water as slimes within the WCP and it is temporarily stored before being transported back to and placed in the mined pit area for reclamation. TPM will maintain three lined process water ponds and one lined process water overflow pond to maintain the adequate volume needed operate the WCP. Two deep Upper Floridan Aquifer make up water wells will be used to supply makeup water as needed to maintain adequate process water reserves.

The HMS concentrate material from the WCP is transported to the Mineral Separation Plant (MSP), via dump truck. Water needed for processing will also be provided by the makeup water wells. Once water has been used in the mineral processing it will be pumped 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 deposits the tailings back into the mined pit area for reclamation.

Reclamation

As part of reclamation, the tailings and slimes are transported from their stockpiles to the open mined area where they are deposited/backfilled. The backfilled areas will then be recontoured using bulldozers to the approximate pre-mining LiDAR topographic data (via onboard GPS technology and/or survey crew GPS technology). After the tailings are contoured and levels reach approximate pre-mining topography, the topsoil will be replaced to its original thickness. The area will then be re-graded and contoured to mimic pre-mining contours, based upon the pre-mining survey. The operation is a continuous process, while the dragline is operating, backfilling of the pit is occurring as well. A cross-section view of the dragline cut and backfill, perpendicular to the direction of the dragging movement, is shown in **Figure 6B.** A detailed discussion of the reclamation process is provided in **Section VII.**

VI. INFORMATION ON OTHER PERMITS

Other permits being applied for include United States Army Corps of Engineers (USACE) Individual Permit, National Pollutant Discharge Elimination System (NPDES) Permits, Groundwater Extraction Permit, and an Air Permit.

VII. PERFORMANCE CRITERIA FOR MINING PLAN AND MINING ACTIVITIES

SMLUP drawings show property to be mined, the limits of the affected acreage, the natural drainage features and water disposal, the initial mining and overburden areas, the erosion and sedimentation controls, the ingress/egress areas, the direction and schedule of mining advancement, the area to be left undisturbed, and final reclamation.

Mining operations will be performed in a manner that will minimize erosion and sedimentation. Prior to initiating mining activities, TPM will implement the erosion and sedimentation prevention plan as

described in the SMLUP. Depicted in the SMLUP are the placement/location of silt fencing and other necessary erosion control measures. **Figures 7A, 7B, 7C, and 7D** depict erosion control notes. Existing drainage patterns at the site are shown on **Figure 8.** The facility will operate under a DNR-EPD General Permit No. GAR050000 Stormwater Discharges Associated with Industrial Activities.

Containment/diversion and process pond berms will be constructed in accordance with the Manual for Erosion and Sedimentation Control in Georgia. Design water levels will be set to provide a minimum of 3 ft of freeboard within the containment berms and process water pond berms. Process water pond berms will be constructed from compacted sub-soil material on un-mined lands or compacted sand tailings.

Containment berms shall be constructed as depicted in typical cross-sections (**Figure 6C**). Crests will be sloped to the inside and be graded level. The top and exterior slope and toe of all berms will be grassed with quick-growing/germinated grasses. Silt fencing shall be installed along a 15-foot setback along the exterior toe of the outer berms, and in all areas where deemed necessary for erosion control. Silt fencing shall be armored with stacked hay bales abutting the fence perpendicular to the direction of stormwater flow.

Following completion of construction of auxiliary erosion and sedimentation control structures, areas shall be vegetated with seed (millet rye) as soon as possible. Effort shall be made to utilize natural existing vegetation in those areas where buffers are proposed or where practical.

Construction of auxiliary erosion and sedimentation control structures including diversion, dikes, or berms shall be constructed to retain, direct, and control surface water runoff from affected areas into designed sediment control structures. All surface water discharge shall be controlled and released in a non-erosive velocity onto stabilized areas or into stabilized channels.

