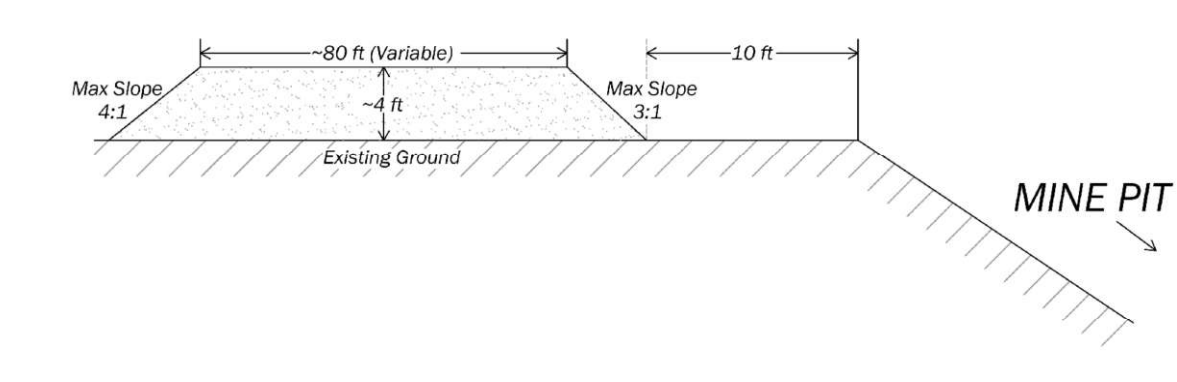
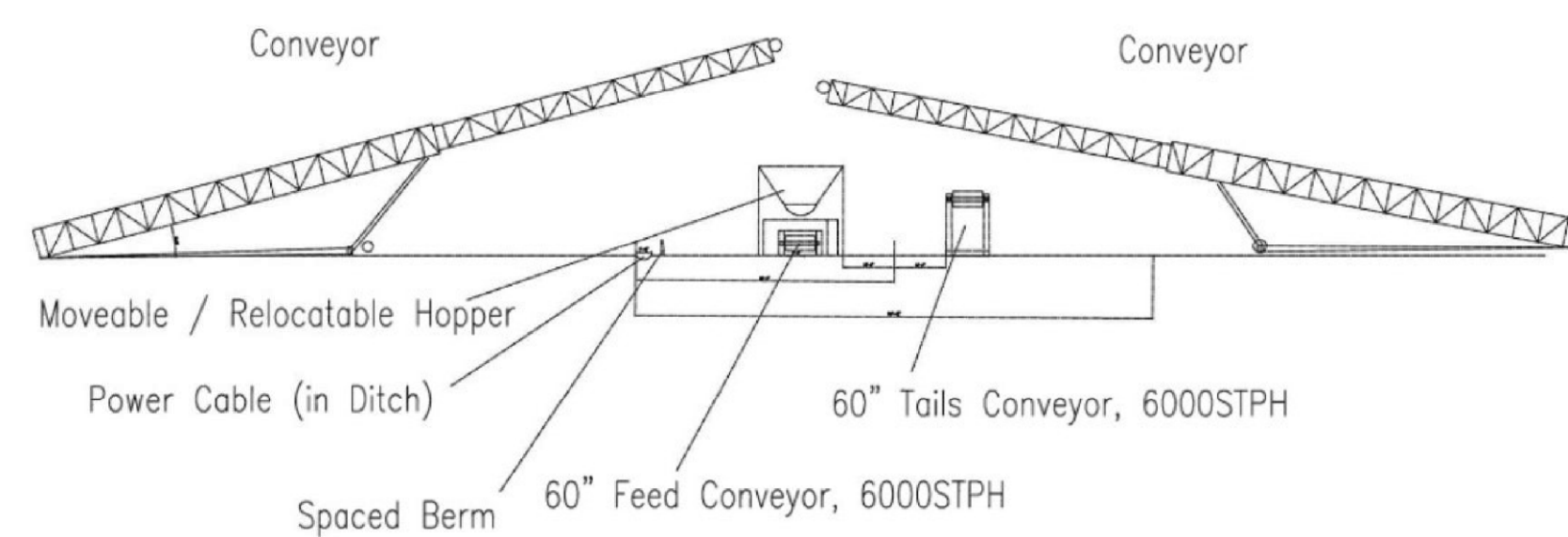
**MINING PROCESS FLOW DIAGRAM**



**NOTES**

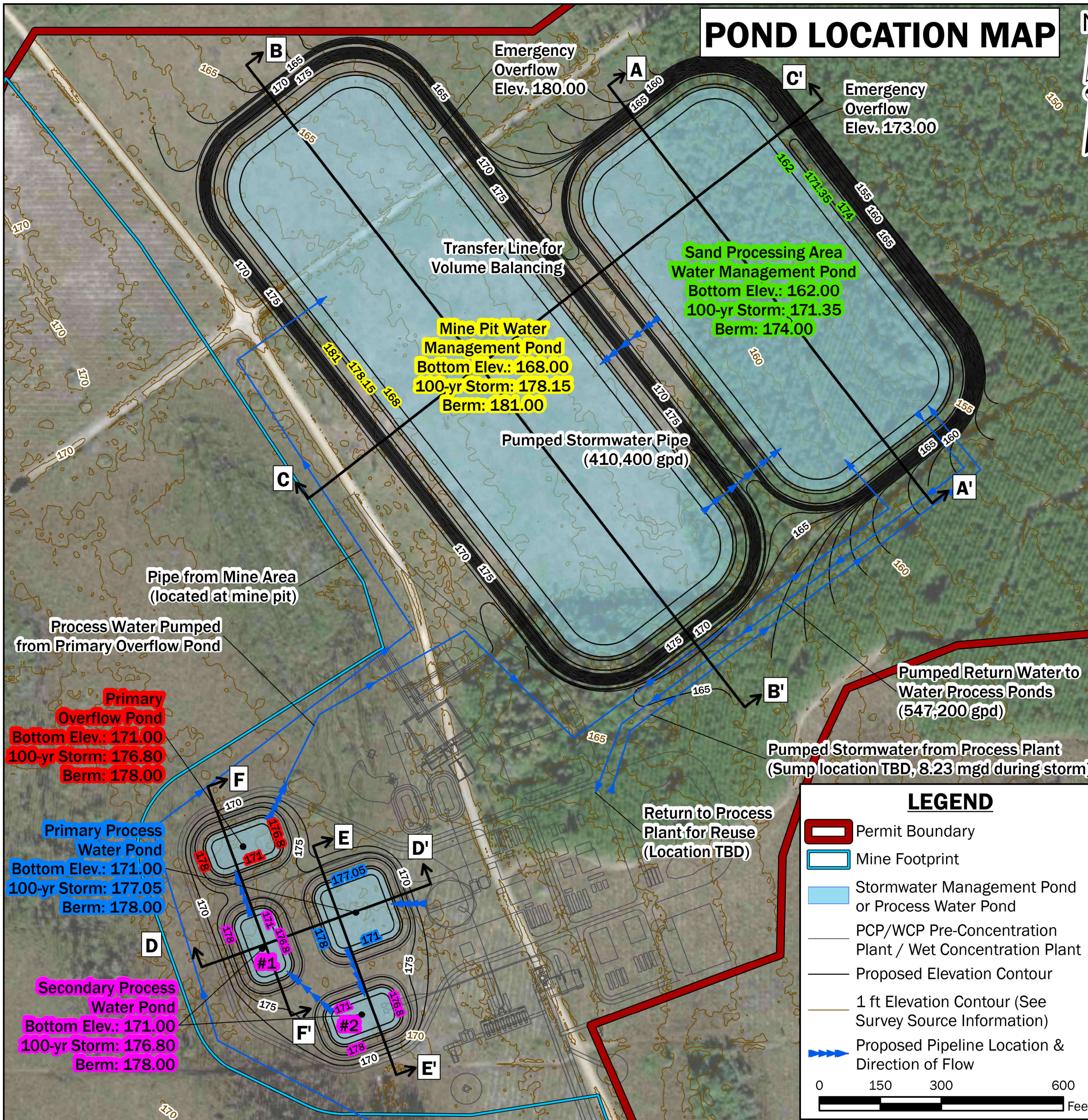
- Dragline advancement will be 100 to 200 feet per day; backfilling shall proceed no more than 500 feet (i.e. 5 to 7 days) behind the progressing mine pit.
- See Sheet 17 for a more in-depth narrative regarding the mining process.

	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



**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

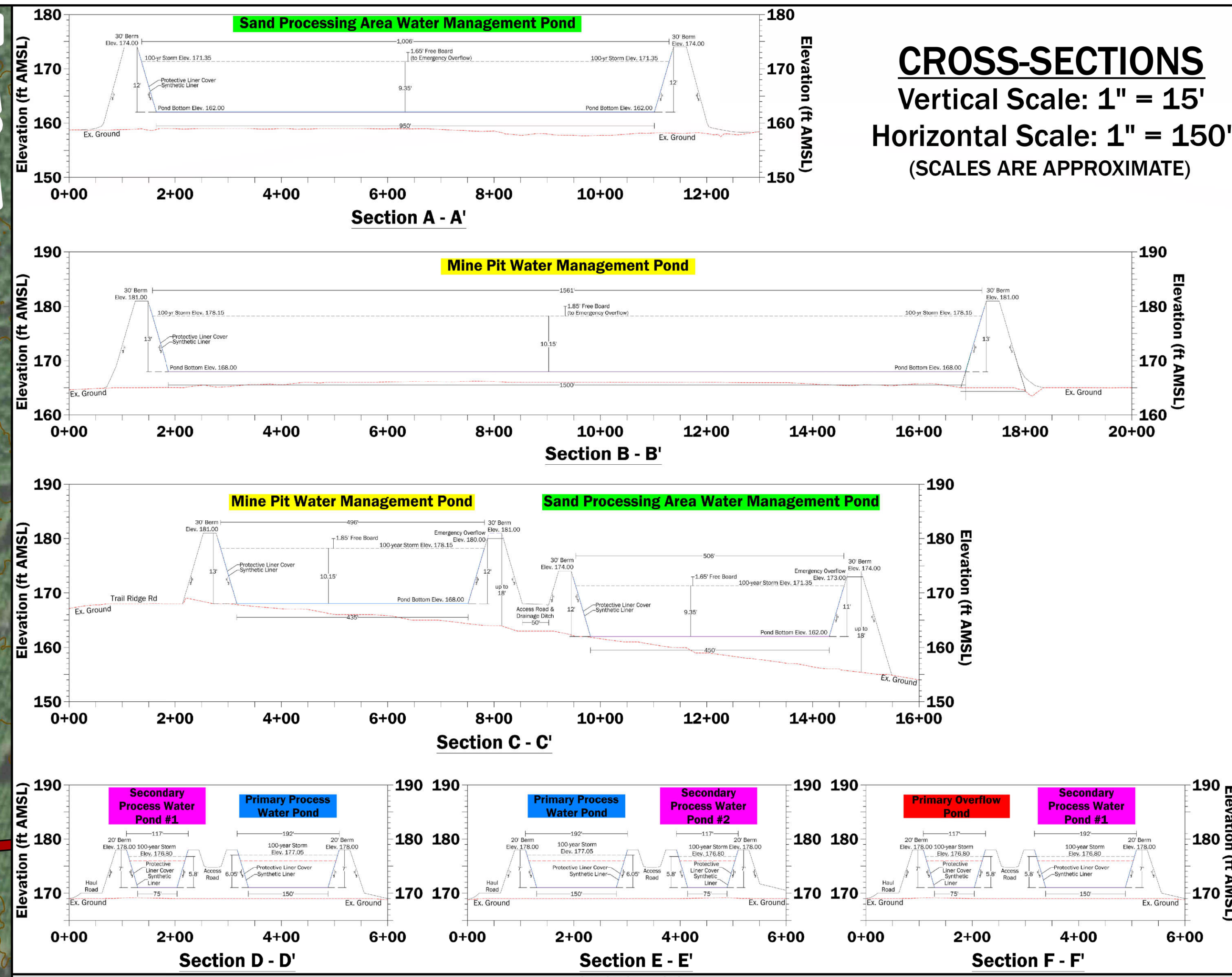
DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: N.T.S.



### LEGEND

- Permit Boundary
- Mine Footprint
- Stormwater Management Pond or Process Water Pond
- PCP/WCP Pre-Concentration Plant / Wet Concentration Plant
- Proposed Elevation Contour
- 1 ft Elevation Contour (See Survey Source Information)
- ▶▶▶▶▶ Proposed Pipeline Location & Direction of Flow

0 150 300 600 Feet



#### POND CALCULATIONS

	Sand Processing Area Water Management Pond				Mine Pit Water Management Pond				Primary Process Water Pond				Secondary Process Water Pond (x2)				Primary Overflow Pond			
	Elevation (ft AMSL)	Area (sqft)	Depth (ft)	Design Volume (million gal)	Elevation (ft AMSL)	Area (sqft)	Depth (ft)	Design Volume (million gal)	Elevation (ft AMSL)	Area (sqft)	Depth (ft)	Design Volume (million gal)	Elevation (ft AMSL)	Area (sqft)	Depth (ft)	Design Volume (million gal)	Elevation (ft AMSL)	Area (sqft)	Depth (ft)	Design Volume (million gal)
Pond Bottom	162	413,291	0	-	168	643,916	0	-	171	22,157	0	-	171	10,906	0	-	171	10,906	0	-
Operations																				
100-year Storm	171.35	488,786	9.35	31.5	178.15	759,442	10.15	53.3	177.05	33,458	6.05	1.3	176.8	19,090	5.8	0.7	176.8	19,090	5.8	0.7
Emergency Overflow	173	502,622	11	37.7	180	781,127	12	64.0	178	35,421	7	1.5	178	21,021	7	0.8	178	21,021	7	0.8
Berm Elevation	174		12		181		13		178		7		178		7		178		7	

- NOTES:**
- Pond dimensions and volumes are based on the 24-hour 100-year storm event.
  - Proposed berm and ground slopes shown are 3:1.
  - All exposed ground areas will be covered with temporary vegetation for erosion and sediment control. See Sheet 10 for planting schedule.
  - Pump capacity and pipeline size to be determined by the engineer of record.
  - The emergency overflow is included to maintain pond safety/integrity and is not intended for discharge.
  - Final pond and emergency overflow geometry, design specifications, and details to be determined by the engineer of record.

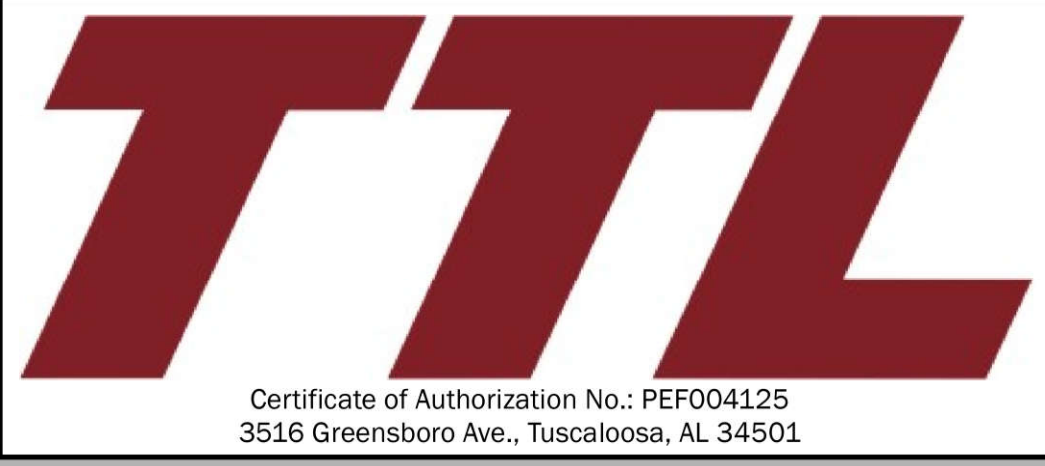
#### LINER DETAIL (Typical)

NOT TO SCALE

**NOTES:**

1. Final liner system specifications and geometry shall be established by the engineer of record.
2. Thickness and material type of liner protective cover shall be established by the engineer of record.
3. Provide sufficient stable base for support to the liner system and berm. Base material and thickness to be determined by the engineer of record.

**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 Air Bourne 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.



## SHEET 6: POND DESIGN DETAILS & NOTES

TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)  
ST. GEORGE, CHARLTON COUNTY, GEORGIA  
BASEMAP: Maxar, Vivid Imagery, 11/20/2019 (0.5 m Resolution).

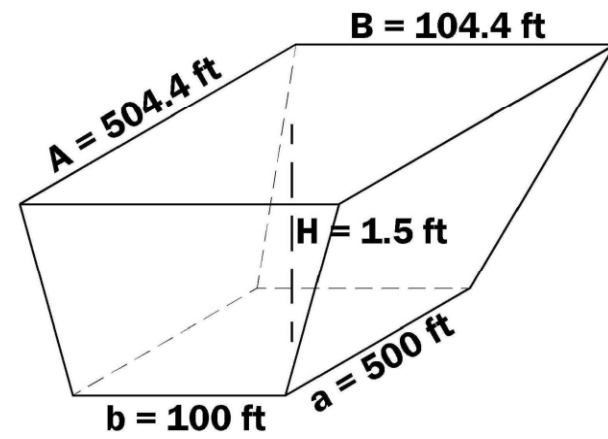
DRAWN BY: DEK
CHECKED BY: KHR
DRAWING DATE: 11/19/2021
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: See Sheet

**MINE PIT WATER MANAGEMENT POND CALCULATIONS**

THE FOLLOWING APPROXIMATE MINE PIT DIMENSIONS ARE EXPECTED:

- BOTTOM WIDTH: 100 FEET (b)
- BOTTOM LENGTH: 500 FEET (a)
- MINE PIT TOTAL DEPTH: 50 FEET

SIDE SLOPES FOR THE MINE PIT ARE EXPECTED TO BE APPROXIMATELY 1 TO 1.5, APPROXIMATELY 34° (DEGREES) FROM HORIZONTAL (56° FROM VERTICAL). THE RESULTANT SHAPE OF MINE PIT IS AN INVERTED OBELISK. THE FOLLOWING FIGURE DEPICTS THE SHAPE OF THE MINE PIT WITH 1.5 FEET OF WATER:



WHEN THE MINE IS INACTIVE, THE WATER LEVEL IS EXPECTED TO RISE TO APPROXIMATELY 45 FEET ABOVE THE MINE BOTTOM. IN ORDER FOR THE MINING OPERATION TO START AGAIN, THE ACCUMULATED WATER WILL NEED TO BE REMOVED DOWN TO 1.5 FEET ABOVE THE MINE BOTTOM.

THE LENGTHS OF THE LONG AND SHORT ENDS OF THE TOP OF THE WATER SURFACE (SIDES A AND B ABOVE) WITHIN THE MINE PIT VARY BASED ON THE WATER HEIGHT (H IN FEET). TO DETERMINE THESE DIMENSIONS, THE FOLLOWING FORMULAS WERE UTILIZED:

- TOP LONG END (A) = 500 FEET + (2 X H X TAN 56°)
  - H=1.5 FEET; A=504.4 FEET
  - H=45 FEET; A=633.4 FEET
- TOP SHORT END (B) = 100 FEET + (2 X H X TAN 56°);
  - H=1.5 FEET; B=104.4 FEET
  - H=45 FEET; B=233.4 FEET

TO DETERMINE THE VOLUME OF WATER TO BE REMOVED FROM THE MINE PIT DURING A RESTART SCENARIO, THE VOLUME OF 1.5 FEET OF WATER (H=1.5) WAS SUBTRACTED FROM THE VOLUME OF 45 FEET OF WATER (H=45). THE VOLUME AT THESE WATER LEVELS WERE CALCULATED UTILIZING THE FOLLOWING FORMULA:

VOLUME (V - CUBIC FEET - FT³) = (H/6) \* (Ab+aB+2(ab+AB))  
 VOLUME WHERE H=1.5 FT = 76,989.68 FT³ = 575,882.8 GALLONS  
 VOLUME WHERE H=45 FT = 4,317,833.4 FT³ = 32,297,393.8 GALLONS

DEWATERING VOLUME = 32,297,393.8 GALLONS - 575,882.8 GALLONS = 31,721,511 GALLONS.

