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March 3, 2023

Mr. Jeremy Eddy, PG Manager
Mining and Reclamation Section
SC Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

RE: Soilutions, LLC
Edge Road Mine; Application for Mine Permit
Responses to Comments regarding Water Quality, Flooding and Increased Forest Fire Potential

Dear Mr. Eddy:

On behalf of Soilutions, LLC, attached are responses to several public comments concerning the planned Edge Road Mine. As stated in the response, the Edge Road mining operations will not have a significant adverse impact on any of the above referenced issues.

If you have any questions, please feel free to contact me.

Respectfully submitted,

Craig Kennedy

Craig Kennedy, PG
Principal

Response to Water Quality Concerns Comments
Groundwater quality will not be degraded by mining operations at the Edge Road Mine. The sand mining will only excavate the sand deposit and load onto trucks without processing. No chemicals will be used in the mining process.

Surface water discharges are regulated by the NPDES General Permit coverage under SCG731593. The pollutant of concern is total suspended solids (TSS). Stormwater and groundwater for Phase 1 of mining will be routed into the pit's rim ditch and the intercepted water will be directed to a pit sump. The sump allows the sediment to settle and clean water from the surface is decanted and discharged. Once Phase 1 mining is complete, the pit will be utilized for a sediment/groundwater recharge basin by pumping all subsequent pit dewatering from Phases 2 through 4 into the Phase 1 sediment/recharge basin. Some of the water will be retained in the basin and infiltrate into the groundwater system as recharge. The remaining portion of surface water discharge will be decanted from the surface of the pond through the outfall.

It appears there is a concern that mining will increase the turbidity of the surface water receiving the discharge and increased turbidity will increase the bacteria. The concern for bacteria loading in a discharge *is e. coli*. *E coli* contamination in water systems is the result of domestic or agricultural wastewater (e.g. human or animal waste). The sand mine will not have such a wastewater discharge that could increase the harmful bacteria, i.e., *e. coli*, loading in the receiving stream.

An allegation was made that water quality in Boggy Swamp and Big Jones Swamp could become impaired because of the Edge Road Mine as Sterritt Swamp's water quality is impaired. The Edge Road Mine is not in Sterritt Swamp's watershed. However, Horry County Solid Waste Authority's Class 3 solid waste facility is located within Sterritt Swamp's watershed. It was not stated if the solid waste facility is the reason for the water quality impairment of Sterritt Swamp, but comparing the potential for impacting water quality between a municipal landfill and sand mine is an inappropriate comparison. There is no basis to support a concern that the proposed mining would impair water quality in Boggy and Big Jones Swamp.

Increased Flooding Potential
Concerns that mining will increase flooding in and downstream of Boggy Swamp are exaggerated. Stormwater falling within the disturbed area of the mine will be diverted into the pit/sediment basin for treatment and discharged. The capacity for the pit to hold stormwater is much greater than the void space in the soil; consequently, stormwater falling within the mine area will be released more slowly into the receiving stream than it would be pre-mining. The wetland areas associated with Boggy Swamp downstream of the mine discharge are significant and will provide significant areas to hold a minor amount of mine water discharge. Furthermore, pursuant to regulation 89-140 D., the operator must manage any discharge so as to not increase flooding downstream. If Boggy Swamp were to experience flooding conditions from a large storm event, the operator must and will cease surface water discharges until flooding conditions abate.

Increase Fire Hazard
References were made that due to mine dewatering and lowering of the groundwater levels, the soils and vegetation would become excessively dry, thereby increasing the potential for forest fires. The mine dewatering only will affect the groundwater in the phreatic zone. That is the zone where all the pores are filled with groundwater and under saturated conditions. For groundwater to be influenced by dewatering, the pore spaces must be saturated. The zone between the phreatic zone and ground surface is the vadose zone where moisture only partially fills the pore spaces. Because it is not under saturated conditions, pumping of groundwater, i.e., mine dewatering, does not affect the vadose zone.

All non-hydrophilic plants obtain their water from the vadose zone that is not influenced by groundwater; consequently, mine dewatering will not affect these plants' water source. Hydrophilic plants within

wetlands and Carolina Bays will not be adversely impacted as discussed in the *Edge Road Mine Groundwater Drawdown Estimate and Limited Effects to Wetlands*.

Conclusion

Based on the above reasons, there is no reasonable technical basis to support a concern that the proposed mine will impair water quality or increase the risk of flooding or fire hazard in the vicinity of the mine.

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February 22, 2023

Mr. Jeremy Eddy, PG Manager
Mining and Reclamation Section
SC Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

RE: Soilutions, LLC
Edge Road Mine; Application for Mine Permit
Responses to Comments on Mine Dewatering Impacts

Dear Mr. Eddy:

Please find attached information regarding the groundwater drawdown estimates for the Edge Road Mine. The drawdown is the basis for determining which wetlands within the Lewis Ocean Bay Preserve may be within the estimated drawdown radius. Soilutions has committed to limit mining depth in Phase I to 30 feet. This will minimize the groundwater drawdown during initial mining. Also, once mining is completed in Phase I (segment 1), mine dewatering in Phase II, segments 2 – 4, will be pumped into the mined-out Phase I for increased sediment control and to serve as a groundwater recharge basin during mining in Phase II, segments 2 - 4.