- No permanent land form changes or permanent mining support structures are proposed.
- Protective barriers, such as berms or other similar structures will be placed between jurisdictional waters of the U.S. A minimum setback of 25 ft will be maintained between barrier berms and adjacent un-impacted wetlands or streams.
- The proposed mining activity lies within areas designated as Zone A on the Flood Insurance Rate Map. **Figure 9** shows the floodplain areas in the vicinity of the proposed mine. The Zone A areas are isolated depressions within the site. No structures are proposed to be placed within these areas, and mining activities will not impact the overall floodway.
- The proposed mining operation will include the temporary alteration of streams and wetlands. A copy of the USACE Individual Permit application, which describes the impacts and associated mitigation is provided as Exhibit B to this Plan.
- TPM will obtain all required permits and maintain compliance with the Rules and Regulations of the State of Georgia. TPM will obtain a DNR-EPD General Permit No. GAR050000 for stormwater discharges. The stormwater management system will be inspected regularly as required by the permit. Any deficiencies noted will be corrected immediately.
- No properties listed on the National Register of Historic Places are located within one mile of any portion of the proposed mining operation. In the event historic or archaeological resources

are identified in the future, work shall cease and proper authorities shall be notified. A copy of the Cultural Resources assessment is included as an attachment to the USACE Individual Permit Application.

- Activities within the proposed mine shall adhere to air quality requirements including the National Ambient Air Quality Standards (NAAQS) and Mine Safety and Health Administration (MSH) regulations. If these parameters are anticipated to be exceeded, a dust control or air quality abatement plan will be implemented. Mining activities will be conducted in compliance with all applicable audible element regulations.
- TPM will post an identification sign at the entrance to the mine. The sign will include the Operator's name, Mine name, and Permit Number (**Figure 7D**).

VIII. PERFORMANCE CRITERIA FOR RECLAMATION

Reclamation activities shall begin within 1 to 2 weeks of the beginning of mining with the placement of sand tails into the active mining pit as it advances. The reclamation will progress following the proposed mining progression plan and will be completed in a timely manner. Final site reclamation will be completed within 24 months following the completion of mining. Following completion of all mining activities, all structures, equipment, and material associated with the operation shall be removed (**Figure 10**). Backfilling of mined areas will use overburden, spoil material, and stockpiled topsoil.

To ensure long term reclamation success TPM intends to observe hydrologic regimes post-mining to determine which areas will be planted to trees and which areas will be managed as treeless wet meadows similar to the wet prairie or seepage slope community types (FNAI Natural Community Classification Guide 2010). In a pine flatwoods landscape, small differences in elevation (just a few centimeters) and soil saturation can produce quite different plant communities. The best assurance of successful reclamation is to work with current (i.e. post-mining) conditions. TPM expects that areas designated as mesic pine flatwoods will have similar surface hydrology post-mining, so those areas will likely be replanted to pine. Areas currently designated as wetlands will likely remain wetlands post-mining, although specific wetland community goals (e.g. trees versus treeless) will need to be established as post-mining conditions dictate. Areas currently designated as wet pine flatwoods will likely be a mosaic of fine-scale elevational and hydrologic conditions, some of which may be appropriate sites for tree planting, and some of which will be more successful as wet meadows.

The goal of reclamation will be to produce functional communities that are resistant to the invasion of exotic species as quickly as possible. We will begin observing hydrologic regimes, soil characteristics and plant community development immediately after the mining pit is backfilled. TPM expects plant communities to develop from the seedbank in the topsoil (which will be preserved and replaced) and we will address issues with community development as they arise (e.g. invasive species control, native 'weedy' species dominance). We expect to determine which areas will be planted with trees within one-year post-mining. Trees will be planted in late fall/winter which is common forestry practice and best ensures planting success. Active growing season varies by plant species, but many species are dormant for some period in the winter.

TPM does not anticipate using fertilizers because pine flatwoods systems and their embedded wetlands are naturally nutrient deficient; the addition of fertilizers would degrade rather than enhance reclamation by encouraging exotic and native 'weedy' species.