BASED ON A PILOT EXCAVATION STUDY PREVIOUSLY CONDUCTED BY TPM, A FACTOR OF 1.5 WAS CALCULATED TO THE THEORETICAL DEWATERING VOLUME TO COMPENSATE FOR RECHARGE OF THE OPEN MINE PIT BY THE SURROUNDING SURFICIAL AQUIFER. THE TOTAL DEWATERING STORAGE VOLUME IS CALCULATED BY:

DEWATERING STORAGE VOLUME REQUIRED = 1.5 X 31,721,511 GALLONS = 47,582,266.5 GALLONS  
 THIS VOLUME ROUNDED IS 47,582,267 GALLONS.

**MINE PIT WATER MANAGEMENT POND SIZING**

THE MINE PIT WATER MANAGEMENT POND SIZE WAS THEN ESTIMATED TO HAVE A BOTTOM WIDTH OF 435 FEET AND A BOTTOM LENGTH OF 1,500 FEET. INTERIOR BERM SIDE SLOPES WERE SET TO 3:1 AND EXTENDED UP TO A POINT WHERE THE DEWATERING STORAGE VOLUME REQUIRED WAS REACHED (47,582,267 GALLONS). THE BERM HEIGHT WAS THEN EXTENDED TO 12 FEET, TO THE ESTIMATED ELEVATION OF THE EMERGENCY OVERFLOW. AT THIS HEIGHT, THE POND SURFACE AREA WAS APPROXIMATED TO BE 18 ACRES.

TTL ACCESSED THE POINT PRECIPITATION FREQUENCY ESTIMATES PROVIDED BY NOAA, NATIONAL WEATHER SERVICES WEBSITE (<https://hdsc.nws.noaa.gov/hdsc/>) FOR FOLKSTON, GEORGIA. THE RAINFALL AMOUNT FOR THE 24-HOUR, 25-YEAR STORM AS WELL THE 24-HOUR 100-YEAR STORM WAS UTILIZED TO ACCOUNT FOR RAINFALL FALLING DIRECTLY ONTO THE MINE DEWATERING STORAGE POND. THE FOLLOWING RAINFALL ESTIMATES WERE RECORDED FOR THE ABOVE-LISTED STORM EVENTS:

- 24-HOUR, 25-YEAR = 8.45 INCHES (0.7 FEET)
- 24-HOUR, 100-YEAR = 11.4 INCHES (0.95 FEET)

UTILIZING THE ABOVE-LISTED RAINFALL EVENTS AND A POND SIZE OF 18 ACRES, THE POND STORAGE CAPACITY WAS INCREASED TO THE FOLLOWING RESPECTIVE STORAGE VOLUMES TO ACCOUNT FOR THE STORM EVENTS:

- 24-HOUR, 25-YEAR EVENT:  
 VOLUME 24-HOUR-25-YEAR EVENT = (RAINFALL IN FT) X (18 ACRES X 43,560 FT²/ACRE) X (7.48 GAL/FT³)  
 VOLUME 24-HOUR-25-YEAR EVENT = (0.7 FT) X (18 ACRES X 43,560 FT²/ACRE) X (7.48 GAL/FT³)

MINE DEWATERING VOLUME: 47,582,267 GALLONS  
 24-HOUR-25-YEAR ADDITIONAL VOLUME: 4,105,443 GALLONS  
 TOTAL VOLUME REQUIRED: 51,687,710 GALLONS

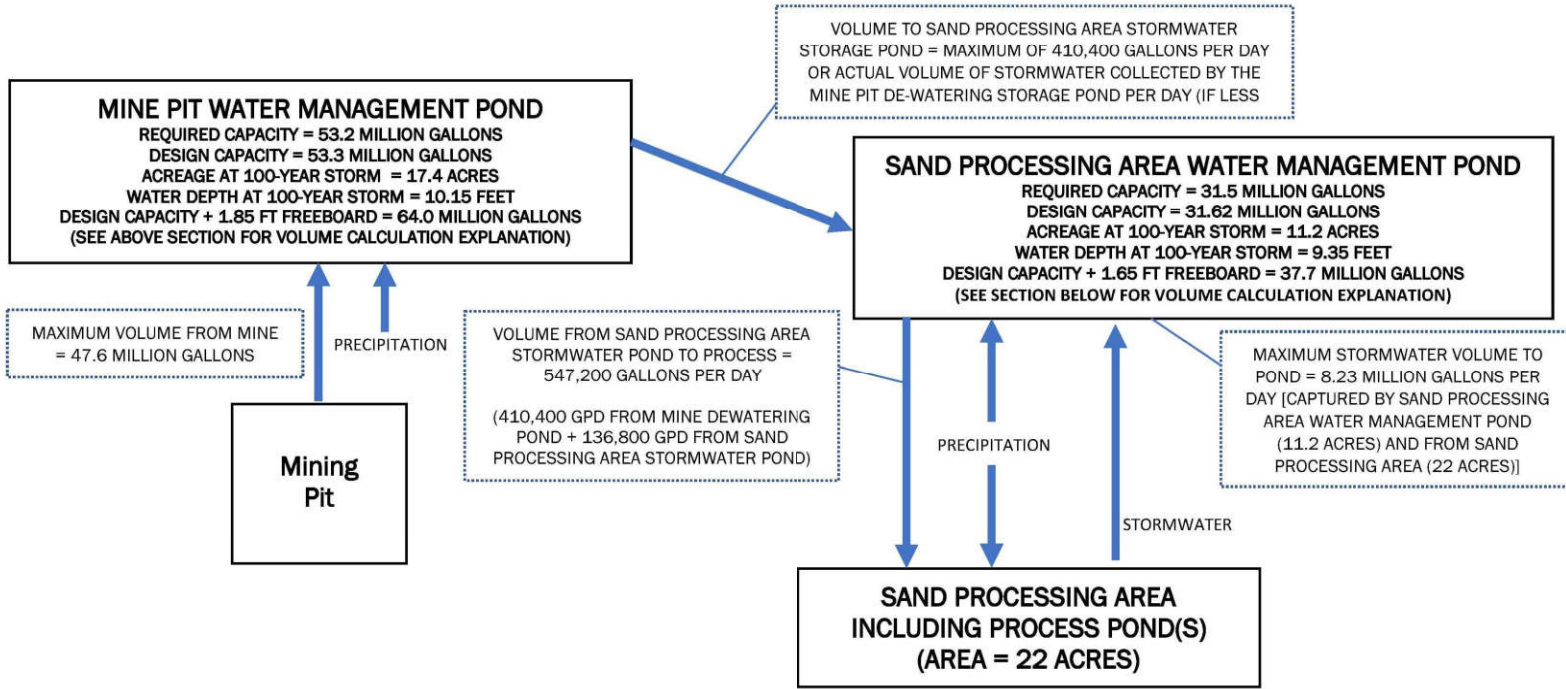
- 24-HOUR, 100-YEAR EVENT:  
 VOLUME 24-HOUR-100-YEAR EVENT = (RAINFALL IN FT) X (18 ACRES X 43,560 FT²/ACRE) X (7.48 GAL/FT³)  
 VOLUME 24-HOUR-100-YEAR EVENT = (0.95 FT) X (18 ACRES X 43,560 FT²/ACRE) X (7.48 GAL/FT³)

MINE DEWATERING VOLUME: 47,582,267 GALLONS  
 24-HOUR-100-YEAR ADDITIONAL VOLUME: 5,571,672 GALLONS  
 TOTAL VOLUME REQUIRED: 53,153,939 GALLONS  
 TOTAL VOLUME REQUIRED (ROUNDED): 53.2 MILLION GALLONS

DESIGN POND VOLUME OF 53.3 MILLION GALLONS (163.6 ACRE-FT), WITH WATER HEIGHT OF 10.15 FEET ABOVE THE BOTTOM OF THE POND, WAS UTILIZED IN ORDER TO CONTAIN THE 24-HOUR, 100-YEAR EVENT VOLUME (SHEET 6). AN ADDITIONAL 1.85 FEET OF FREEBOARD (12-FOOT POND DEPTH) WAS PROVIDED FOR ADDITIONAL STORAGE. THIS FREEBOARD PROVIDES AN APPROXIMATE TOTAL STORAGE OF 64.0 MILLION GALLONS (196.4 ACRE-FT). REFER TO SHEET 6 FOR THE PROPOSED POND DIMENSIONS.

**SAND PROCESSING AREA WATER MANAGEMENT POND**

THE FOLLOWING PROCESS FLOW DIAGRAM DESCRIBES THE ANTICIPATED MOVEMENT OF WATER THAT IS EXPECTED TO TAKE PLACE DURING MINING OPERATIONS:



NOTE: HEIGHTS PROVIDED ABOVE ARE DEPENDENT UPON GEOMETRY OF POND PROVIDED ON SHEET 6.

APPROXIMATELY 35 YEARS OF DATA FROM DAILY RAINFALL EVENTS (JANUARY 1, 1986 TO JUNE 30, 2021; 12,965 DAYS) WERE TABULATED FROM WEATHER STATIONS NEAR FOLKSTON, GA AND GLEN ST. MARY, FL. THE DAILY RAINFALL VOLUMES CAPTURED BY THE SAND PROCESSING AREA WATER MANAGEMENT POND (SPAWMP) AND THE SAND PROCESSING AREA (SPA) DURING THIS TIME PERIOD WERE CALCULATED BASED ON THE RESPECTIVE SURFACE AREAS AND DAILY RAINFALL MEASUREMENTS. A TWO-DAY PLANT SHUTDOWN RESULTING IN A FULL MINE PIT WAS SIMULATED EVERY 6-MONTHS THROUGHOUT THE SIMULATED TIME PERIOD. THE VOLUME OF STORAGE REQUIRED WAS CALCULATED BASED ON THE PROCESS DIAGRAM ABOVE.

WHEN MINE PIT DEWATERING IS REQUIRED, THE VOLUME OF WATER IN THE MINE PIT PLUS GROUNDWATER INFLOW IS TRANSFERRED TO THE MINE PIT WATER MANAGEMENT POND (MPWMP). WATER IS PUMPED FROM THE MPWMP TO THE SPAWMP AND THEN TO THE SAND PROCESSING AREA TO PROVIDE PROCESS WATER FOR THE PLANT. THE DAILY CALCULATION OF WATER ENTERING THE SPAWMP FROM STORMWATER AND THE MPWMP AND REMOVED FROM THE SPAWMP FOR PLANT MAKE-UP WATER WAS SUMMARIZED FOR THE ENTIRE TIME PERIOD. THE MAXIMUM VOLUME OF WATER ACCUMULATED IN THE SPAWMP FOR THE TIME PERIOD WAS USED AS THE MINIMUM STORAGE VOLUME FOR THE SPAWMP (30,464,993 GALLONS).

A 24-HOUR, 25-YEAR RAINFALL EVENT OCCURRED DURING THE TIME PERIOD. HOWEVER, A 24-HOUR, 100-YEAR STORM EVENT WAS NOT ENCOUNTERED DURING THE TIME PERIOD. FOR THIS REASON, THE ADDITIONAL STORAGE NEEDED FOR A 100-YEAR STORM EVENT WAS CALCULATED BY UTILIZING THE DIFFERENCE IN THE TWO PRECIPITATION EVENTS:

24-HOUR, 100-YEAR EVENT:  
 VOLUME 24-hour-100-YEAR event = (100-YR RAINFALL FT - 25-YEAR FT) X (502,622 FT²) X (7.48 GAL/FT³)  
 VOLUME 24-hour-100-year event = (0.95 FT - 0.7 FT) X (502,622 FT²) X (7.48 GAL/FT³)

SIMULATED SPAWMP VOLUME: 30,464,993 GALLONS  
 24-HOUR-100-YEAR ADDITIONAL VOLUME: 939,903 GALLONS  
 TOTAL SPAWMP VOLUME REQUIRED: 31,404,896 GALLONS (31.4 MILLION GALLONS)

BASED ON THE SPAWMP DIMENSIONS PROVIDED ON SHEET 6, A POND DEPTH OF 9.35 FEET WILL BE SUFFICIENT TO STORE 31.5 MILLION GALLONS (= DESIGN VOLUME - 96.7 ACRE-FT). ALSO, NOTE THAT NO EVAPORATION VOLUMES WERE CONSIDERED IN THESE CALCULATIONS FOR THE SPAWMP. A FREEBOARD STORAGE OF 1.65 FEET (11-FOOT POND DEPTH TO EMERGENCY OVERFLOW) WAS UTILIZED FOR THE PROPOSED POND DIMENSIONS. THIS FREEBOARD WOULD BE SUFFICIENT TO STORE APPROXIMATELY 37.7 MILLION GALLONS (115.7 ACRE-FT, I.E. MAXIMIZING FREEBOARD). REFER TO THE POND CALCULATIONS TABLE ON SHEET 6).

**SUMMARY**

THE FOLLOWING TABLE SUMMARIZES THE ESTIMATED POND STORAGE REQUIREMENTS AND THE RESPECTIVE VOLUMES DESIGNED FOR EACH POND:

	MINE PIT WATER MANAGEMENT POND	SAND PROCESSING AREA WATER MANAGEMENT POND	TOTAL STORAGE
DESIGNED STORAGE WITH FREEBOARD (MILLION GALLONS)	64.0	37.7	101.7
ESTIMATED NEEDED STORAGE (MILLION GALLONS)	53.1	31.4	84.5
ESTIMATED EXCESS STORAGE (MILLION GALLONS)	10.9	6.3	17.2
ESTIMATED PERCENT EXCESS	20.5%	20.1%	20.4%

**SPECIAL CONSIDERATIONS**

THE MINE OPERATOR SHOULD ATTEMPT TO MAINTAIN MAXIMUM AVAILABLE STORAGE CAPACITY DURING ROUTINE MINING OPERATIONS. PLANNED SHUTDOWNS/STARTUPS SHOULD OCCUR WHEN MAXIMUM STORAGE IS AVAILABLE AND WHEN SIGNIFICANT RAINFALL EVENTS ARE NOT EXPECTED.

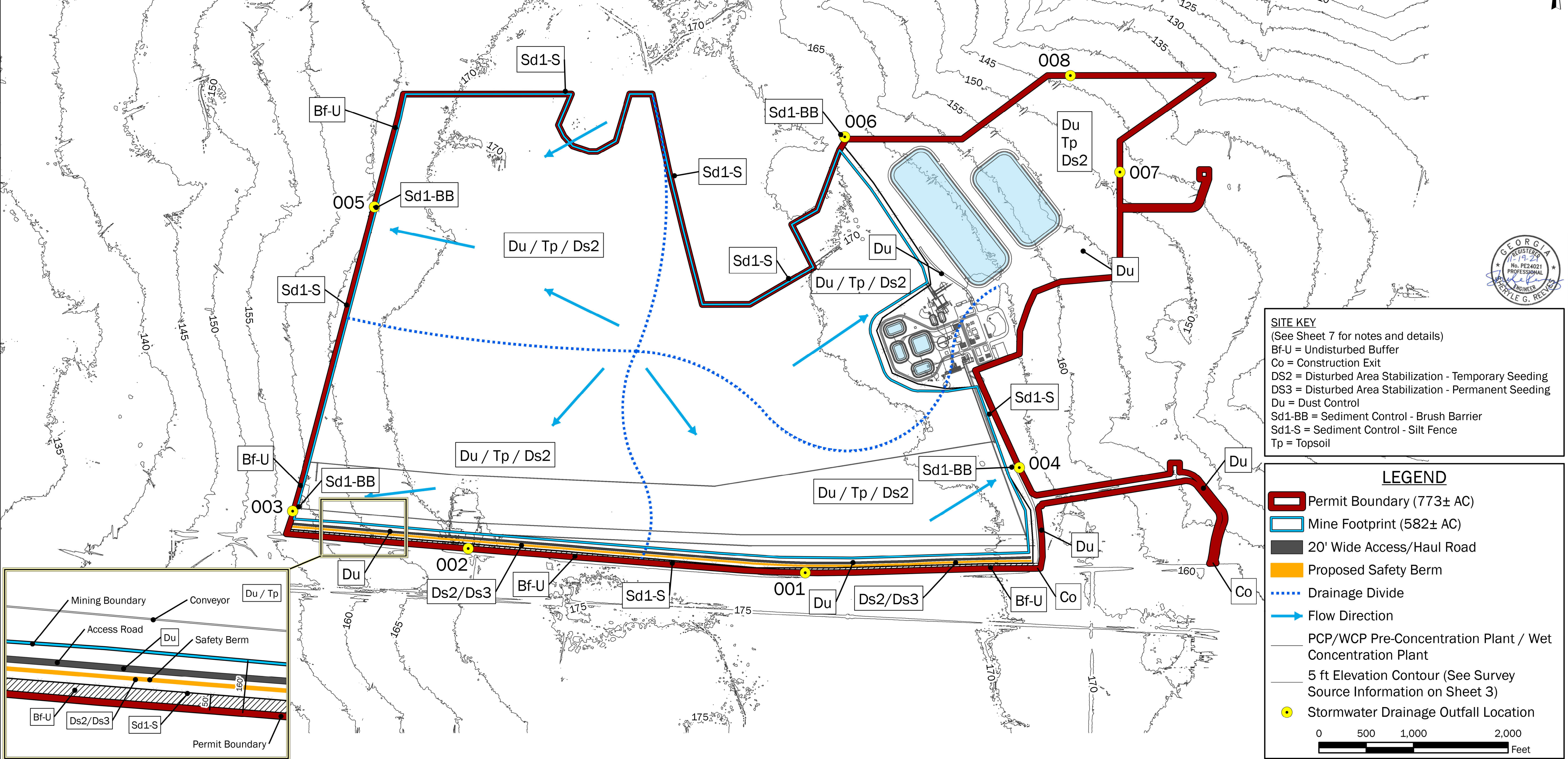
IN CIRCUMSTANCES WHERE THE MINE PIT WILL REQUIRE DEWATERING AFTER A SHUTDOWN, THE WATER WILL BE PUMPED DIRECTLY FROM THE MINE PIT TO THE MINE PIT WATER MANAGEMENT POND. DURING/AFTER RAINFALL EVENTS, STORMWATER FROM THE MINE PIT WATER MANAGEMENT POND AND THE PRIMARY OVERFLOW POND WILL BE PUMPED DIRECTLY TO THE SAND PROCESSING AREA WATER MANAGEMENT POND. STORMWATER FROM THE PROCESSING PLANT AREA WILL BE DIRECTED TO SUMP(S) AND PUMPED DIRECTLY TO THE SAND PROCESSING AREA WATER MANAGEMENT POND. WATER FROM THE SAND PROCESSING AREA WATER MANAGEMENT POND WILL BE PUMPED DIRECTLY TO THE PROCESS PONDS OR PROCESSING FACILITY FOR REUSE. NO WATER WILL BE DISCHARGED FROM THE PONDS.



