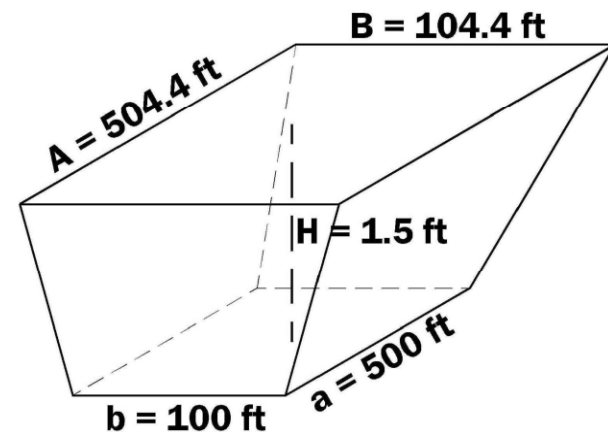


**MINE PIT WATER MANAGEMENT POND CALCULATIONS**

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

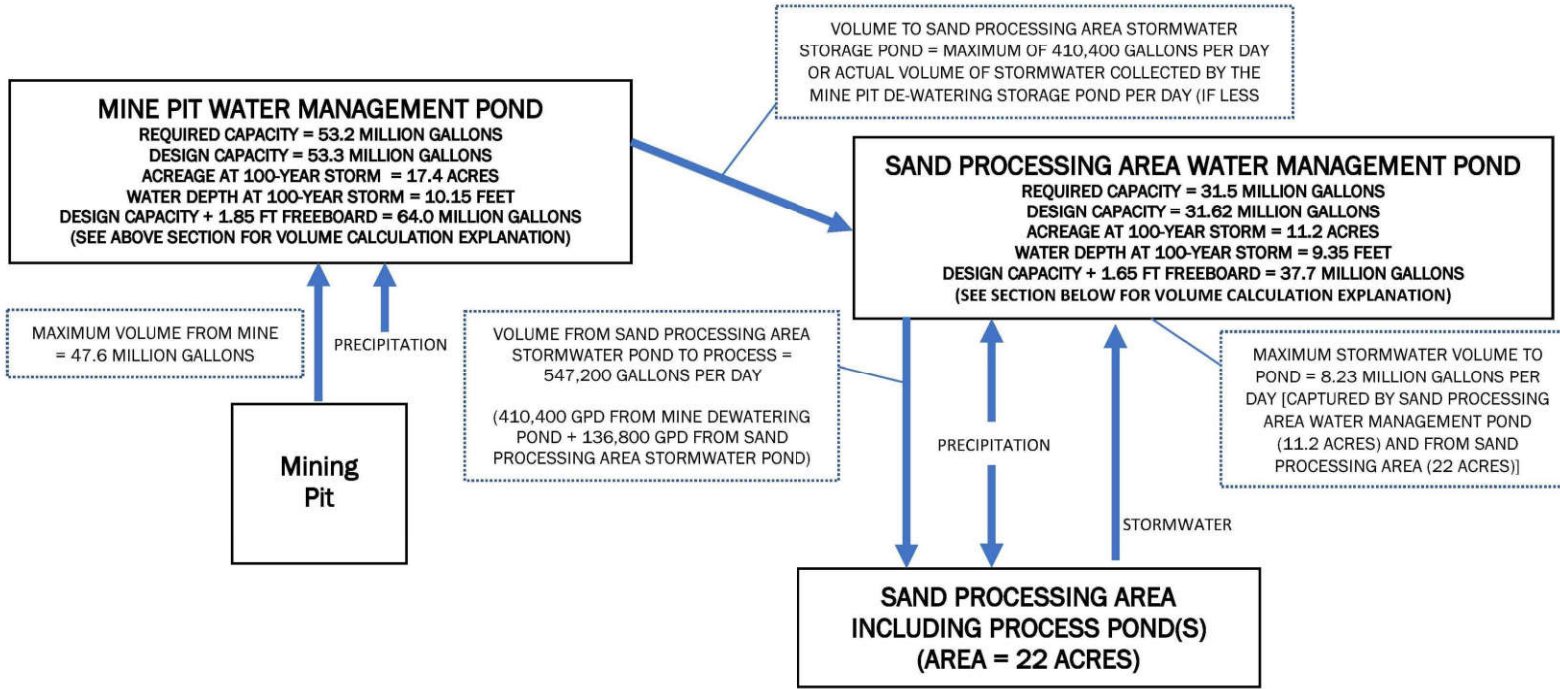
- 24-HOUR, 100-YEAR EVENT:  
 VOLUME 24-HOUR-100-YEAR EVENT = (RAINFALL IN FT) X (18 ACRES X 43,560 FT²/ACRE) X (7.48 GAL/FT³)  
 VOLUME 24-HOUR-100-YEAR EVENT = (0.95 FT) X (18 ACRES X 43,560 FT²/ACRE) X (7.48 GAL/FT³)

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