Timing of stable, mature growth of plant communities post-mining is also somewhat unpredictable as there will be multiple potential successional trajectories (see Chapter 9 The Dynamic Nature of Ecological Systems: Multiple States and Restoration Trajectories by Suding and Gross, in Foundations of Restoration Ecology, eds. Falk, Palmer and Zedler). Species turnover rates will undoubtedly be high in the first 2-3 years, but we expect some stabilization after that. Some systems are in a state of dynamic equilibrium in which species turnover will continue to occur into the foreseeable future; they are still functioning ecosystems. Mature meadows may be established in a relatively short period of time (< 10 years), whereas pines may not reach maturity for 30-40 years.

Estimated final contours will approximate pre-mining contours; wetlands will remain wetlands and uplands will remain uplands. T-Model and Trail Ridge Roads will remain post-mining.

Erosion control measures shall remain in place until adequate vegetative cover has been established. The operator will restore all grades to mimic pre-mining topography and be blended into the existing landscape. Reclamation shall mimic approximate pre-mining topography and restore surface water flow to approximate pre--mining drainage basins. Constructed slopes shall not exceed 3:1. No highwalls will remain.

Reclamation objectives are depicted on the reclamation plan sheet of this submittal and will be adhered to unless circumstances dictate amendments to the plan. Reclamation objectives for the proposed mining activity include re-establishment of vegetation and post-mining topography, which will mimic pre-mining topography.

Specific requirements that TPM, LLC will adhere to are:

A. Grade all peaks, ridges, and valleys resulting from surface mining and backfill all pits and trenches resulting from same in a manner to minimize any hazardous effects of mining adjacent to any State or county maintained public road.

B. Backfill all affected lands as stated in the Reclamation Objective of this Plan utilizing overburden, spoil material, and/or borrow from affected (permitted) land unless approval from the Division is obtained to utilize other materials. Sound engineering principles shall be applied to ensure that affected lands, as reclaimed, meet the intended use.

C. Apply immediate erosion control measures to protect the topsoil cover until an adequate vegetative cover is established. Erosion control measures may include scarifying the land surface parallel to contours.

D. There will be no highwalls remaining on site.

E. All affected land shall be graded to mimic pre-mining topography and blended into the existing landscape, unless otherwise amended.

F. Constructed slopes shall not exceed three horizontals to one vertical (3:1) except where may be approved otherwise in this Plan. Fill and cut slopes shall be designed and constructed to prohibit slumping or shear failures. Prior to final grading, all slopes will be blended in with the

original existing topography. Slope grades shall be uniform. Mechanical or vegetative or both stabilization measures shall be employed as soon as practical to prevent erosion.

G. Overburden, spoil or refuse, when used as backfill material, for berm or other construction, will be segregated as necessary, emplaced and compacted in accordance with sound engineering practices to provide for the purpose intended. All new landform structures created with the use of overburden (spoil) or refuse materials shall be constructed in a manner to protect against failure, subsidence and/or erosion and will be permanently stabilized upon completion of construction.

H. No lakes or ponds are proposed as part of the reclamation plan.

I. Any proposal for the construction of wetlands as a reclamation objective shall be consistent with accepted practices utilizing the best available technology (BAT) and include the best management practices (BMP's) to attain the desired result. A copy of the Corps of Engineers Individual Permit Application, which includes site reclamation, is attached to this Plan

J. The Operator will file a Final Reclamation Report and Request for Release upon completion of reclamation responsibilities on affected acreage.

IX. GROUNDWATER- AND SURFACE-WATER MONITORING PLANS

Twin Pines developed groundwater and surface water monitoring plans to assess the groundwater and surface water levels and quality throughout the life of the mining operation. The plans were submitted as part of the USACE Individual Permit Application and are outlined in the following sections.