**SHEET 7: STORAGE VOLUME CALCULATIONS & PROCESS DESCRIPTION**  
 TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY: DEK
CHECKED BY: KHR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: N/A

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

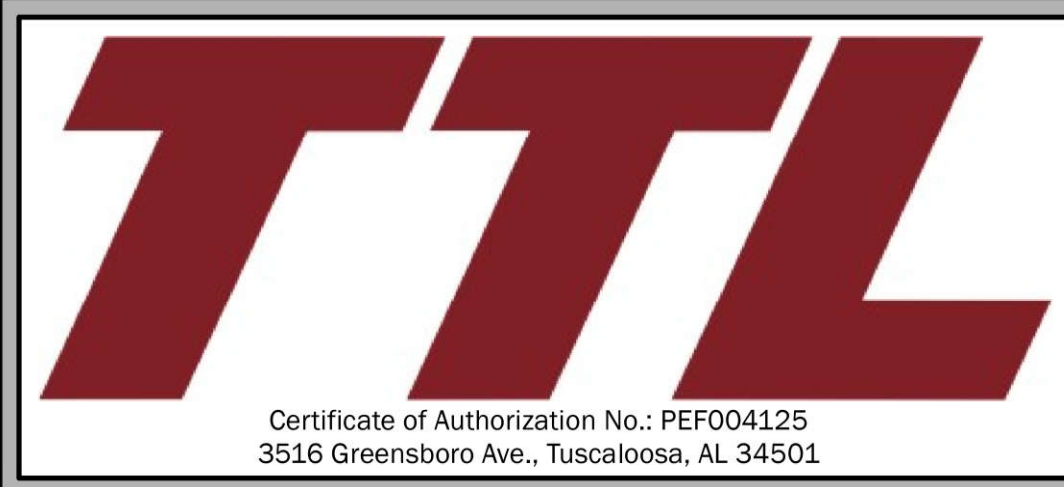
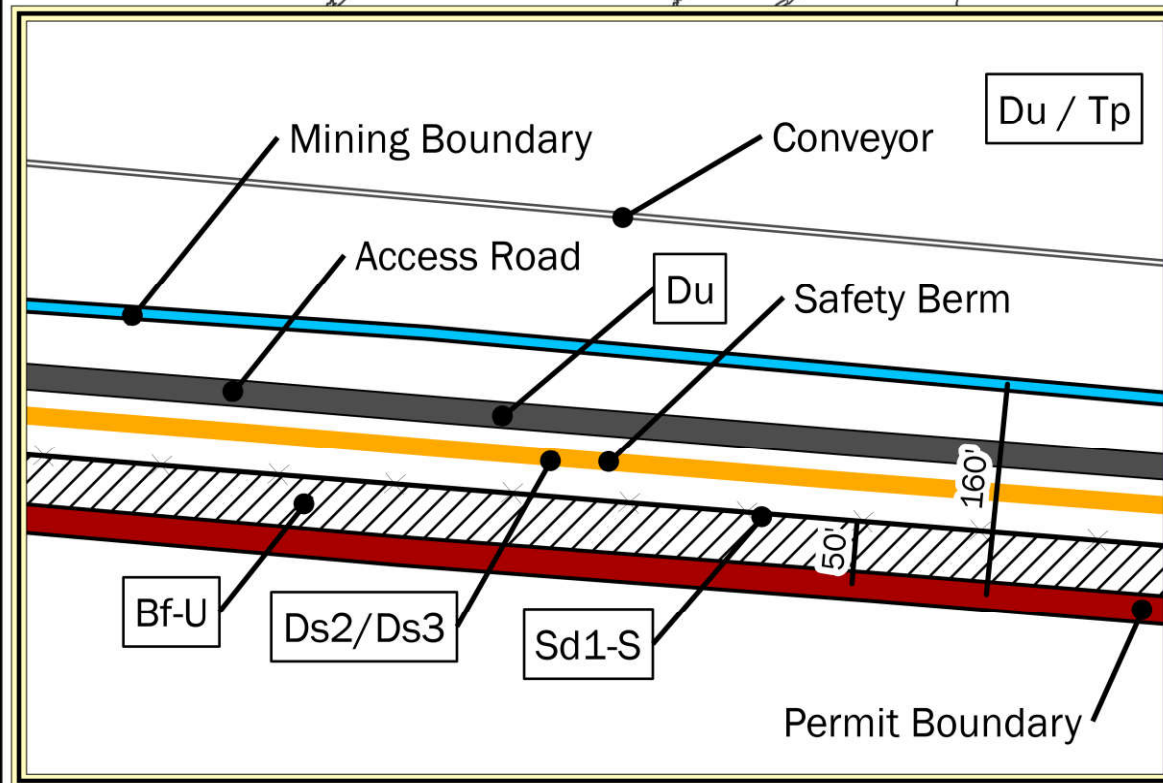


**SITE KEY**  
 (See Sheet 7 for notes and details)  
 Bf-U = Undisturbed Buffer  
 Co = Construction Exit  
 DS2 = Disturbed Area Stabilization - Temporary Seeding  
 DS3 = Disturbed Area Stabilization - Permanent Seeding  
 Du = Dust Control  
 Sd1-BB = Sediment Control - Brush Barrier  
 Sd1-S = Sediment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



**SHEET 8: 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: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 500 ft



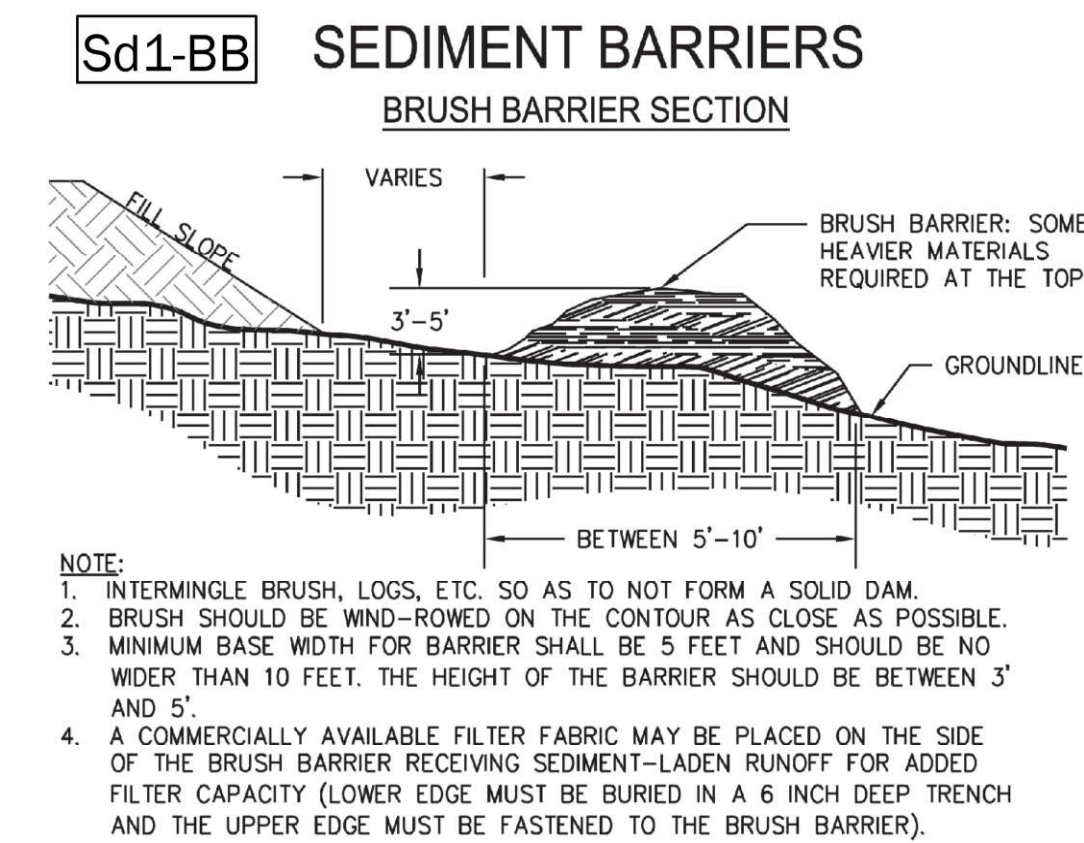
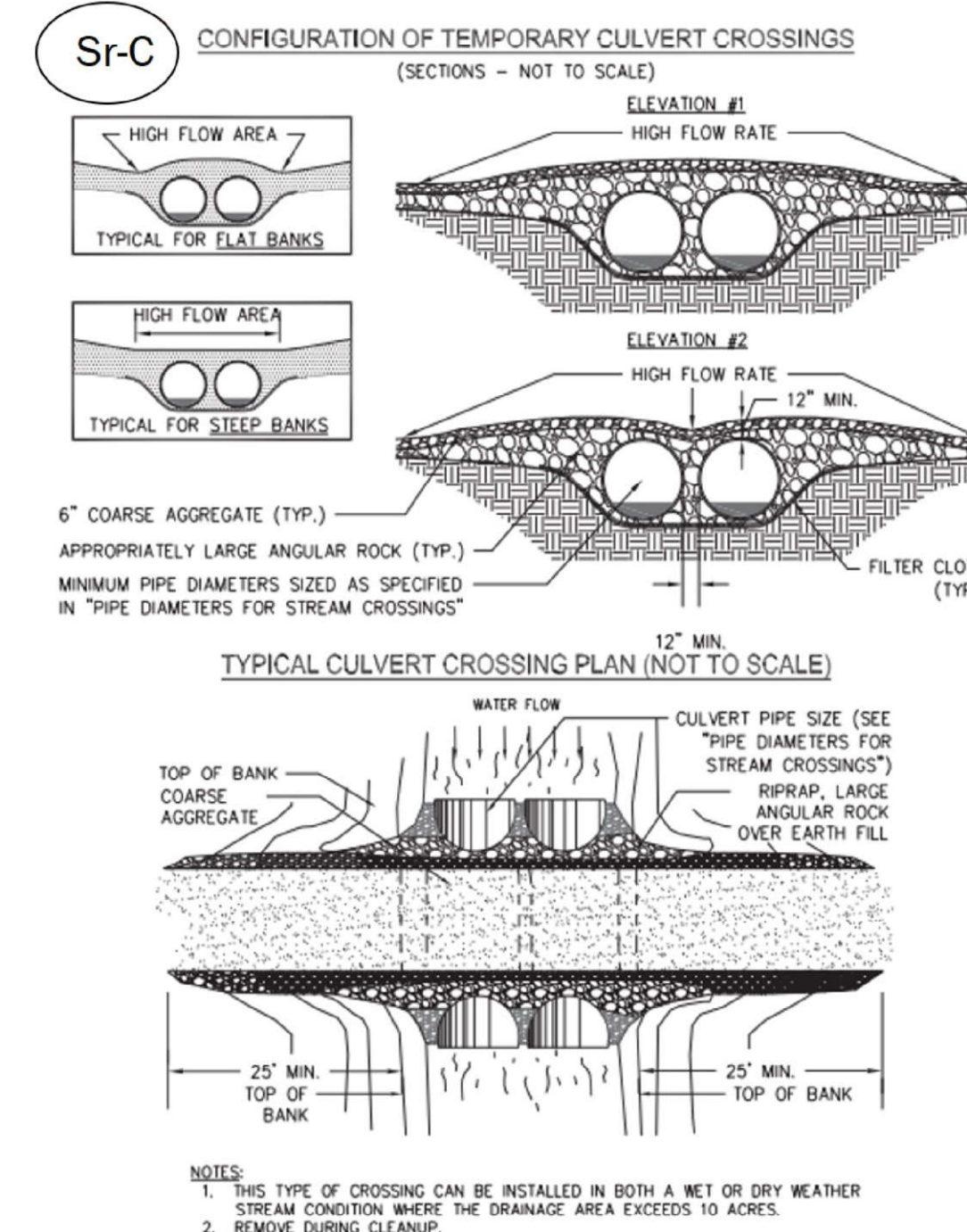
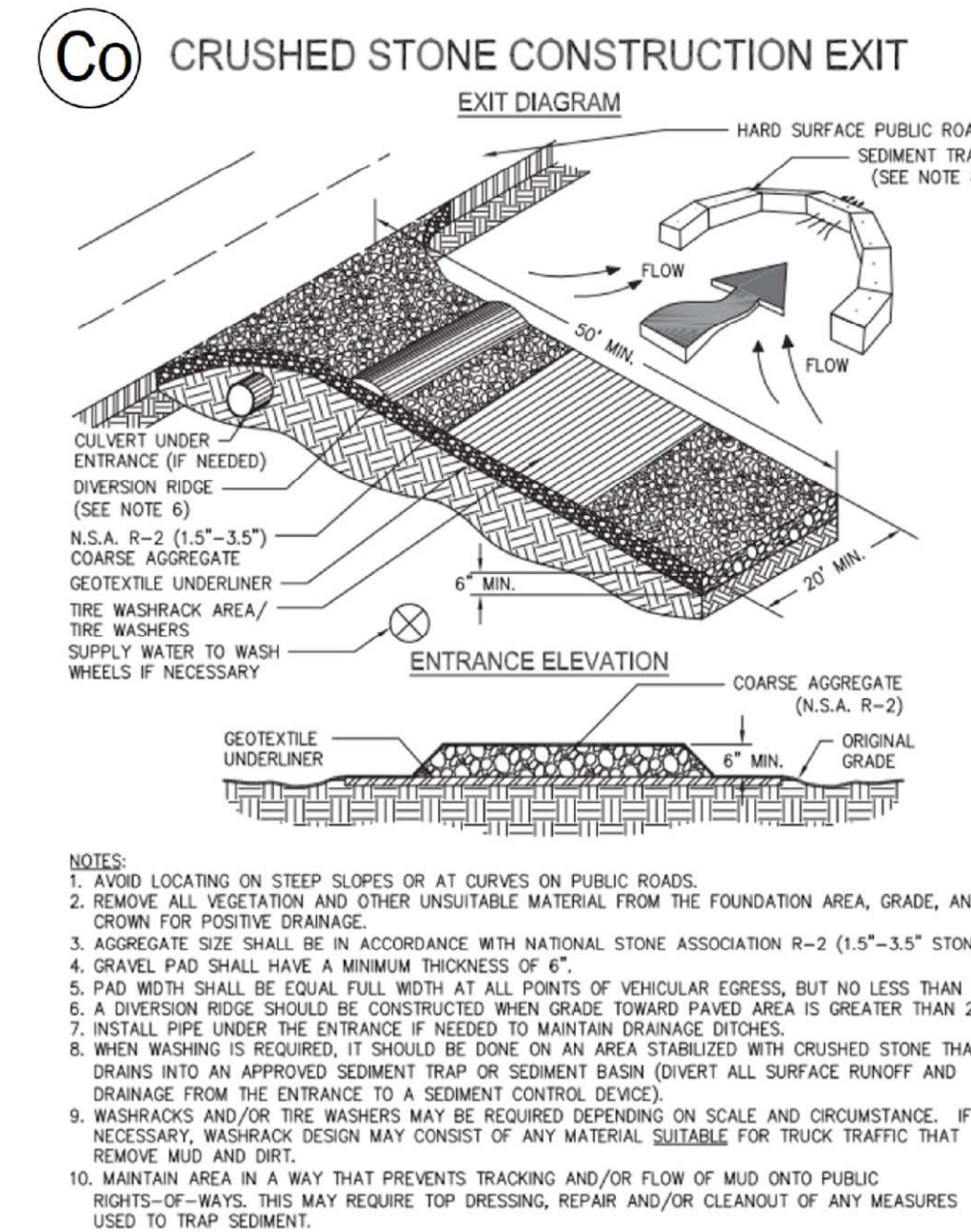
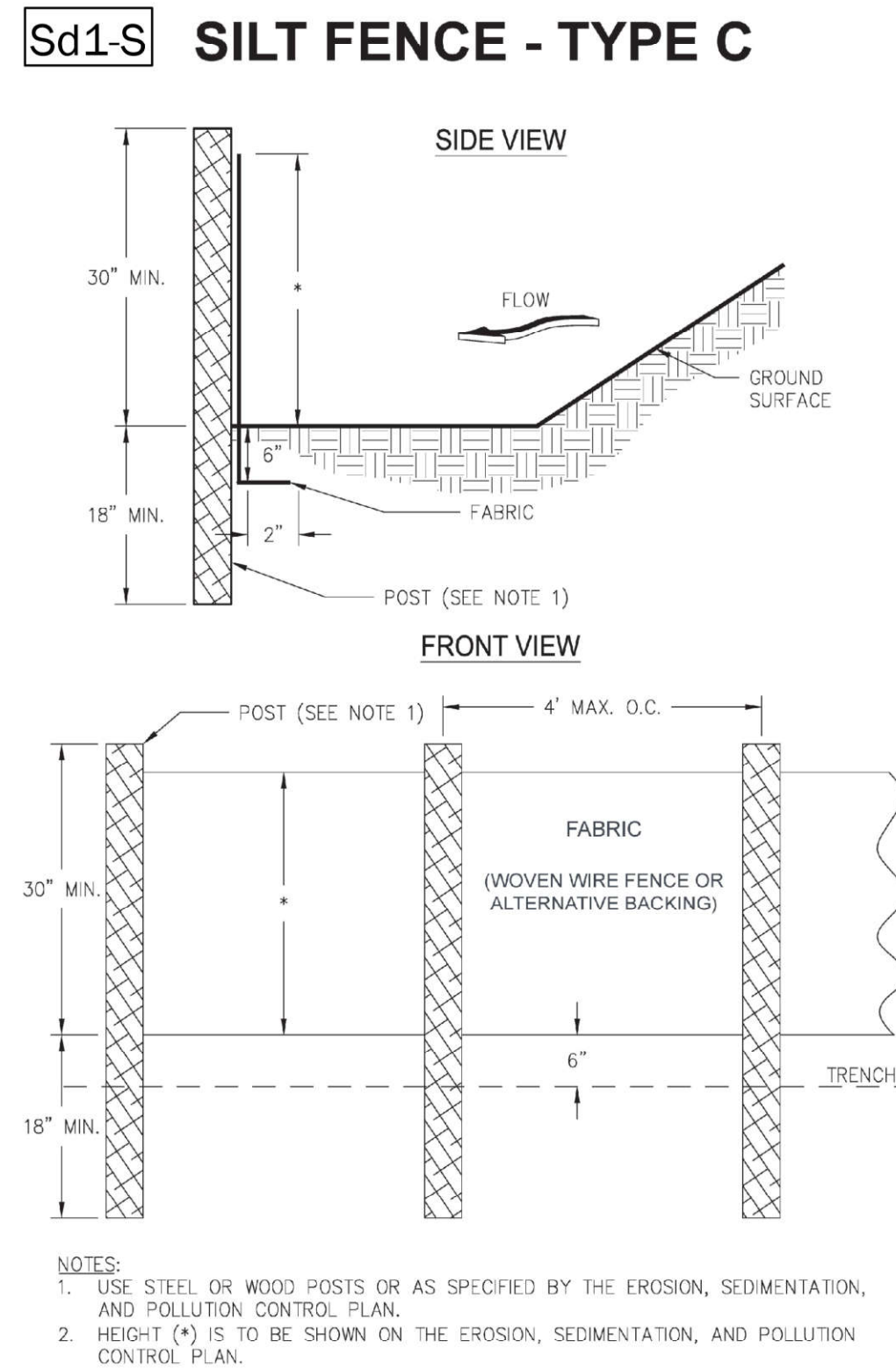
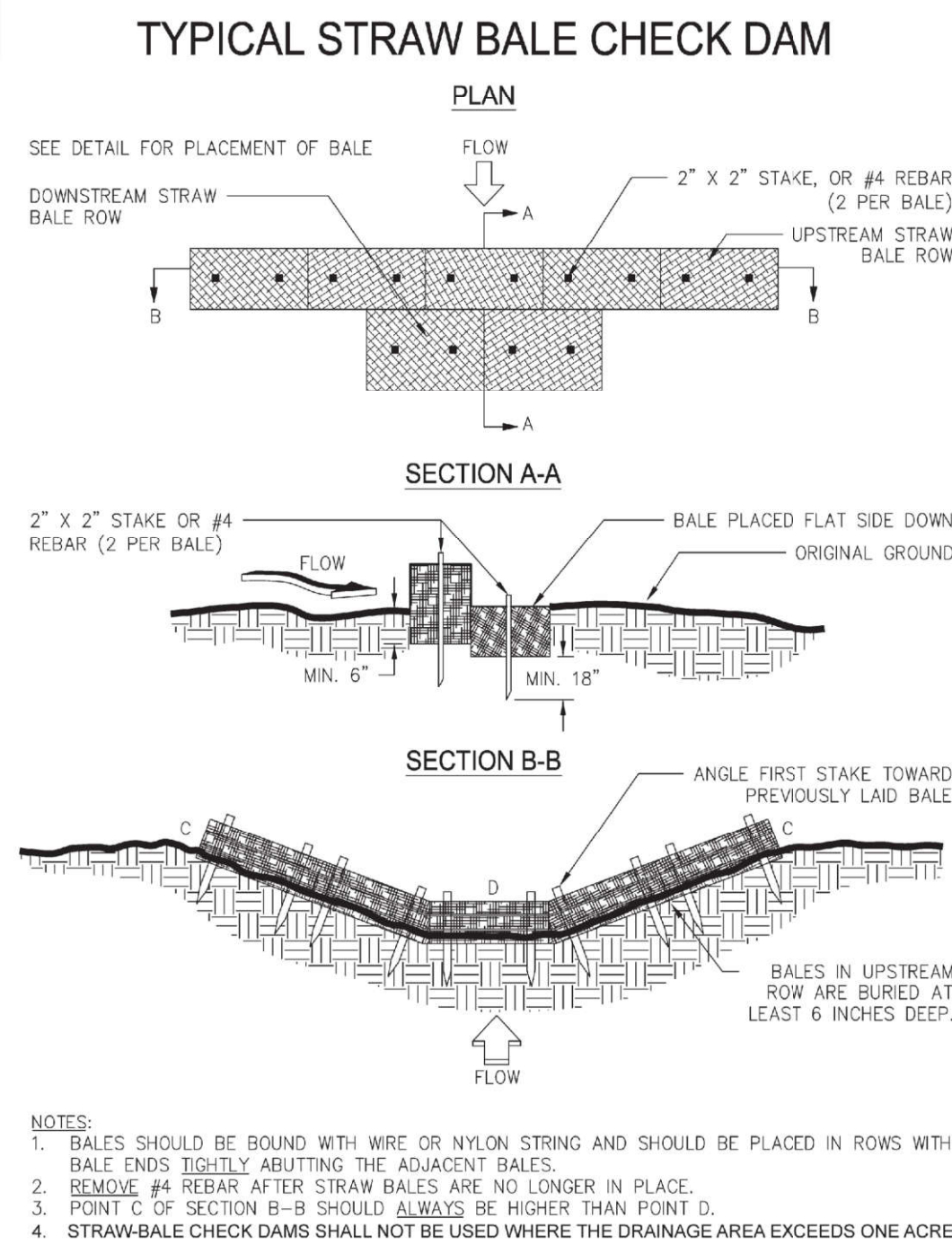
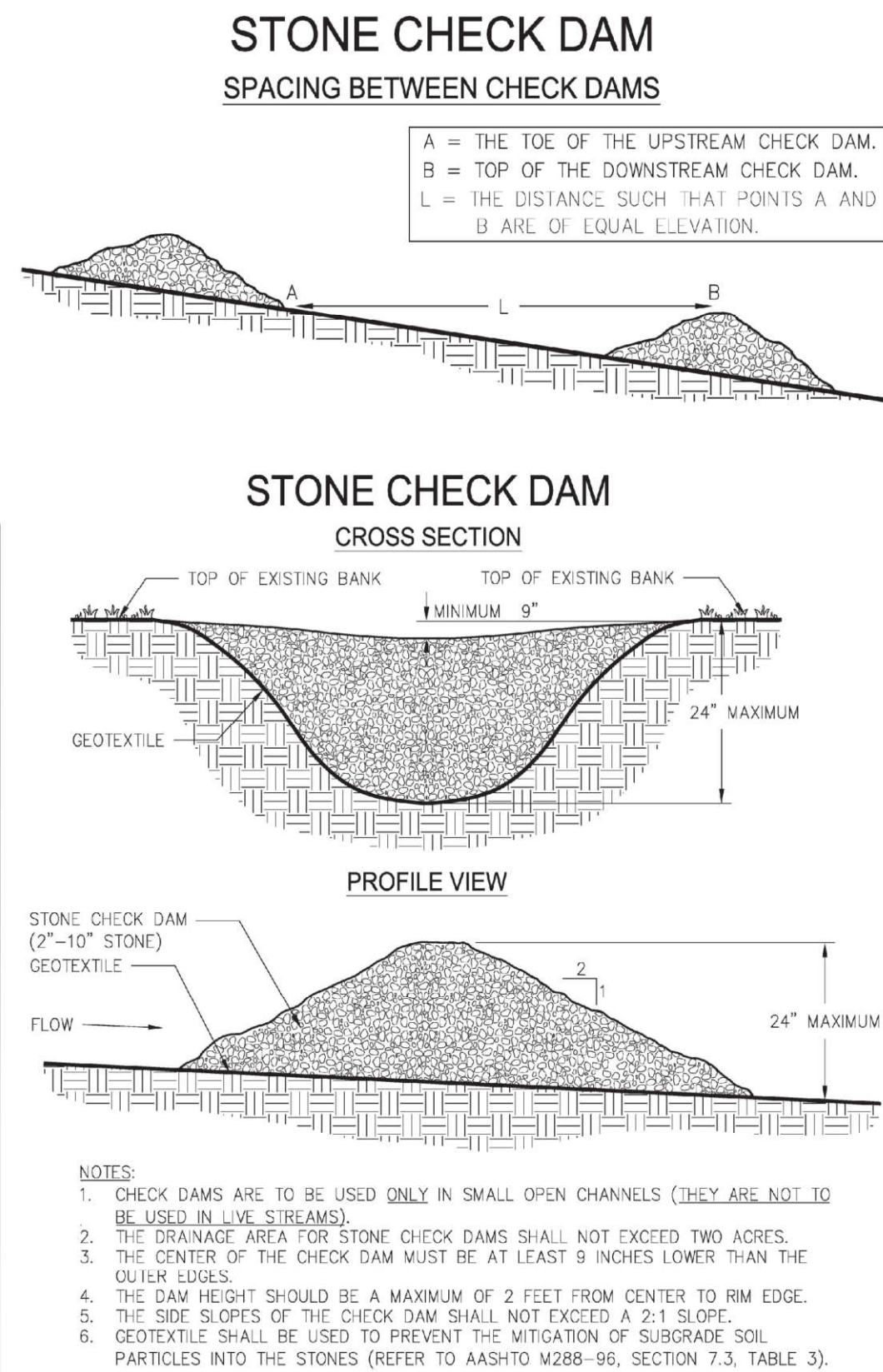
# GEORGIA UNIFORM CODING SYSTEM

FOR SOIL EROSION AND SEDIMENT CONTROL PRACTICES  
 GEORGIA SOIL AND WATER CONSERVATION COMMISSION  
**STRUCTURAL PRACTICES**

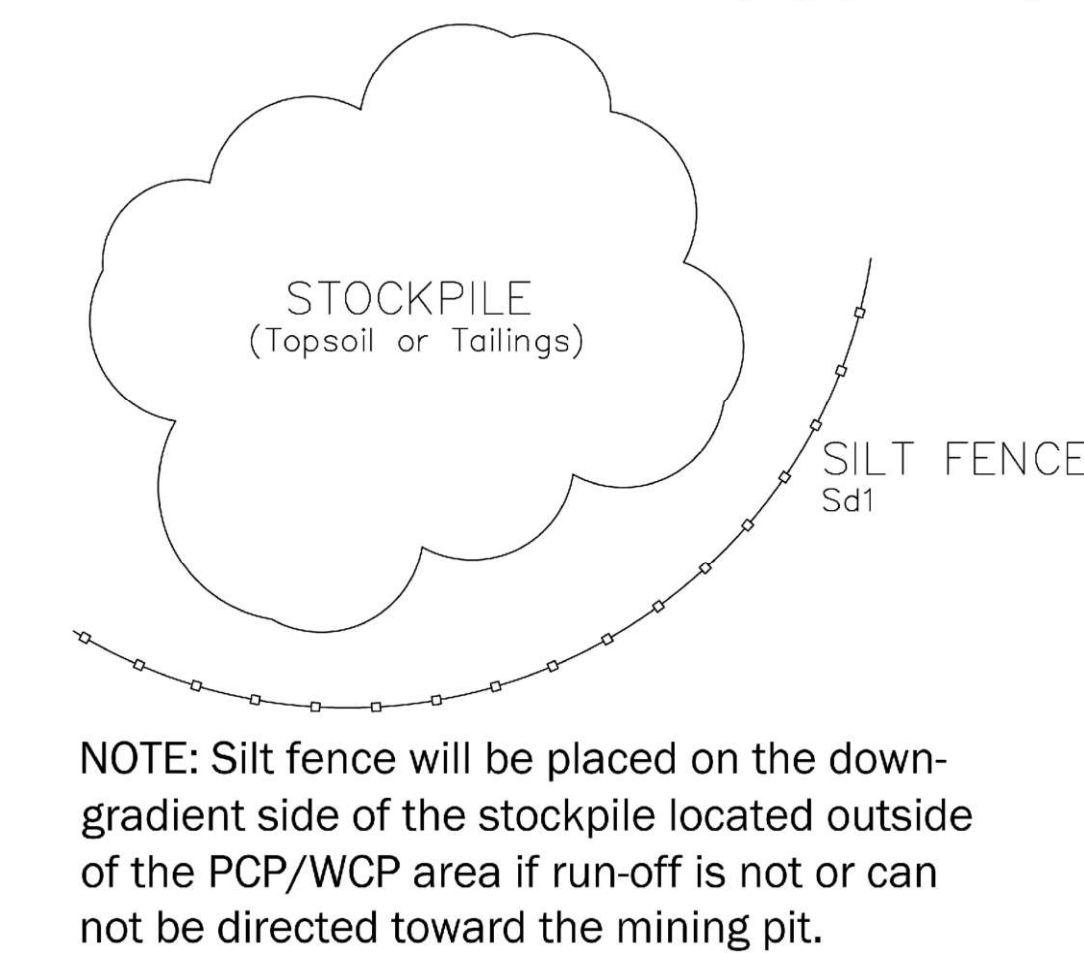
CODE	PRACTICE	DETAIL	MAP SYMBOL	DESCRIPTION
Cd	CHECKDAM			A small temporary barrier or dam constructed across a swale, drainage ditch or area of concentrated flow.
Ch	CHANNEL STABILIZATION			Improving, constructing or stabilizing an open channel, existing stream, or ditch.
Co	CONSTRUCTION EXIT			A crushed stone pad located at the construction site exit to provide a place for removing mud from tires thereby protecting public streets.
Sd1	SEDIMENT BARRIER			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			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			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			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)			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)			Establishing a temporary vegetative cover with fast growing seedlings on disturbed areas.
Ds3	DISTURBED AREA STABILIZATION (WITH PERM SEEDING)			Establishing a permanent vegetative cover such as trees, shrubs, vines, grasses, or legumes on disturbed areas.
Ds4	DISTURBED AREA STABILIZATION (SODDING)			A permanent vegetative cover using sods on highly erodible or critically eroded lands.
Du	DUST CONTROL ON DISTURBED AREAS			Controlling surface and air movement of dust on construction site, roadways and similar sites.



## STOCKPILE BMP (Typical)



### 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.

#### EROSION CONTROL NOTES:

- 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.
- 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.
- ANY DISTURBED AREA LEFT EXPOSED FOR A PERIOD GREATER THAN 14 DAYS WILL BE STABILIZED WITH MULCH OR TEMPORARY SEEDING.
- ALL EROSION AND SEDIMENT CONTROL MEASURES WILL CONFORM WITH THE GUIDELINES OF THE "MANUAL FOR EROSION AND SEDIMENT CONTROL."
- 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.
- 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.
- DUST WILL BE CONTROLLED BY APPLYING WATER TO HAUL ROADS AND OTHER HIGH-TRAFFIC AREAS.
- TPM WILL INSPECT EROSION CONTROL MEASURES AT THE END OF EACH WORKING DAY TO ENSURE PROPER FUNCTIONING.

#### AUXILIARY EROSION & SEDIMENT CONTROL MEASURES

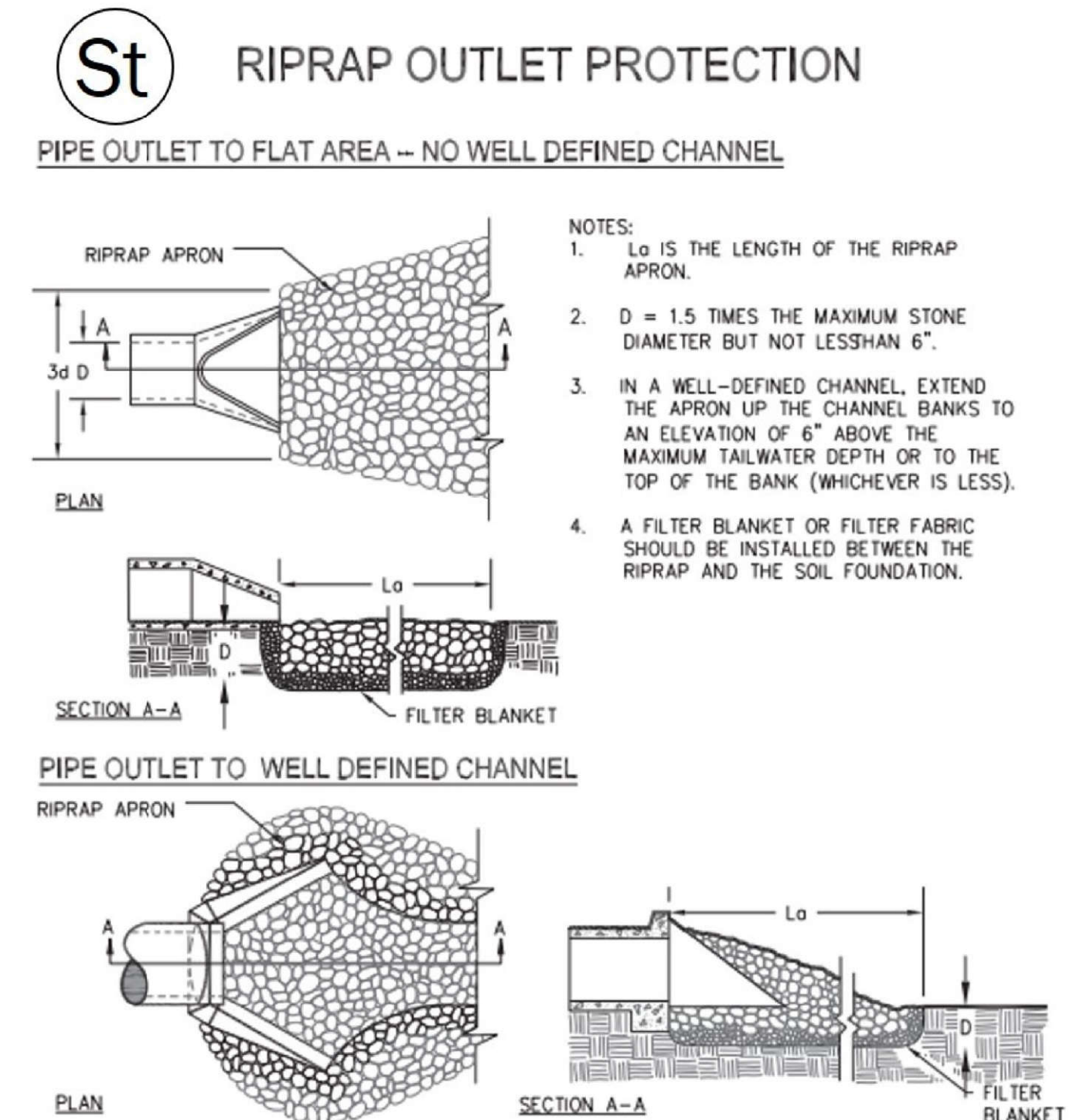
- AUXILIARY BMPs INCLUDING DIVERSIONS, DIKES, OR BERMS WILL BE CONSTRUCTED TO RETAIN, DIRECT, AND CONTROL SURFACE WATER RUNOFF FROM AFFECTED AREAS INTO DESIGNED SEDIMENT CONTROL STRUCTURES. SURFACE WATER DISCHARGE WILL BE CONTROLLED AND RELEASED IN A NON-EROSIVE VELOCITY ONTO STABILIZED AREAS OR INTO STABILIZED CHANNELS.
- CONTAINMENT BERMS WILL BE DESIGNED TO PROVIDE A MINIMUM OF 3 FEET OF FREEBOARD.
- 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.
- 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 VEGETATION

- DISTURBED AREAS LEFT EXPOSED FOR A PERIOD GREATER THAN 14 DAYS WILL BE STABILIZED WITH MULCH OR TEMPORARY SEEDING.
- 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.
- 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.
- 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.

#### NPDES NOTES

- STORMWATER FALLING WITHIN THE ACTIVE MINING AREA, TO INCLUDE THE CONVEYORS AND TOPSOIL AND TAILINGS STOCKPILES WILL BE DIRECTED BACK INTO THE MINING PIT AS PRACTICAL. FOR STORMWATER DISCHARGES OFF-SITE, THE FACILITY WILL OPERATE UNDER A DNR-EPD GENERAL PERMIT NO. GAR050000 STORMWATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITIES.
- STORMWATER FALLING WITHIN THE PCP/WCP AREA WILL BE DIRECTED INTO THE PROCESS PONDS AND RECIRCULATED AS PROCESS WATER.
- ROUTINE DEWATERING OF THE MINE PIT IS NOT ANTICIPATED. AFTER EQUIPMENT SHUTDOWNS OR HEAVY RAIN EVENTS, IF DEWATERING IS NECESSARY, THIS WATER WILL BE PUMPED TO A HOLDING POND AND SUBSEQUENTLY USED FOR PROCESS MAKE-UP WATER.



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

# SHEET 9: EROSION & SEDIMENT CONTROL NOTES & DETAILS

## 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: 11/19/2021
TTL JOB NO.: 000180200804.00
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 ANTICIPATED TO TAKE 4 TO 5 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 FROM 7 TO 10 FEET BELOW THE LAND SURFACE. GROUNDWATER LEVELS WILL BE MONITORED, AND THE ADAPTIVE MANAGEMENT PLAN WILL BE FOLLOWED TO ADDRESS ANY UNEXPECTED OCCURRENCES.

- 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.
- 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.
- 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.)

- 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.
- REVEGETATION WILL BEGIN WITH THE REPLACEMENT OF TOP SOIL. TEMPORARY VEGETATION/SEEDING (SHEETS 8, 9 & 10) WILL BE USED AS NEEDED AND REQUIRED FOR EROSION CONTROL. EROSION CONTROL MEASURES WILL REMAIN IN PLACE UNTIL ADEQUATE VEGETATIVE COVER HAS BEEN ESTABLISHED.

- 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 12. THE GROWING SEASON, AS INDICATED BY NRCS A&G&S WEETS TABLE (WEETS STATION: FOLKSTON 9 SW GA. YEARS: 1971-2000) FOR THE PROBABILITY OF TEMPERATURES ABOVE 28 DEGREES FAHRENHEIT, 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 elliotii*).
- 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 SAPPLINGS 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.

- ALTHOUGH RECLAIMED HABITATS AND THE ASSOCIATED PLANTINGS ARE ANTICIPATED TO FOLLOW THE SCHEDULE OUTLINED IN #4 AND AS SHOWN ON SHEET 12, 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 ( <i>Aristida sp.</i> , <i>Andropogon sp.</i> , <i>Sporobolus sp.</i> , <i>Dichanthelium sp.</i> ), SAW PALMETTO ( <i>Serenoa repens</i> ), GALLBERRY ( <i>Ilex glabra</i> ), FETTERBUSH ( <i>Lyonia lucida</i> ), AND DWARF LIVE OAK ( <i>Quercus minima</i> ).
WET PINE FLATWOODS	SLASH PINE	BUNCHGRASSES ( <i>Aristida sp.</i> , <i>Andropogon sp.</i> , <i>Ctenium aromaticum</i> , <i>Muhlenbergii sp.</i> , <i>Sporobolus sp.</i> , <i>Rhynchospora sp.</i> ), LARGE GALLBERRY ( <i>Ilex coriacea</i> ), FETTERBUSH, SWEETBAY, SAW PALMETTO
DEPRESSIONAL WETLAND - DOME/DEPRESSION SWAMP	POND CYPRESS, SWAMP TUPELO	VIRGINIA CHAIN FERN ( <i>Anchistia virginica</i> ), ROYAL FERN ( <i>Osmunda regalis</i> ), CINNAMON FERN ( <i>Osmunda cinnamomea</i> ), MAIDENCANE ( <i>Panicum hemitomon</i> ), REDROOT ( <i>Lachnanthes caroliniana</i> ), BEAKSEDGES ( <i>Rhynchospora sp.</i> ), AND SEDGES ( <i>Carex sp.</i> ).
DEPRESSIONAL WETLAND - SHRUB BOG	POND PINE, SLASH PINE	TITI ( <i>Cyrilla racemiflora</i> ), BLACK TITI ( <i>Cliftonia monophylla</i> ), SWEET PEPPERBUSH ( <i>Clethra alnifolia</i> ), FETTERBUSH, LARGE GALLBERRY, AND LAUREL GREENBRIER ( <i>Smilax laurifolia</i> ).
DEPRESSIONAL WETLAND - BAYGALL	LOBLOLLY BAY, SWAMP BAY, SWEETBAY	LOBLOLLY BAY, SWAMP BAY, SWEETBAY, FETTERBUSH, DAHOON ( <i>Ilex cassine</i> ), LARGE GALLBERRY, TITI, BLACK TITI, WAX MYRTLE ( <i>Myrica cerifera</i> ), DOGHOBBLE ( <i>Leucothoe sp.</i> ), SWEETSPICE ( <i>Itea virginica</i> ).

- 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:

- 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.
- 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.
- 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.
- NO HIGHWALLS WILL REMAIN ON SITE.
- ALL AFFECTED LAND WILL BE GRADED TO MIMIC PRE-MINING TOPOGRAPHY AND BLENDED INTO THE EXISTING LANDSCAPE, UNLESS OTHERWISE AMENDED.
- 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.
- SPOIL OR REFUSE, WHEN USED AS BACKFILL MATERIAL, FOR BERM OR OTHER CONSTRUCTION, WILL BE SEGREGATED AS NECESSARY, EMLACED 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.
- NO LAKES OR PONDS ARE PROPOSED AS PART OF THE RECLAMATION PLAN.