Groundwater and Surface-Water-Level Monitoring

Currently, there are five piezometers (PZ-15, PZ-16S, PZ-16D, PZ-28S, and PZ-28D,) installed within the proposed mine footprint (**Figure 11**). There are an additional 19 piezometers located within 2,000 ft of the proposed mine footprint. In addition to the above-referenced monitoring points, 62 piezometers were installed within the larger project study area. Combined, each of these 86 piezometers are equipped with Rugged Troll pressure transducers and have been recording background groundwater-level data for a period of between six months and one year. These piezometers will continue to be monitored throughout the period of mining and during post mining.

An additional 100 shallow 1.5-foot deep piezometers were installed inside the proposed mine footprint to monitor groundwater levels within wetlands. These shallow "wetlands" piezometers are also equipped with Rugged Troll pressure transducers and will be monitored during pre-mining, active mining and post-mining periods (**Figure 12**).

A total of 23 staff gauges were installed to evaluate surface water elevations across the project study area (**Figure 13**). Each staff gauge segment measures approximately 3.3 ft in length and is mounted to a metal fence post or pressure-treated wood post so that the base of the gauge was positioned at ground surface. TTL installed In-Situ, Inc. Rugged Troll 200 non-vented data logger/cable combinations at the 23 staff gauge locations across the project study area. The data loggers were 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 six months and one year. These staff gauges will continue to be monitored throughout the period of mining and during post mining.

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 at the northern, central, and southern portions of the project study area (**Figure 13**). The data loggers for each rain gauge record the accumulation of precipitation in units of hundredths of an inch. Rain gauge data is manually downloaded in the field by TPM representatives on a monthly or bi-monthly basis. During the proposed course of mining, rain gauge data will continue to be manually downloaded in the field once every two weeks.

Proposed Configuration of Piezometers

As part of this monitoring plan, new piezometers will be installed within the mining footprint for the collection of groundwater data. Prior to the start of mining, a site grid will be established to assist in the placement of these new piezometers. **Figure 15** shows the approximate locations of proposed piezometers within the mine footprint. A new piezometer will be installed approximately every 2,000 ft in an east-west direction and every 1,000 ft in the north-south direction. The spacing will provide five rows of piezometers (approximately 23 piezometers), covering an area of roughly 898 acres, or one piezometer every 39 acres. This spacing was developed to provide for monitoring of the predicted steady-state drawdowns due to the moving mine, which has an estimated cone of depression of approximately 1,000 ft wide and 2,000 ft long (**Figure 16**).

The 23 new piezometers will be identified at MPZ-01 through MPZ-23. In addition to these 23 proposed piezometers, four existing piezometers (PZ30D, PZ14, PZ57D, and PZ44) located within 2,000 ft of the mine footprint will also be included in the monitoring program. Monitoring of these piezometers will be initiated prior to the start of mining.

Piezometer Construction

Each of the 23 new piezometers will be constructed to a depth of approximately 50 ft below land surface (bls) using a sonic drill rig (**Figure 17**). Fifty feet is the maximum depth of mining. During installation of the new piezometers, soil cores will be continuously collected and described by an on-site geologist. Boring and well construction logs will be prepared for each newly constructed piezometer.

Each piezometer will be constructed with 40 ft of 0.010-inch slotted, 2-inch diameter, threaded-joint, schedule 40 PVC installed from a depth of 10 to 50 ft bls. From the top of the screen to approximate land surface will be cased with solid 2-inch diameter, schedule 40 PVC riser. The natural formation sand will be allowed to settle around the screen to provide a natural pack to a depth of approximately eight feet bls. A two-foot thick bentonite pellet seal will be placed above the top of the natural filter sand. The remaining annular space above the bentonite seal 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. Each piezometer will be fitted with a Rugged Troll transducer in order to continuously monitor groundwater levels.

Sequencing of Piezometer Installation Relative to Progression of Mining

Once initiated, mining will advance at an estimated rate of about 100-200 ft 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 piezometers is discussed below:

- Within one or two days of the advancing mine face reaching a piezometer, the transducer will be removed and the piezometer will subsequently be excavated by the advancing drag-line excavator,
- Within approximately five to seven days of mining, the open excavation pit will be backfilled with post-processed soils,
- Within five to ten days of backfilling the excavation, a replacement piezometer will be installed in the approximate location of above-referenced excavated piezometer and,
- The replacement piezometer will be fitted with the Rugged Troll transducer that was removed from the previous piezometer in order to continue monitoring of groundwater levels.