- WITHIN APPROXIMATELY 180 DAYS OF COMPLETION OF MINING ACTIVITIES, COMMENCEMENT OF DECOMMISSIONING OF THE PONDS WILL BEGIN IN THE FOLLOWING MANNER:
  - PROCESS WATER WILL BE ELIMINATED FROM EACH POND BY THE FOLLOWING OR A COMBINATION OF THE FOLLOWING:
    - PUMPING TO TANKER TRUCKS FOR TRANSPORT TO AN OFF-SITE FACILITY FOR DISPOSAL IN ACCORDANCE WITH STATE AND/OR FEDERAL REQUIREMENTS.
    - UTILIZING AN ENGINEER DESIGNED EVAPORATION SYSTEM OR ALTERNATIVE TECHNOLOGY CAPABLE OF ELIMINATING LIQUIDS.
  - UNDER NO CIRCUMSTANCES WILL PROCESS WATER BE DISCHARGED AT THE FACILITY WITHOUT PRIOR AUTHORIZATION FROM THE GEORGIA EPD (I.E., A PERMIT IS OBTAINED THAT WILL ALLOW FOR THE DISCHARGE OF PROCESS WATER AT THE FACILITY).
  - AFTER THE ELIMINATION OF PROCESS WATER FROM EACH POND, SEDIMENTS THAT HAVE ACCUMULATED ON TOP OF THE LINER SYSTEM AND THE LINER WILL BE REMOVED AND TRANSPORTED TO AN OFF-SITE FACILITY FOR DISPOSAL IN ACCORDANCE WITH STATE AND/OR FEDERAL REQUIREMENTS.
  - NEXT, THE BERM WALLS WILL BE GRADED TO GENERALLY MATCH THE SURROUNDING LAND SURFACE AND THE AREAS WILL BE REVEGETATED.
  - 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 OPERATIONAL PERIOD OF THE MINE.

- 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 ENSURE THAT THE HOMOGENIZATION OF SOILS DUE TO MINING DOES NOT AFFECT OR ALTER THE 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 MINING 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 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.

**1.2 MAPPING THE HUMATE-CEMENTED CONSOLIDATED BLACK SANDS**

THE SOIL AMENDMENT IS INTENDED TO MIMIC THE HYDRAULIC CONDUCTIVITY OF CONSOLIDATED BLACK SANDS THAT UNDERLAY PORTIONS OF THE SITE. 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:

- UNCONSOLIDATED BLACK SANDS,
- SEMI-CONSOLIDATED BLACK TO DARK BROWN SANDS, AND
- 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<sup>-7</sup> TO 10<sup>-8</sup> 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:

- BLACK OR VERY DARK BROWN COLOR
- 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).
- 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 GEOLOGIST:

- UNIQUE BORING IDENTIFIER
- DATE OF DRILLING (START/END DATE)

- SURVEYED BORING LOCATION AND ELEVATION DATA
- DEPTH TO SATURATED SOILS AS MEASURED IN THE BOREHOLE OR AS IDENTIFIED IN THE CORE
- LITHOLOGIC DESCRIPTIONS OF SUBSURFACE SOIL TO INCLUDE:
  - SOIL TYPE (UNIFIED SOIL CLASSIFICATION SYSTEM)
  - PERCENTAGE OF CLAY VERSUS SAND (VISUAL ESTIMATE)
  - HUMATE PRESENT AND RELATIVE PERCENT (I.E. LOW, MEDIUM, HIGH; VISUAL ESTIMATE)
  - DEGREE OF CONSOLIDATION OF SANDS (UNCONSOLIDATED, SEMI-CONSOLIDATED, OR CONSOLIDATED)
  - SORTING OF SAND
  - DESCRIPTION OF FINE, MEDIUM, COARSE GRAINS PER SANDY SOIL TYPE
  - COLOR DESCRIPTION USING A MUNSELL OR GSA ROCK COLOR CHART
- BORING TERMINATION DEPTH
- 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**

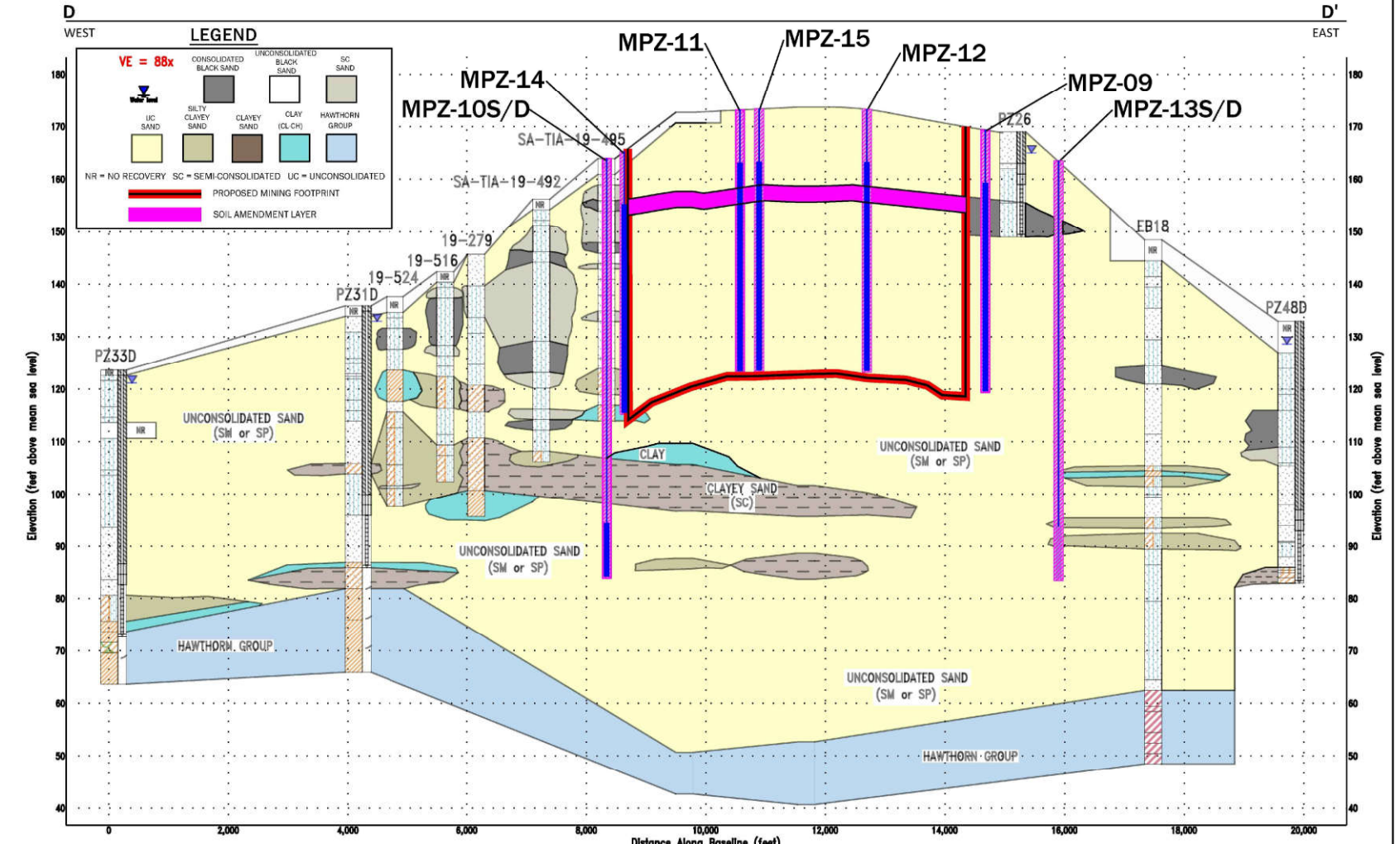
A GROUNDWATER-LEVEL MONITORING PLAN, ACTION LEVELS FOR COMPLIANCE, AND AN ADAPTIVE MANAGEMENT (OR CONTINGENCY) PLAN IF GROUNDWATER LEVELS ARE NOT RESTORED IS INCLUDED IN SECTION 2, SHEET 13 OF THE GROUNDWATER AND SURFACE WATER MONITORING PLAN OF THE SURFACE MINING LAND USE PLAN.

**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.

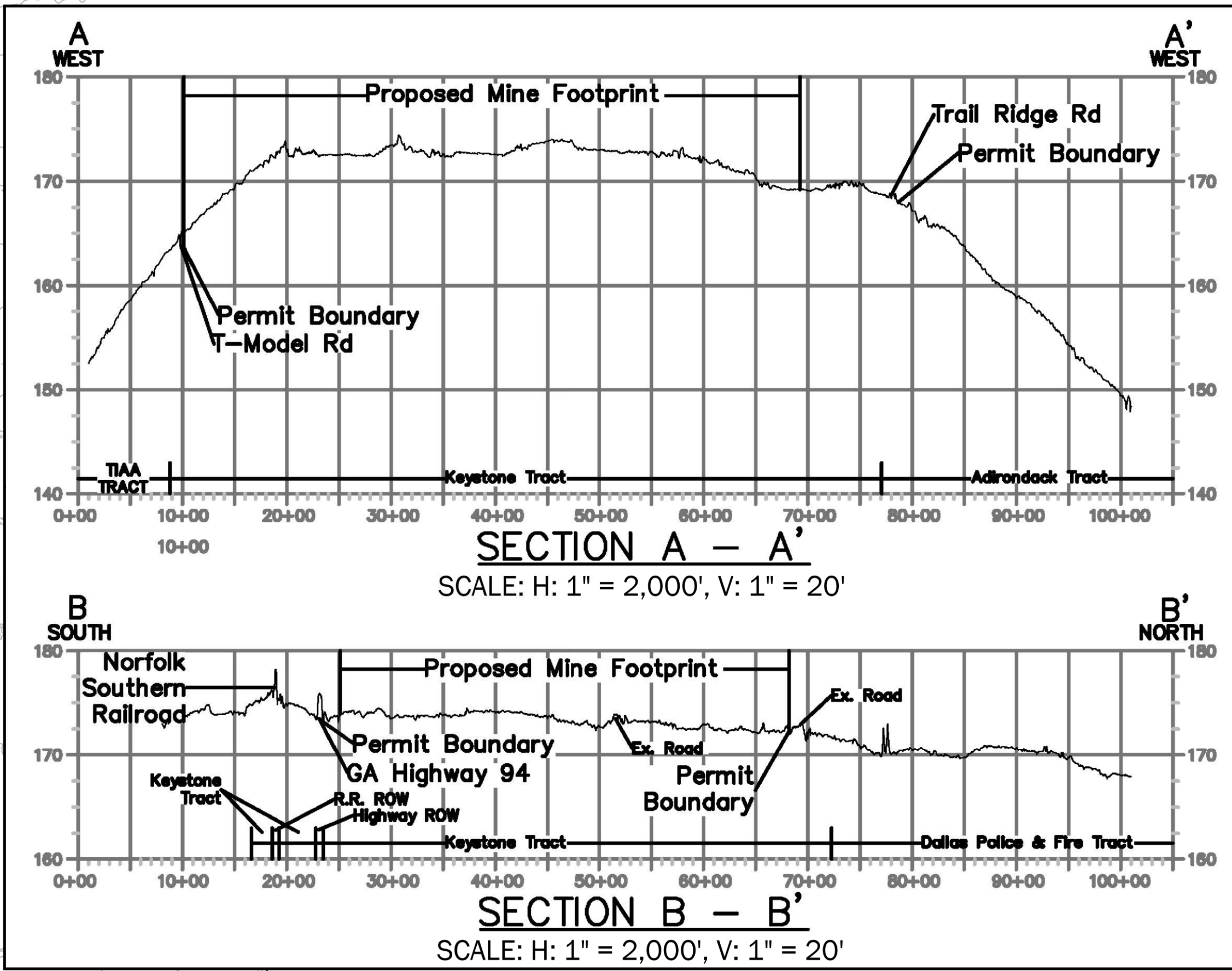
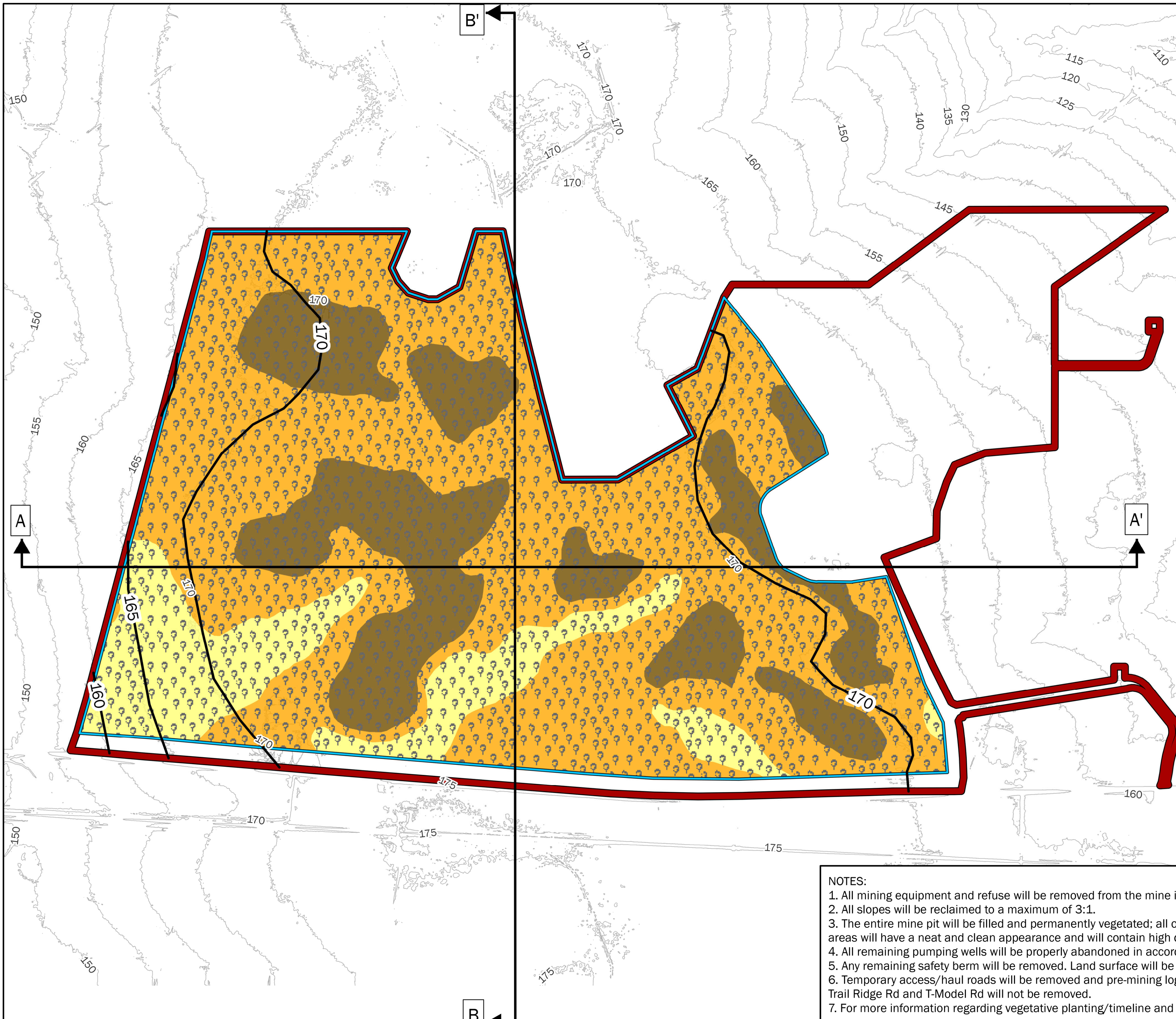


**POST-MINING GENERALIZED GEOLOGIC CROSS-SECTION OF THE MINE FOOTPRINT**



**SHEET 11: 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: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: N/A



- 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 11.

**LEGEND**

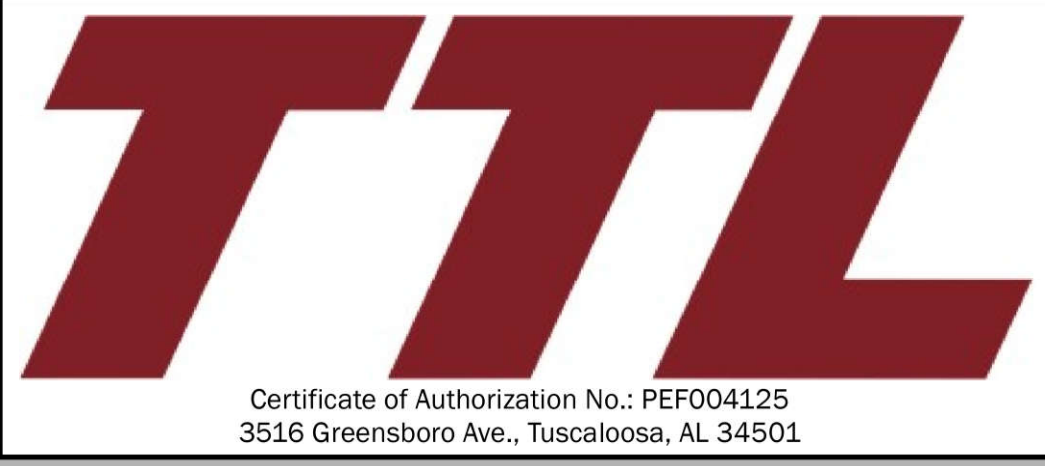
- Permit Boundary (773± AC)
- Mine Footprint (582± AC)
- Vegetative Reclamation Area<sup>7</sup>

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)

0 500 1,000 2,000 Feet



**SHEET 12: POST-MINING RECLAMATION PLAN (2)**  
**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: 11/19/2021
TTL JOB NO.: 000180200804.00
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-NINE (69) PIEZOMETERS ARE CURRENTLY INSTALLED WITHIN THE MINE AND SURROUNDING TPM OWNED PROPERTIES OUTSIDE THE MINE FOOTPRINT. THE LOCATIONS ARE SHOWN ON SHEET 14. 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
MPZ-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, MPZ-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 MPZ-17D 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 582 ACRES, OR APPROXIMATELY ONE PIEZOMETER EVERY 32 ACRES. THE APPROXIMATE LOCATIONS OF THE NEW PIEZOMETERS ARE DEPICTED ON SHEET 14, 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 15.

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, MPZ-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, MPZ-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 15.

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 15.

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 TO TWO DAYS OF THE ADVANCING MINE 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 14):

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 14). THE DATA LOGGERS FOR EACH RAIN GAUGE RECORD THE ACCUMULATION OF PRECIPITATION IN UNITS OF HUNDRETHS 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 14).

**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	OWB18S
PZ06	PZ16D	PZ25S	PZ42	PZ51D	OWB1S
PZ07	PZ17S	PZ25D	PZ43	PZ52	OWB1D
PZ08	PZ17D	PZ26	PZ44	PZ53	
PZ09	PZ18	PZ27S	PZ45S	PZ53S	
PZ10	PZ19	PZ27D	PZ46D	PZ54D	
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
MPZ-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 14).

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 15. 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:

- 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 15; AND/OR
- POST-MINING GROUNDWATER LEVELS FLUCTUATE UNIFORMLY IN THE NORTH, CENTRAL AND SOUTH SECTIONS;

SUPPORTING DOCUMENTATION DESCRIBING THE RATIONAL 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 TO RESTORE GROUNDWATER LEVELS TO PRE-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:

- 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.
- 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 14).

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

- 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 TRENDS).
- BEGINNING ONE MONTH AFTER MINING BEGINS
- POST-MINING MONITORING WILL BEGIN AT THE END OF ACTIVE MINING AND CONTINUE FOR A PERIOD OF APPROXIMATELY FIVE YEARS
- 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
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 14 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 <sup>1</sup>	
	DURING MINING <sup>2</sup>	POST MINING <sup>3,4</sup>
MSW-BG04	QUARTERLY	SEMI-ANNUAL
MSW-BG05		
MSW-BG06		

- BASED ON THE RESULTS IS 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 TRENDS).
- BEGINNING ONE MONTH AFTER MINING BEGINS
- POST-MINING MONITORING WILL BEGIN AT THE END OF ACTIVE MINING AND CONTINUE FOR A PERIOD OF APPROXIMATELY FIVE YEARS
- 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, TOTAL KJELDAHL (TKN)	EPA 351.2
NITROGEN	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**  
 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.

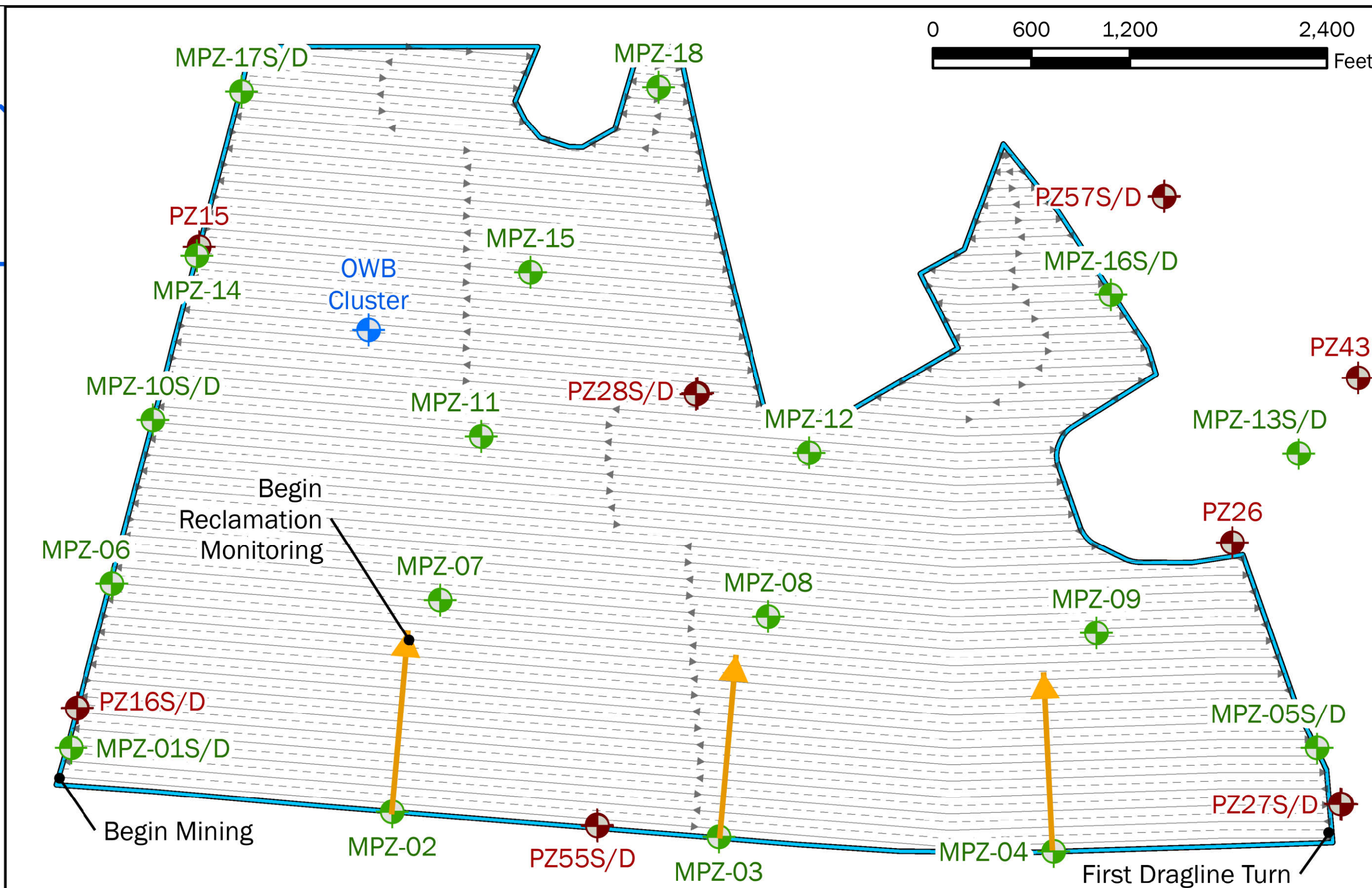
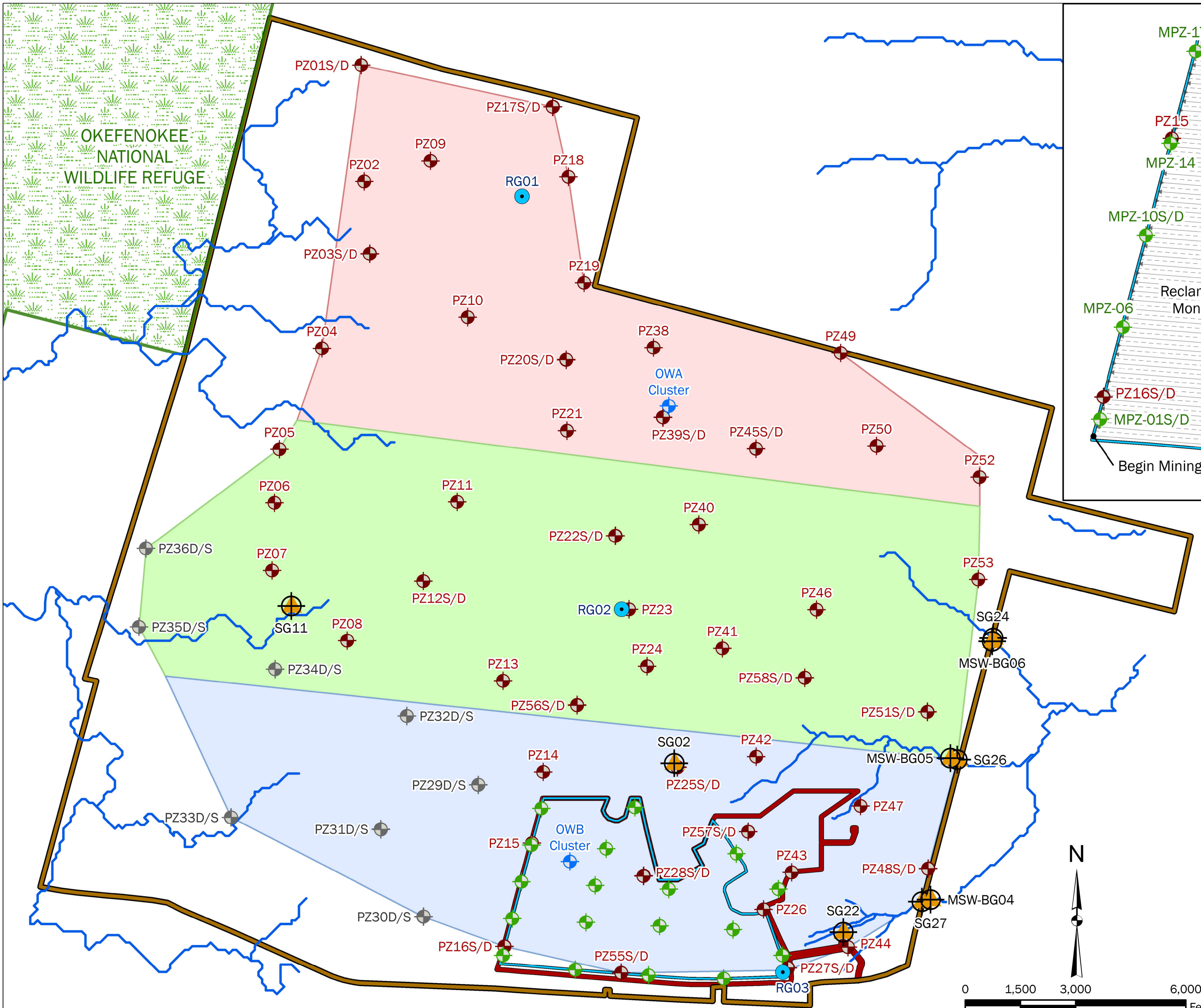
**3.3.2**

**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.

**3.3.3**

**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



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 13 for a more complete description of the proposed dragline mining process.

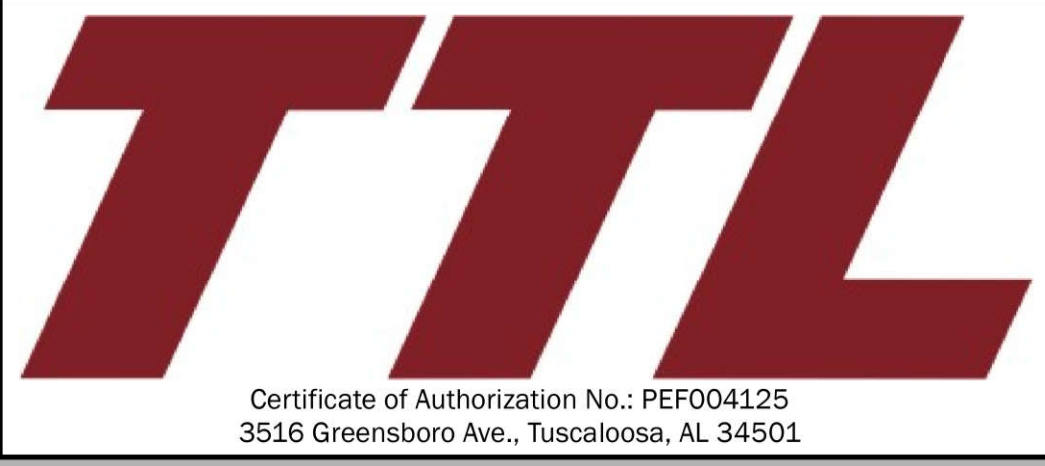
NOTE: Access to the TIAA property is restricted. Piezometers were abandoned in October 2020.

**LEGEND**

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

\* See Sheet 15 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.



**SHEET 14: GROUNDWATER & SURFACE WATER MONITORING PLAN (2)**  
**TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)**  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

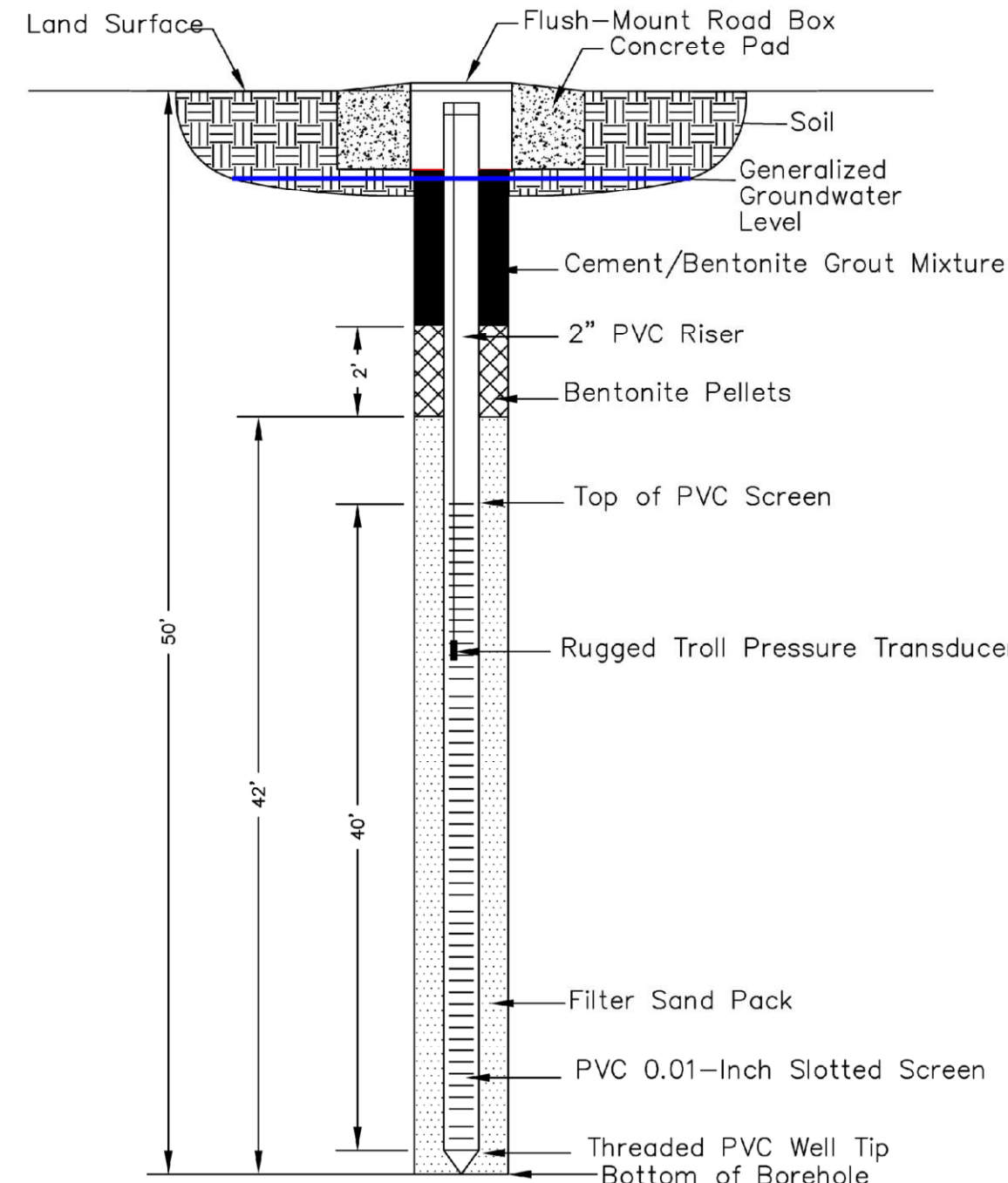


DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 1,500 ft

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				

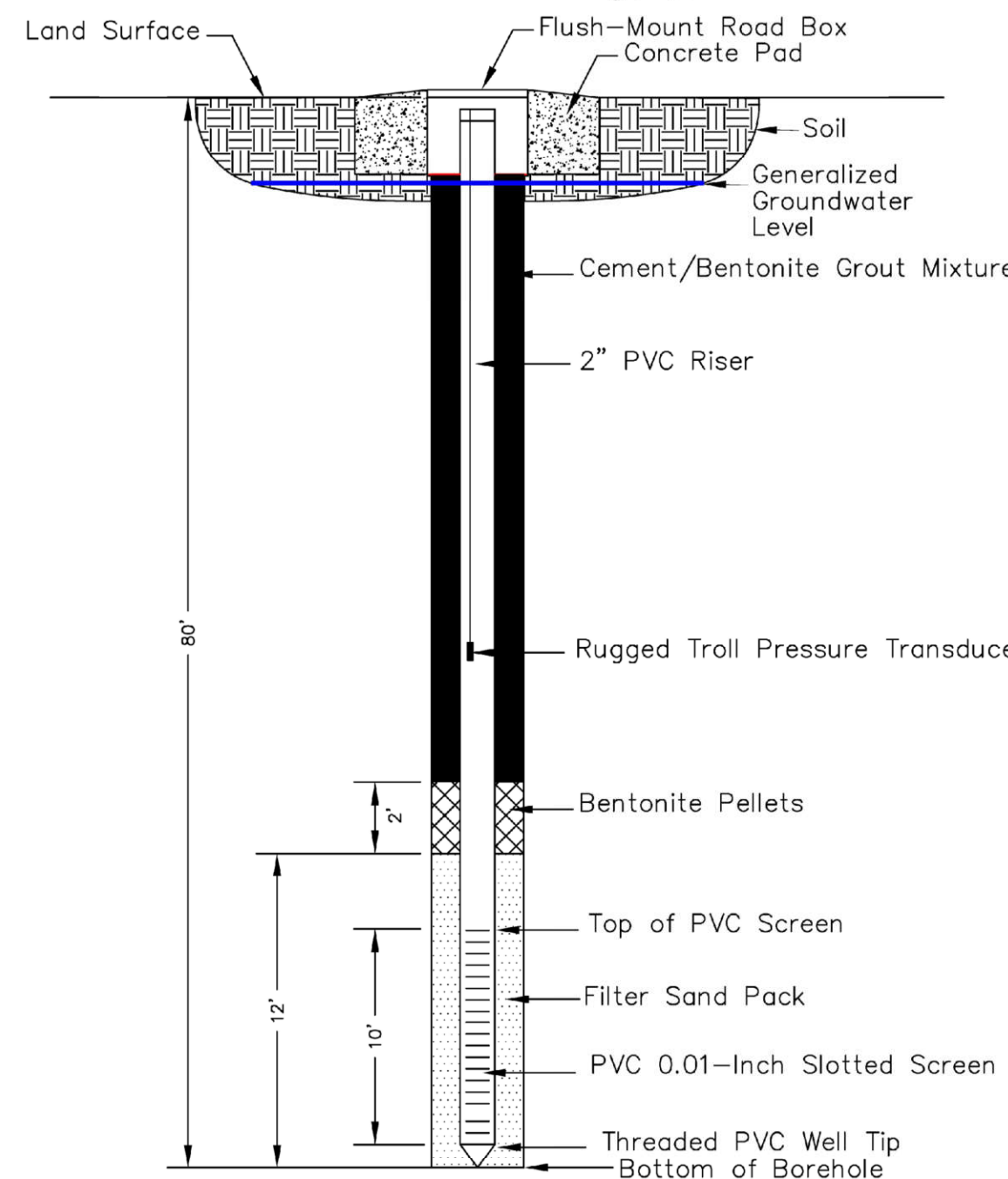
SURFACE WATER MONITORING TABLE		
ID	ELEVATION	QUALITY
SG02	X	
SG11	X	
SG22	X	
SG24	X	
SG26	X	
SG27	X	
MSW-BG04		X
MSW-BG05		X
MSW-BG06		X

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, MPZ-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.