Using this approach for the removal and reinstallation of piezometers, will aid in maintaining the full complement of piezometers within the mine boundary. This same methodology will be applied for the excavation and reinstallation of the shallow "wetlands" piezometers.

Proposed Surface-Water Monitoring Locations

Nine surface water locations are proposed to be monitored in the same general manner as previously installed staff gauges. Six additional staff gauges will be installed and equipped with Rugged Troll pressure transducers. These locations are shown on **Figure 18**.

Frequency of Water-Level Monitoring

As previously stated, water levels will be recorded using Rugged Troll pressure transducers. The transducers will generally be programmed to record water-level measurements at the following intervals; however, the frequency of measurements may be changed as necessary during the life of the mine.

Shallow "Wetland" Piezometers

- Transducers installed, in the shallow 1.5-foot-deep piezometers for monitoring water levels within existing wetlands, will record water-level measurements at 6-hour intervals.

Remaining Piezometers

- Transducers installed, in the row of 50-foot-deep piezometers located within 1,000 ft of the active excavation and within the mining footprint, will record water-level measurements at 10-minute intervals.
- Transducers installed, in the row of 50-foot-deep piezometers located greater than 1,000 ft from the active excavation but within the mining footprint, will record water-level measurements at one-hour intervals.
- Transducers installed, in the remaining piezometers outside of the mining footprint, will record water-level measurements at 6-hour intervals.

Surface Water Transducers

- Transducers installed at staff gauges will record water-level measurements at 6-hour intervals.

Initially, transducer data will be downloaded twice per week to evaluate water levels within and adjacent to the proposed mine. The frequency of transducer data downloading may be adjusted as needed during the life of the mine.

Groundwater- and Surface-Water Quality Monitoring Plan

Frequency of Groundwater/Surface-Water Quality Monitoring

Water-quality samples will be collected once prior to the start of mining (background) from the 23 new piezometers, four existing piezometers, and nine surface-water locations. The monitoring locations are listed below:

- Newly installed piezometers (MPZ-01 through MPZ-23) (**Figure 15**),
- Piezometers PZ30D, PZ14, PZ57D, and PZ44 (**Figure 11**),
- Wetland Monitoring Points WSP-01 through WSP-03 (**Figure 18** and,
- Stream monitoring points MSW-01 though MSW-06 (**Figure 18**).

The following is a schedule for the frequency of water-quality sampling:

- One sampling event performed prior to initiation of mining.
- Four quarterly monitoring events beginning three months after mining is initiated
- Semi-annual sampling thereafter until the end of mining unless a notable change in water quality occurs.
- Semi-annual monitoring of post mining conditions for an estimated period of six years (estimated duration of mining).

Based on the results of water-quality data monitoring and the progression of the mine, the frequency of water-quality data sampling and number of monitoring locations may periodically be adjusted (i.e. increased or decreased) during the life of the mine.

Post-Mining Monitoring

Twin Pines estimates that it will take about six years to mine the entire 898 acres. Post-mining monitoring will be performed for a period equal to the period of mining, and will consist of the monitoring of water levels in the piezometers on a continuous basis. This monitoring will include a manual download of the pressure transducers once every quarter during the post-mining period. Water-quality samples will be collected semi-annually for analysis of the constituents specified in this monitoring plan.

Water-Quality Sample Collection and Analysis of Data

To ensure that water-quality samples are collected properly, a Sampling and Analysis Plan (SAP) has been prepared. The SAP addresses well preparation, sample collection, chain-of-custody, analytical procedures, and field and laboratory quality assurance/quality control (QA/QC).

TTL

SURFACE MINING LAND USE DEVELOPMENT PLAN (2)

TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

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CHECKED BY: WW
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