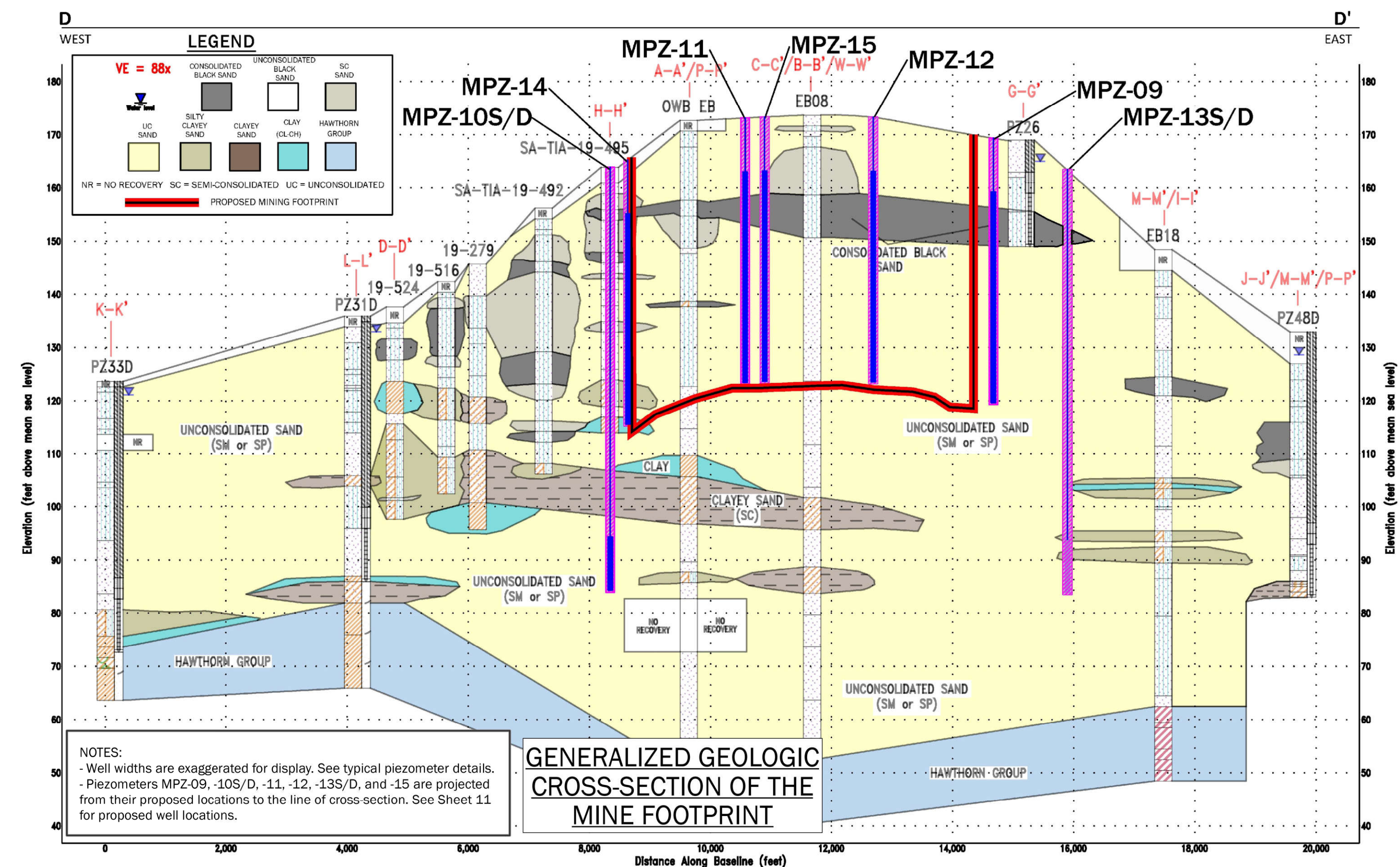


TYPICAL PIEZOMETER DETAIL (50 FEET)

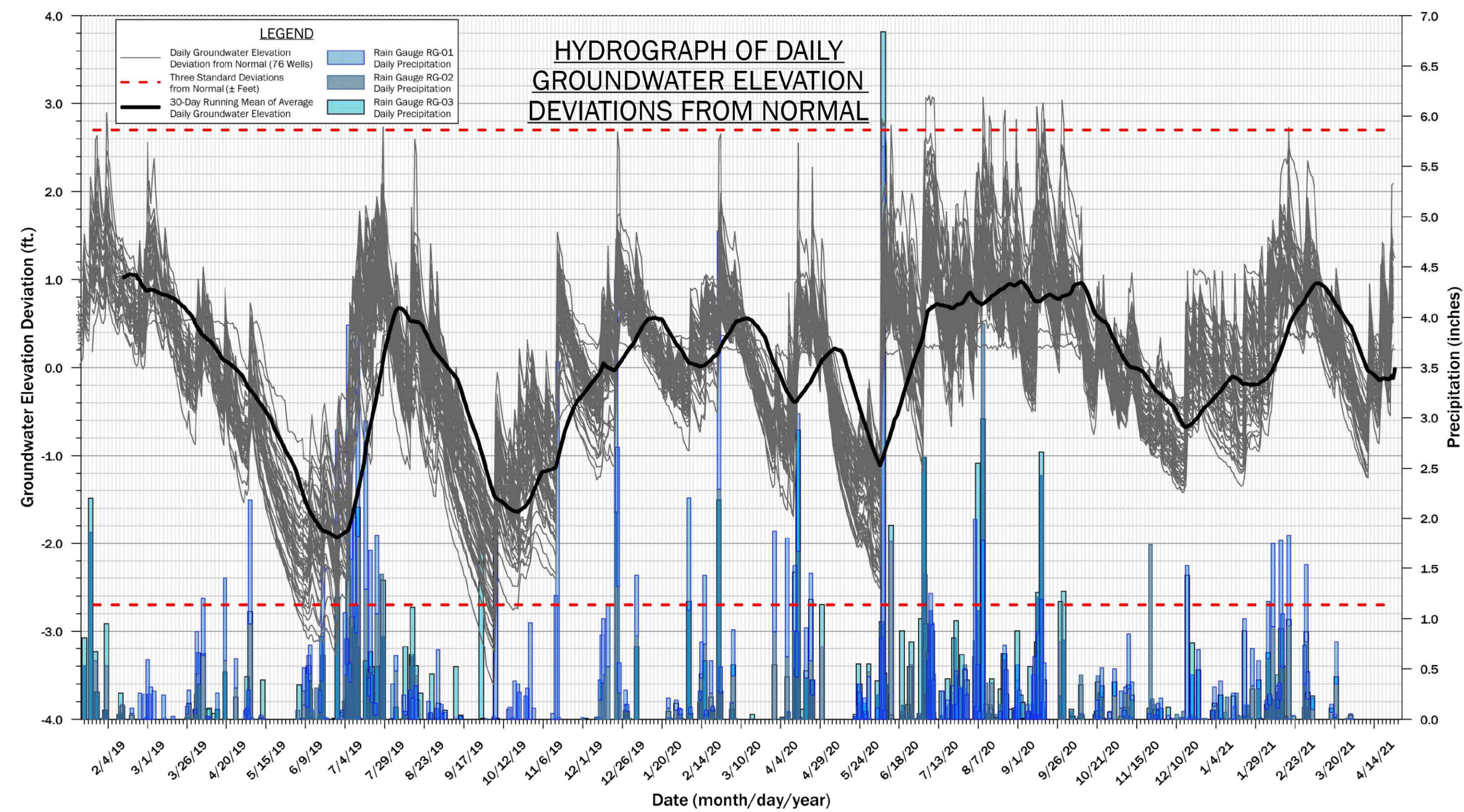
Note: Six piezometers will be installed to depths of about 80 feet below ground surface in order to monitor water levels and water quality of the Surficial Aquifer below the maximum mining depth.



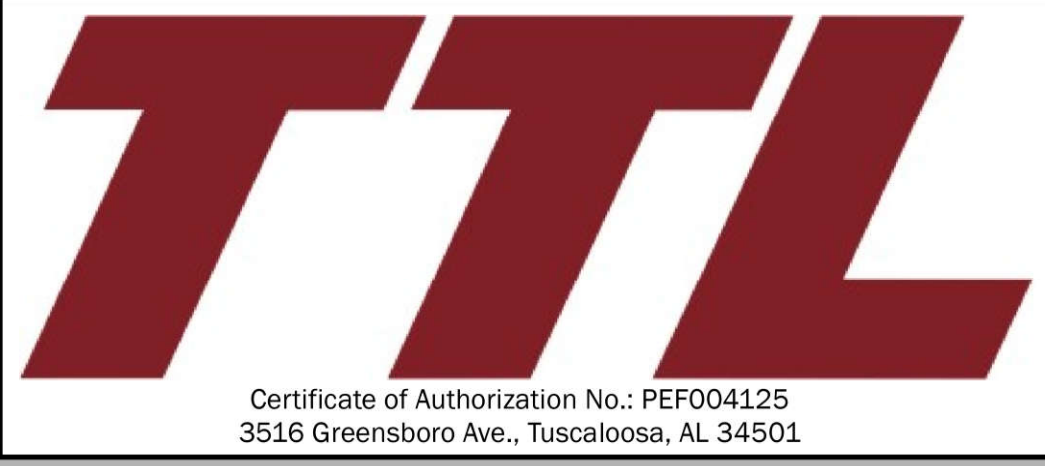
TYPICAL PIEZOMETER DETAIL (80 FEET)



GENERALIZED GEOLOGIC CROSS-SECTION OF THE MINE FOOTPRINT



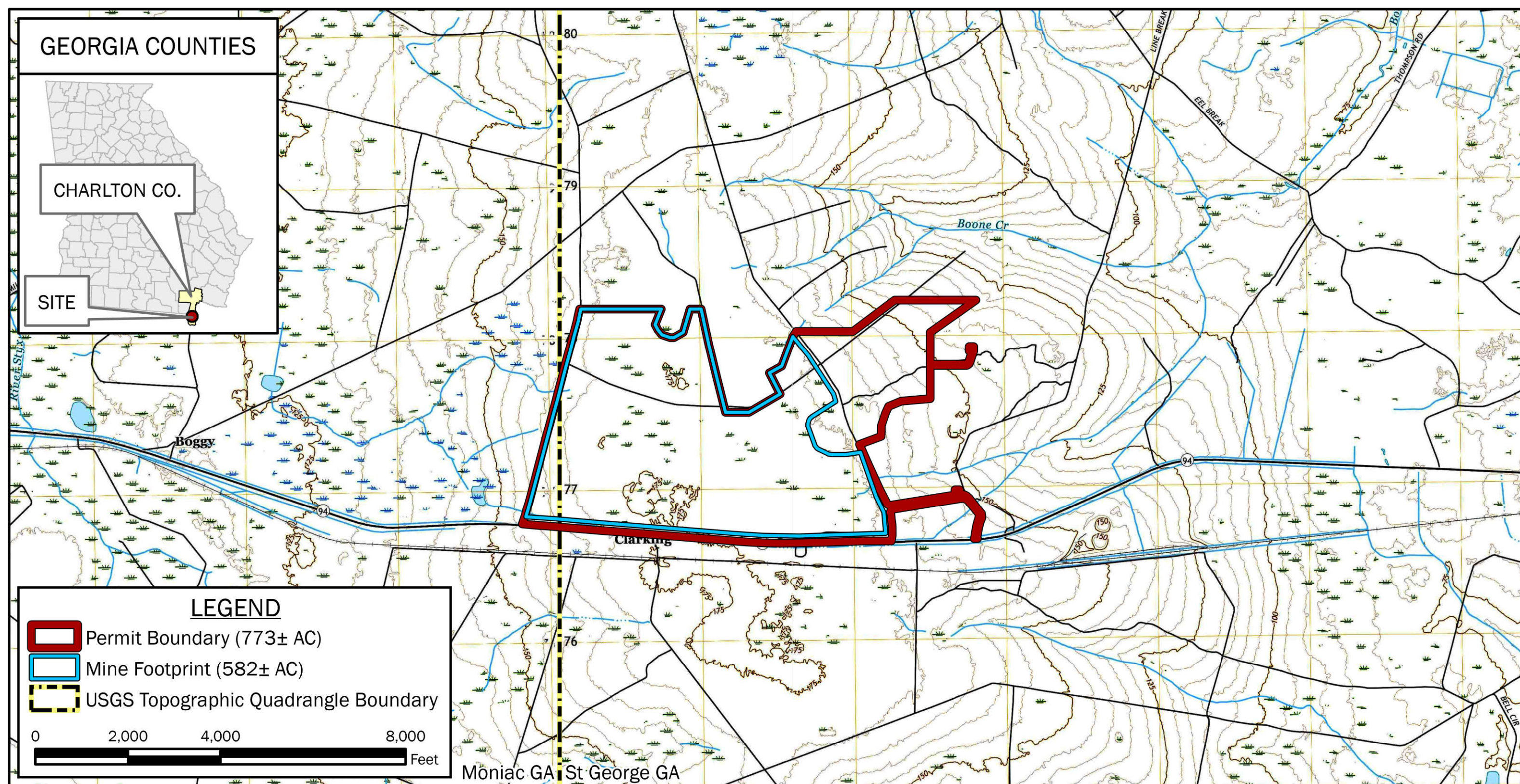
HYDROGRAPH OF DAILY GROUNDWATER ELEVATION DEVIATIONS FROM NORMAL



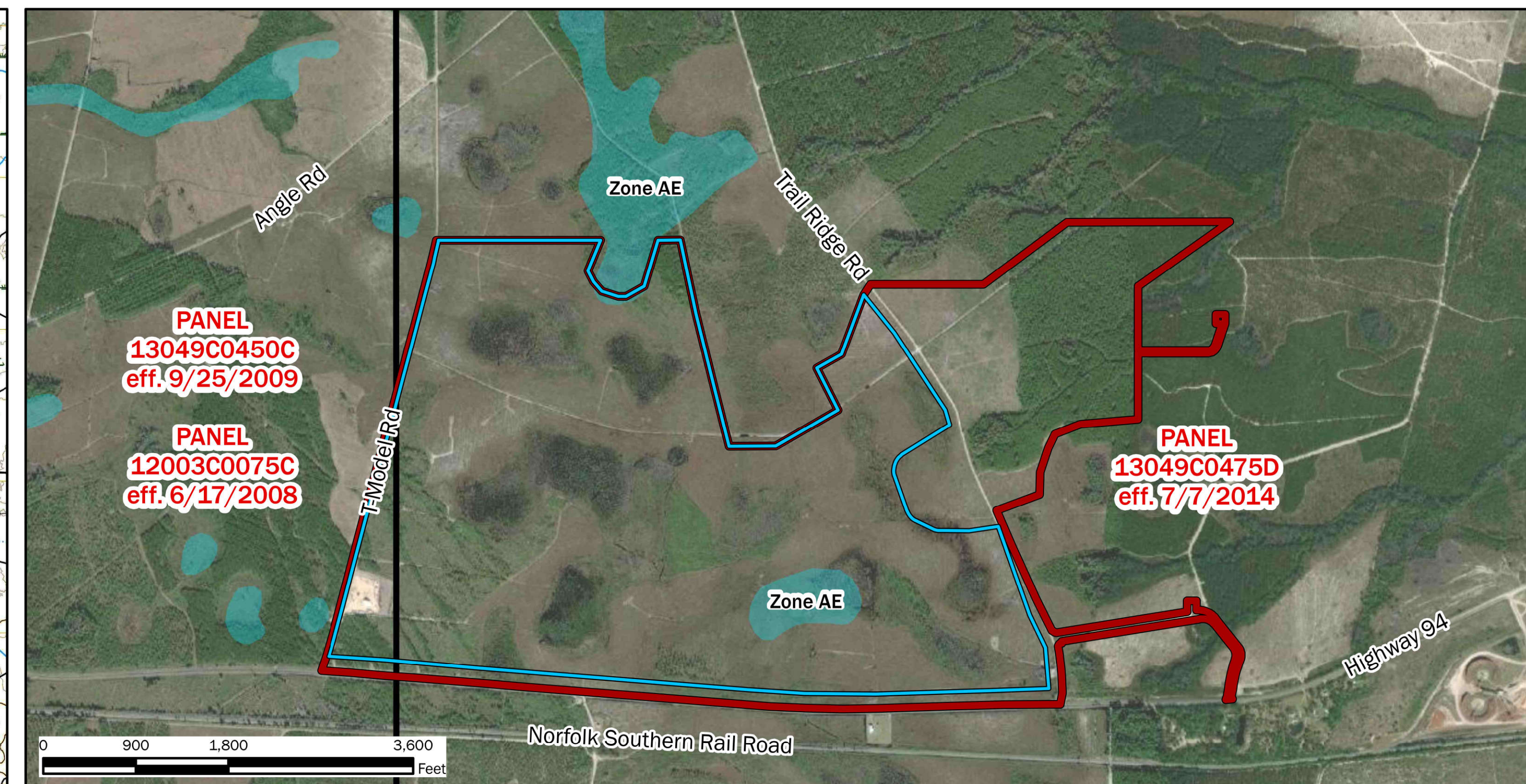
SHEET 15: GROUNDWATER & SURFACE WATER MONITORING PLAN (3)  
 TWIN PINES MINERALS, LLC SAUNDERS DEMONSTRATION MINE (ID NO. 2073)  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA



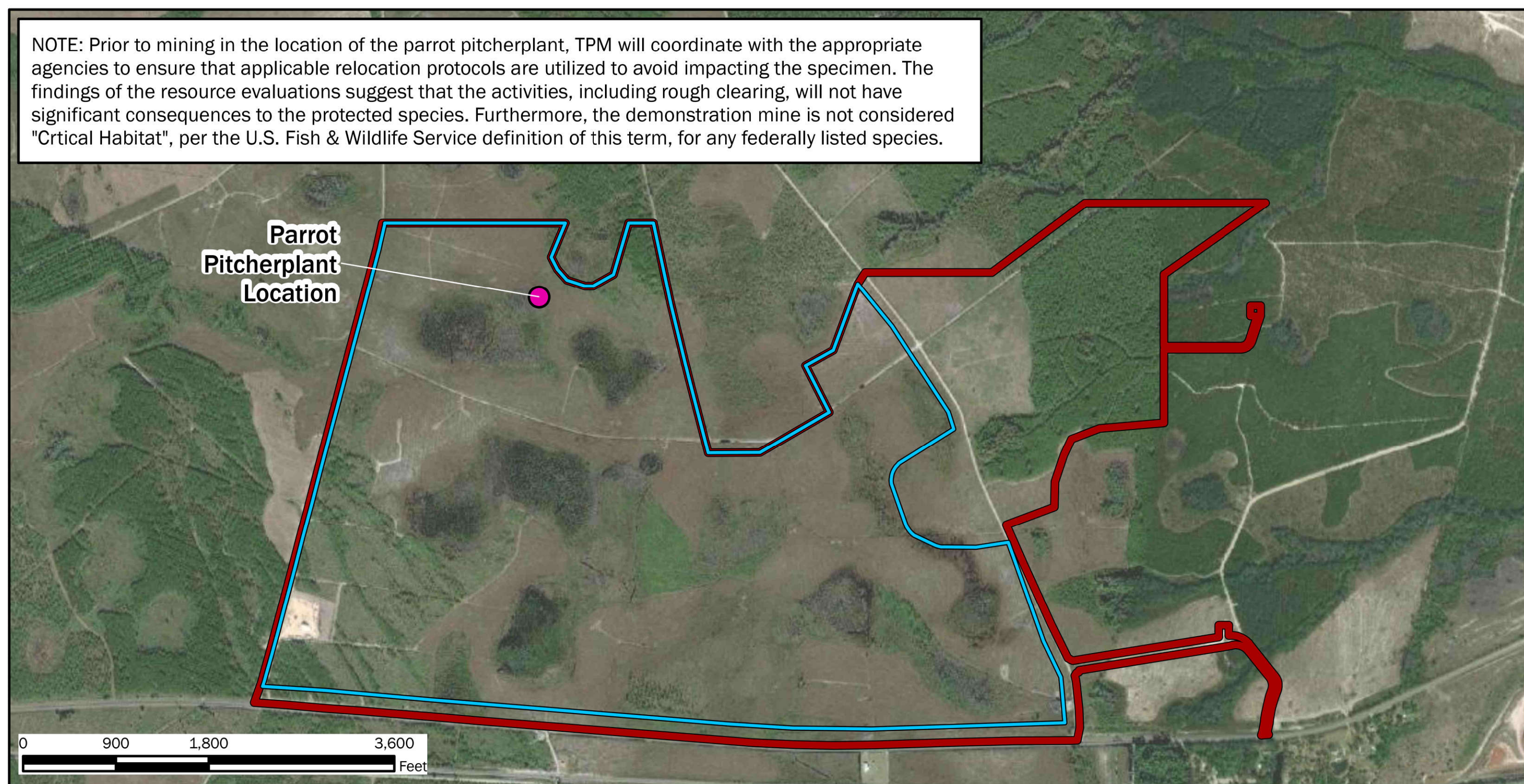
DRAWN BY: DEK
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APPROX. SCALE: N.T.S.



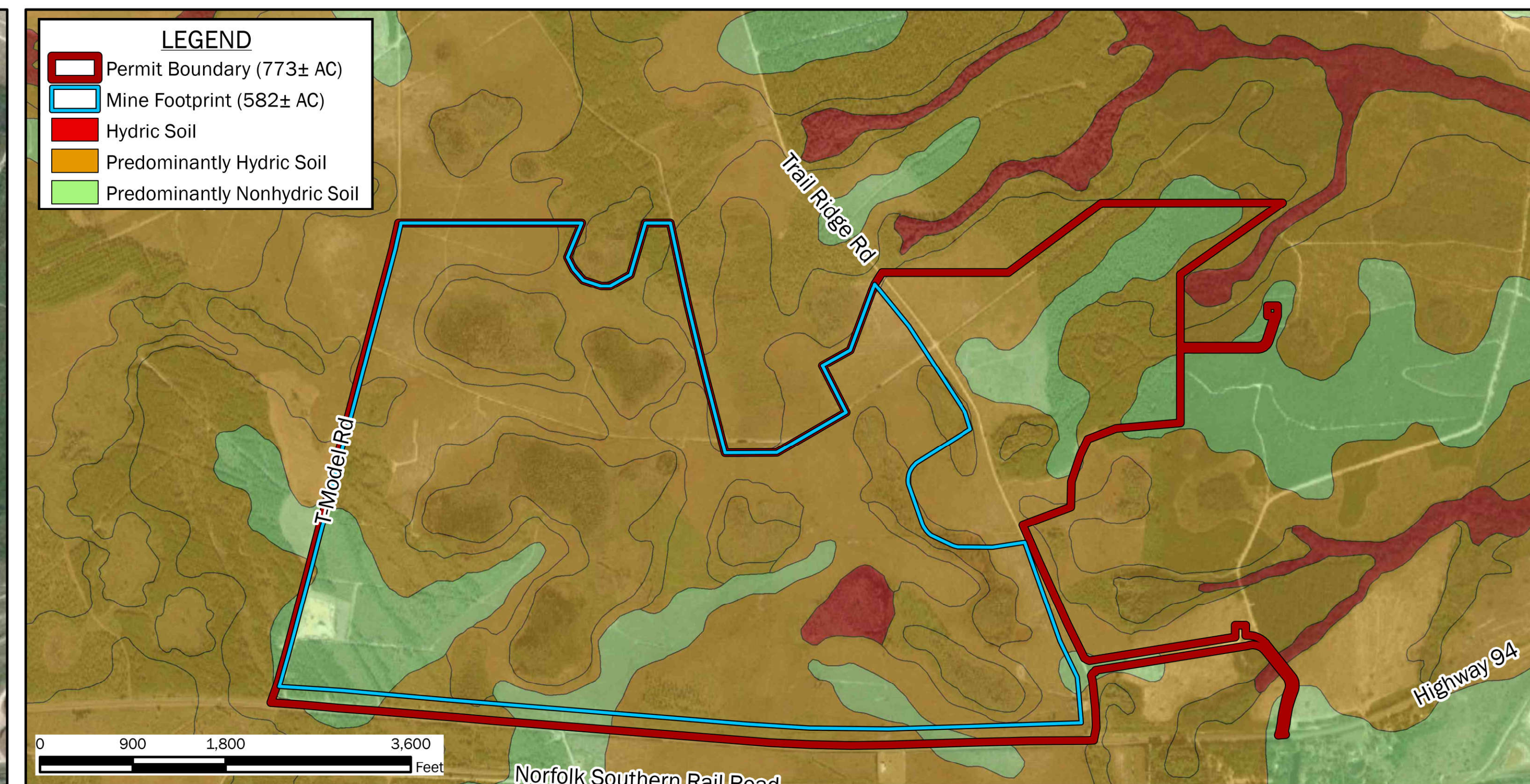
**VICINITY MAP**



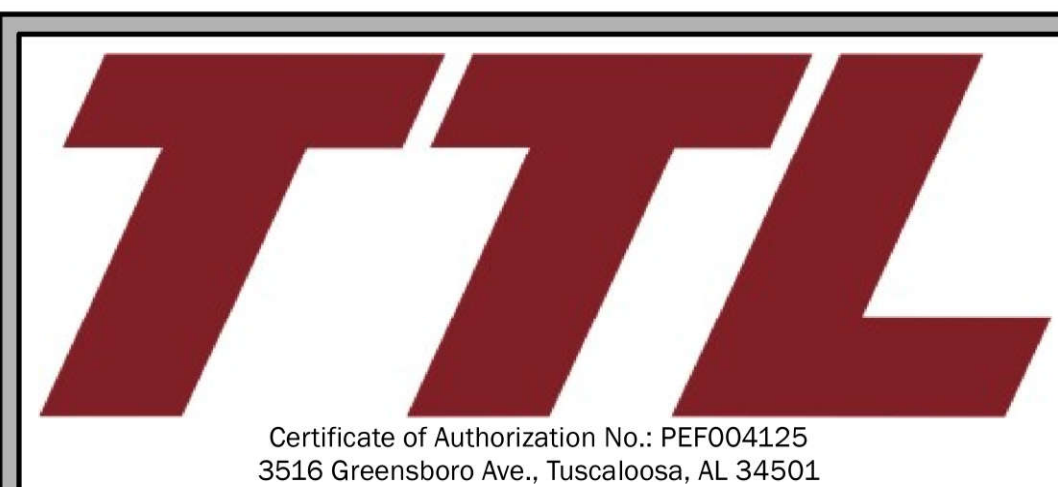
**FEMA FLOOD HAZARD MAP**



**THREATENED & ENDANGERED SPECIES LOCATION MAP**



**NRCS HYDRIC SOIL RATING MAP**



**SHEET 16: 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, Vivid Imagery, 11/20/2019 (West, 0.5 m Resolution) & 3/24/2018 (East, 0.46 m Resolution).

DRAWN BY: DEK
CHECKED BY: SGR
DRAWING DATE: 11/13/2020
REVISION DATE: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: See Panels



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

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3.2 Description of The Minerals to Be Mined

Mineral sands, titanium minerals (ilmenite, leucoxene and rutile), zircon, and staurolite occur in the upper 50 feet of sand in the Trail Ridge physiographic landform, which is an ancient beach ridge in Charlton County. These minerals will be extracted, separate, and concentrated on site. After the HMS products have been separated, the final products will be containerized, bulk shipped or loaded onto trucks or rail dependent upon customer requirements.

These deposits include the primary ores of titanium dioxide (TiO<sub>2</sub>) and zircon (ZrSiO<sub>4</sub>). TiO<sub>2</sub> 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, which increases the TiO<sub>2</sub> percentage to greater than 70 percent. Zircon is recovered as a co-product from the processing of HMS deposits.

3.3 Description of Lands and Community to Be Affected

The mine site is located within a rural area that has historically been and is currently used for silviculture; specifically slash pine plantation in various stages of production. 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. An electrically powered dragline will be utilized to minimize noise disturbance. 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 Nonriverine 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 greater than 88% of the existing land use.

4. Timeframe

After permit issuance, initial prep and facility setup is expected to take six months to one year to complete. Next, excavation of the mine pit will commence. The moving mine pit will progress at a rate of approximately 10 to 15 acres per month once all infrastructure is in place. The extraction of heavy mineral sand is anticipated to take 4 to 5 years. The start of reclamation monitoring will begin after the dragline has moved approximately 1,000 feet north from each completed excavation transect line. Final site reclamation will be completed within 24 months following the completion of mining. Total expected mine life from permit issuance to final reclamation is 7 to 8 years.

TPM will also install two deep water wells (FWP-01 and FWP-02) screened in the Upper Floridan Aquifer to provide make-up water during times of need (locations shown on Sheet 3 - Mining Plan Sheet).

The feed and tailings 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. A berm will be constructed along Georgia State Highway 94 to mitigate erosion and contain stormwater. Berms or other facilities may be constructed along T-Model and Trail Ridge Roads as necessary to control stormwater. Topsoil within each mining cell will be removed by heavy equipment and transported to the topsoil storage piles adjacent to the mine pit. Additionally, silt fencing, brush barriers, and hay bales will also be utilized for erosion and sediment control (see Sheets 8 and 9 - Erosion and Sediment Control Plan Sheets).

The topsoil storage piles/mining perimeter berms will serve to prevent stormwater runoff and sediment-laden waters within the active cut from leaving the site as well as preserve "seed banks" for native vegetation and a planting medium for later reclamation. Topsoil removal will be conducted two weeks in advance of mining activities. The topsoil storage piles will be stabilized with three horizontal to one vertical (3H:1V) internal slope and four horizontal to one vertical (4H:1V) external slope. As noted previously, silt fences and hay bales will be utilized along the outside of the topsoil storage piles to control post construction erosion.

The first step in the mining process will be rough clearing of 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 +/-500 feet ahead of the mining and 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.

5.1.2 Excavation, Processing, and Backfilling

Excavation of the mining cuts will commence after the topsoil is removed. The mining process proceeds as follows: The dragline moves through the mining area excavating approximately 100-foot wide by 50-foot-deep cuts, in an east to west or west to east direction as shown on Sheet 4 - Mining Plan Sheet. A mining cut profile/cross-section is included as Sheet 5 - Mining Plan Sheet. Mining rates are anticipated to vary from approximately 100-200 feet of pit length excavation per day. The excavated material will be stockpiled nearby before being transferred to an apron feeder which feeds to a screen. The screen removes roots and other large objects. The material will then be transferred to a pit/feed conveyor system. The oversized organic material will be placed near the screen area for future deposit into the mining pit during the reclamation process. The pit/feed conveyor system 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 PCP as a slurry.

In the PCP, spirals will be used to separate the heavy mineral sands from the lighter clays and quartz sand. The heavy mineral sands will be fed to the WCP. The WCP further separates the lighter minerals from the heavy mineral sands creating the heavy mineral sands concentrate that will be trucked to the off-site MSP for final mineral separation. Process water will be recovered from the tailings and heavy minerals sands via a series of dewatering screens and hydrocyclones throughout the process. Humates and clays will also be separated from the process water as slimes within the PCP. The slimes will be separated from the process water in a thickener. The underflow from the thickener will be dewatered and temporarily stored before being transported back to and placed in the mined pit area for reclamation. The facility will operate with zero discharge of wastewater. Process water for the mineral separations will be withdrawn from the process water ponds (Sheet 3 - Mining Plan Sheet - Site Layout) TPM will utilize three lined process water ponds and one lined primary process water overflow pond to maintain the adequate volume needed to operate the PCP/WCP. Overflow from the process water primary overflow pond may occur due to heavy rain events. Such overflows will be routed to the sand processing area water management pond. Water in the water management pond will be stored until it can be routed back to the

7.2 Highwall Reduction, Grading and Sloping

The site will be graded and sloped to mimic pre-mining contours. No highwalls will remain.

8. Other Provisions for the Protection of the Environment and Resources of the State

8.1 Consistency with land use in the area

The mine will maintain consistency with land use within the area. As noted in correspondence from the Charlton County Board of Commissioners, dated November 12, 2020, Charlton County confirmed the mining operation is consistent with the land use in the area. Currently, Charlton County has no zoning regulations that would prohibit the mining operation.

8.2 Wetlands and Streams

The proposed mining operation will not impact jurisdictional wetlands or streams. Copies of the U.S. Army Corps of Engineers Approved Jurisdictional Determination documents are provided as Exhibit A.

8.3 Protection of Properties on the National Register of Historic Places

No properties on the National Register will be affected by the mine. A copy of the Cultural Resources assessment is included as Exhibit B.

8.4 Protection of Contiguous Natural and Other Resources

The mine will operate pursuant to the various permits issued by Georgia EPD, which are designed to ensure protection of the environment. Contiguous natural and other resources will not be disturbed or significantly affected by the mining project.

8.5 Threatened and Endangered Species

The Saunders Demonstration Mine site was evaluated for the presence of protected species and/or their associated critical habitat(s) during 2018 - 2020. Referenced species surveys and habitat assessment reports are provided in Exhibit C. With the exception of the (Threatened) Wood Stork (*Myceria americana*), which may forage on-site, but are not known to nest on-site, no Federal protected species are known to occur on the project site. Gopher tortoise burrows are located adjacent to the Saunders Demonstration Mine site, only some of which were occupied by resident tortoises at the time of the surveys. The site and mine layout have been designed to specifically avoid areas of gopher tortoise burrows. No additional federally listed plant or animal species are known to occur on the demonstration project mine site (reference Exhibit C). One State protected species, the (Threatened) parrot pitcherplant (*Sarracenia pattersonii*), was identified within the limits of the proposed year 4 mining progression area. Prior to mining in this location, TPM will coordinate with appropriate agencies to ensure that applicable relocation protocols are utilized to avoid impacting the parrot pitcherplant specimen. The findings of the resource evaluations suggest that the mining activities, including the rough clearing, will not have significant consequences to protected species. Furthermore, the demonstration mine site is not considered "Critical Habitat", per the U.S. Fish and Wildlife Service definition of this term, for any federally listed species.

1. Introduction

The Twin Pines Minerals, LLC (TPM) Saunders Demonstration Mine site is located near St. George, Charlton County, Georgia. The Heavy Mineral Sands (HMS) deposits including zircon, titanium minerals (ilmenite, leucoxene, rutile), and staurolite occur in a portion of a beach ridge on Trail Ridge in Charlton County. The location and adjacent property owners are shown on the Mining Land Use Plan (MLUP) Sheets 1 and 2, respectively. The mine will extract these HMS reserves in a safe, cost effective, and environmentally sound manner for transport from the site by truck and rail to national and international customers.

The purpose of this demonstration mining project is to develop a high-quality HMS reserve to produce HMS concentrate products including titanium mineral concentrates and zircon concentrates to meet global demands in a safe, cost effective, and environmentally sound manner. This project is also to demonstrate that HMS mining can be accomplished in an environmentally sensitive area with negligible impact to the site and surrounding resources.

The TPM mining plan and associated groundwater and surface water monitoring plan will be used to confirm the ability of HMS mining to be conducted within close proximity to sensitive environmental resources. The strategic significance of HMS is notable as this project will serve to decrease the United States dependence on foreign imports of critical minerals and the potential threats related to disruptions to those supply chains. As the economically viable locations for mining HMS within the United States are becoming scarce, it is vital that new mines be developed in such a manner as to minimize environmental impacts. TPM has completed extensive geologic and hydrogeologic evaluations of the Saunders Tract which culminated with the production of a groundwater hydrology model demonstrating that mining can be safely conducted within the demonstration mine area with negligible impact to the site, the surrounding area, and the Okefenokee Swamp. Small scale projects, such as this one, that can demonstrate sound environmental practices for extracting heavy mineral resources in environmentally sensitive locations, represent good stewardship of the environment.

2. Operator and General Information

2.1 Description of 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 Pine 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. Mine Information

3.1 Affected acreage

As shown on Sheet 2- Boundary Sheet, the mining area consists of one mining block (Saunders Tract) bounded by Georgia Highway 94 to the south, Trail Ridge Road to the east, T-Model Road to the west, and surveyed boundaries on the north. As shown on the Site Layout (Sheet 3 - Mining Plan Sheet), the 773-acre permit area includes the mine area (approximately 582 acres), a Pre-Concentration Plant (PCP), a Wet Concentration Plant (WCP), and a material transport road.

The approximate center of the site is located near latitude 30.524023°N and longitude -82.113326°W. According to the USGS Topographic Map, the surface elevation at the mine excavation area ranges from approximately 155 to 175 feet above mean sea level (amsl). Currently a burnt-over pine plantation, the mine site has been used for industrial silviculture for at least the last 50 years.

5. Description of Mining Methods

5.1 Process

TPM has developed a heavy mineral sand mining technique using a dragline excavator, conveyor system for processing, and a mobile processing plant. This mining technique is different from conventional "wet mining", which utilizes a dredge and floating concentration plant to mine and process heavy mineral-bearing sands. In general, a dragline is a more efficient method for moving bulk material where long mining cuts and pits can be utilized. Employing elongated cuts allows for simultaneous mining the mineral sands and tailings placement to occur in the same pit. This process will allow backfilling and rough grading to occur as close to +/- 500 feet behind the dragline dig face.

The dragline method involves a large crane-like earthmoving machine equipped with a bucket to scoop material. The large-capacity bucket swings from cables on the end of the boom, scooping material that is then moved to adjacent areas. Draglines are electrically powered and run by two employees, an operator and an oiler. When mining is occurring, measures must be taken to protect the areas adjacent to the mine property. Appropriate sediment-control measures will be utilized to ensure that sediment-laden waters do not leave the mine property and affect local waterways.

A conveyor system is utilized to transport mined material to the PCP and WCP. Trucks will be used to transport the HMS concentrate from the WCP to the off-site Mineral Separation Plant (MSP). The locations of the mineral processing plants are depicted on Sheet 3 - Mining Plan Sheet. The mineral processing plants are situated so that mineral processing activities are located close to the mining areas, which decreases material transport distances and energy demands. Process water ponds will be constructed adjacent to the processing plant creating an efficient method for process water reuse and recirculation. Sheet 5 - Mining Plan Sheet depicts a process flow diagram for the mining operation.

Mining will commence after the topsoil has been removed from the initial dragline mining cut. The topsoil will be stockpiled near the excavation, generally beneath or alongside the conveyor lines. Mine tailing stockpiles will not be mixed with topsoil stockpiles. The dragline will then excavate and temporarily stockpile the mined material. The material will then be transferred onto the conveyor system for transport to the processing plant. After processing, the tailings will be temporarily stockpiled adjacent to the processing plant. The tailings will then be transported back to the open mining cut via a tailings conveyor system. The back-filled area will then be recontoured, covered with topsoil and revegetated to comply with reclamation standards. The operation is a continuous process and while the dragline is operating, backfilling of the cut is occurring simultaneously.

5.1.1 Site Preparation

Prior to initiating mining activities, the project area will be delineated by survey markers, boundary markers, and flagging in the field to indicate the locations of permanent infrastructure and mining boundaries. A pre-mining survey using LIDAR will be used to create a topographic surface that will serve as a guide for design elevations for all post-mining 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 that 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 the areas have been cleared, the permanent facilities and infrastructure will be constructed/installed along with the berms, stormwater controls, and other best management practices for sediment control.

The permanent facilities will consist of an interior road system, PCP/WCP processing facility, and off-site MSP, described further in the next section. Process water ponds will be constructed adjacent to the processing plant.

process water ponds and used for process make-up water. Two water wells installed in the Upper Floridan Aquifer will be used to supply make-up water as needed to maintain adequate process water reserves.

The HMS concentrate material from the WCP will be transported to the off-site MSP via truck. Water needed for processing at the MSP will also be provided by the make-up water wells. Water will be piped from well FWP-01 to the MSP plant. Once water has been used in the mineral processing it may be recycled for re-use at the MSP or transported to the WCP to be used in the processing of sands.

The MSP further separates the valuable and non-valuable 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 dependent upon customer requirements.

The tailings from the PCP/WCP area will be temporarily stockpiled. Tailings and slimes will then be loaded onto the mainline tails conveyor system. The mainline tails conveyor system will convey material onto a reclamation conveyor. The reclamation conveyor will deposit the tailings back into the mined pit area for reclamation. The mainline tailings conveyor will also be used to transport the blended bentonite/sand mixture to the pit.

Water within the active mining pit is anticipated to be withdrawn only during upset conditions (i.e., equipment maintenance/failure), installation of the soil amendment layer, or due to a heavy rain event. This water will be pumped from the mine pit to the mine pit water management pond and subsequently used for process make-up water or dust control.

5.1.3 Mining Progression and Schedule of Advancement

Mining will initiate in the southwest corner of the mine footprint and will proceed in a west to east transect until the dragline excavator reaches the eastern mining boundary. Heavy mineral sands will be excavated from a moving mine pit that has a length of approximately 500 feet and a width of approximately 100 feet. Within one to two weeks of the commencement of mining, sand tailings will be returned to the pit as mining continues to advance. Once the dragline reaches either the east or west limit of mining, the dragline will reverse its course and mine the next adjacent transect in the opposite direction (Sheet 4 - Mining Plan Sheet). Additionally, a portion of the filled pit will be re-excavated by the next, adjacent dragline pass. This east-west alternating mining will continue throughout the entire course of mining until termination along the northern boundary of the mine footprint.

Mining will commence upon authorization and is expected to be conducted over a four-year period. The moving mine pit will progress at a rate of approximately 10 to 15 acres per month once all infrastructure is in place.

6. Erosion and Sediment Control

The Erosion and Sediment Control Plan is provided on Sheets 8 and 9, which provide for BMPs employed to control sedimentation, protect adjacent watersheds, and prevent erosion on the periphery of the property.

7. Reclamation

The Reclamation Plan is provided on Sheets 11 and 12. The reclamation objective is to restore the land surface and groundwater elevations approximately to pre-mining levels. The mine pit will be back-filled with processed tailings; all structures and materials associated with the mine will be removed; and the site will be revegetated with plant communities appropriate to pine flatwoods. Although some wetlands may be restored and/or created, no lakes will be developed.

7.1 Topsoil Use; Overburden (Spoil) or Refuse Disposal Placement or Use; Backfilling

Topsoil will be stockpiled and returned to the mined area upon reclamation. Spoil will be used to backfill the excavation. No other refuse will be generated.

9. Other Permits

Other required permits include:

- Coverage under the General Stormwater Permit for Stormwater Discharges Associated with Industrial Activity, Permit No. GAR05000 (Issuance Date June 1, 2017);
- 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 permits and a full permitting process.

11. Attachments

- Exhibit A - USACE Jurisdictional Determination
- Exhibit B - Cultural Resources Surveys
- Exhibit C - Species Surveys and Habitat Assessments
- Exhibit D - Groundwater-Level Monitoring Plan
- Exhibit E - Impact of the Proposed Twin Pines Mine on the Trail Ridge Hydrologic System; January 14, 2020
- Exhibit F - Subsurface Lithology of the Surficial Aquifer at Twin Pines Mine; December 11, 2019
- Exhibit G - Assessing the Impact of Soil Amendments During the Reclamation of the Proposed Twin Pines Minerals, LLC Saunders Demonstration Mine Using Groundwater Models; November 13, 2020
- Exhibit H - Subsurface Continuity of Humate-Bearing Sands in the Surficial Aquifer, Trail Ridge, Georgia; January 25, 2021
- Exhibit I - Modeling the Groundwater Flow System at the Proposed Twin Pines Mine on Trail Ridge; Revised September 14, 2021



Certificate of Authorization No.: PEF00415  
3516 Greensboro Ave., Tuscaloosa, AL 35401

SHEET 17: 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: 11/19/2021
TTL JOB NO.: 000180200804.00
APPROX. SCALE: N/A