Please contact me if you have any questions.

Respectfully submitted,

Craig Kennedy

Craig Kennedy, PG
Principal

R. CRAIG KENNEDY REGISTERED NO. 719 SOUTH CAROLINA PROFESSIONAL GEOLOGIST

cc Josh Epps
Jessica King, Esq.

Estimating Groundwater Drawdown for Edge Road Mine
Limited Effects to Wetlands from Mining

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Appendices

Groundwater Drawdown Estimate for Edge Road Mine

1.0 Introduction

The Edge Road Mine is situated adjacent to the northern edge of the Lewis Ocean Bay Preserve (LOB). To facilitate mining, the Edge Road Mine will need to remove groundwater that seeps into their active pit and inhibits access to and loading of materials and compromises safety (i.e., mine dewatering). A determination as to whether mine dewatering will influence the surrounding surficial groundwater system in a limited area around the mine (i.e., groundwater drawdown) depends upon a number of factors including depth of mine dewatering, continuity of pumping, local geology, and characteristics of the sand medium in which the groundwater flows.

Groundwater drawdown will be primarily situated in upland areas. However, the drawdown will extend partially into wetlands near the Edge Road Mine. To determine how the drawdown may affect surrounding wetlands depends on several factors including wetland morphology, extent of groundwater drawdown, surface water hydrology, and others.

Soilutions' approach to ensure protection of surrounding wetlands is to first determine which wetlands may be within the estimated groundwater drawdown area. An analytical approach applying the Sichardt equation is used to estimate the maximum groundwater drawdown for the Edge Road Mine. For wetlands within the groundwater drawdown area, additional issues should be considered in determining if mine dewatering will have any impact on these wetlands' hydrology and their overall functionality. To protect potentially impacted wetlands during mining operation, Soilutions, through a consultant, will deploy a wetland hydrology monitoring system and procedures for tracking groundwater drawdown within wetlands that are closest to mining.

2.0 Estimating Groundwater Drawdown from Mine Dewatering

Groundwater drawdown can be estimated based on an empirical relationship developed by Sichardt using hydraulic conductivity values for the aquifer in which the groundwater is flowing. Hydraulic conductivity data for the Edge Road Mine via a pump test is not available. However, the geology is known based on drilling conducted by the SC Geological Survey. Using values of hydraulic conductivity (K) the radius of influence (R_O) for an unconfined aquifer can be estimated using the following equation, **Eq. (1)** [1]**::**

$$R_0 = 3000(h_0 - h)\sqrt{K}$$

h_o = the total head of the water table aquifer in meters
h = the total head of the dewatered aquifer in meters;
K = hydraulic conductivity of unconfined aquifer in meters/sec;
R_o = radius of influence in meters, calculated via Sichardt's equation

(Broward County Florida uses the Sichardt equation (Powers, 1992)**1** to estimate the drawdown from an excavation to the edge of the nearest contaminant plume to minimize the migration of the plume toward the construction excavation. See attached Broward County document. Appendix A)

To calculate R_0, equations generally assume that water is withdrawn from a circular area. Most construction dewatering activities, however, are rectangular areas. Therefore, an equivalent radius of influence (r_e) must be calculated and added to the Ro. The following equation is used to make this adjustment, **Eq. (2)**[1]:

$$r_e = \sqrt{\frac{a \cdot b}{\pi}}$$

Where;

a = length of excavation (meters)
b = width of excavation (meters)

2.1 Determining Hydraulic Conductivity

The primary input to the Sichardt equation is hydraulic conductivity (**K**). To determine **K** at the mine site, 6 drill logs from SC Geologic Survey (SCGS) boreholes were reviewed to determine the strata around the mine site (Appendix C)[2]. The SCGS describes the surficial geology in the Hand 7.5' geologic map as "Strand deposits (Pleistocene) QPts". The description for the Strand Deposit is – *Light-gray (N7) to dark-gray (N3), sub-rounded to well-rounded, moderately sorted, fine to medium grained quartz sand* (underline added) *with common fine-grained heavy minerals and shell hash. Forms subdued ridges at surface. Thickness varies from 2 to 40 feet.* (The Hand 7.5' Geologic Map, Appendix D, is uploaded into DHEC ePermitting.)

The borehole locations range from 9,000 feet to 5,400 feet from the mine. As provided in the general description for the Strand deposits, quartz sand with predominate grain sizes in the drill logs ranging from fine to medium grain sizes. Pee Dee formation is located at the base of the surficial Strand deposit.

Consequently, it's reasonable to consider that the unconfined shallow aquifer at the Edge Road Mine has a predominantly fine to medium sand grain size range. Referring to *Representative Values of Hydraulic Properties* table (Appendix B)[2]:

- **K** range for medium sand is 5.0 x 10^{-4} m/s to 9.0 x10^{-7} m/s (142 ft/day to 0.26 ft/day).
- **K** range for fine sand is 2.0 x10^{-4} m/s to 2.0 x10^{-7} m/s (57 ft/day to 0.06 ft/day).
- The **K** value used to calculate is 2.0 x10^{-4} m/s (57 ft/day). This is the maximum **K** value for fine sand and is within the **K** value range for medium sand.

2.2 Groundwater Drawdown Calculations

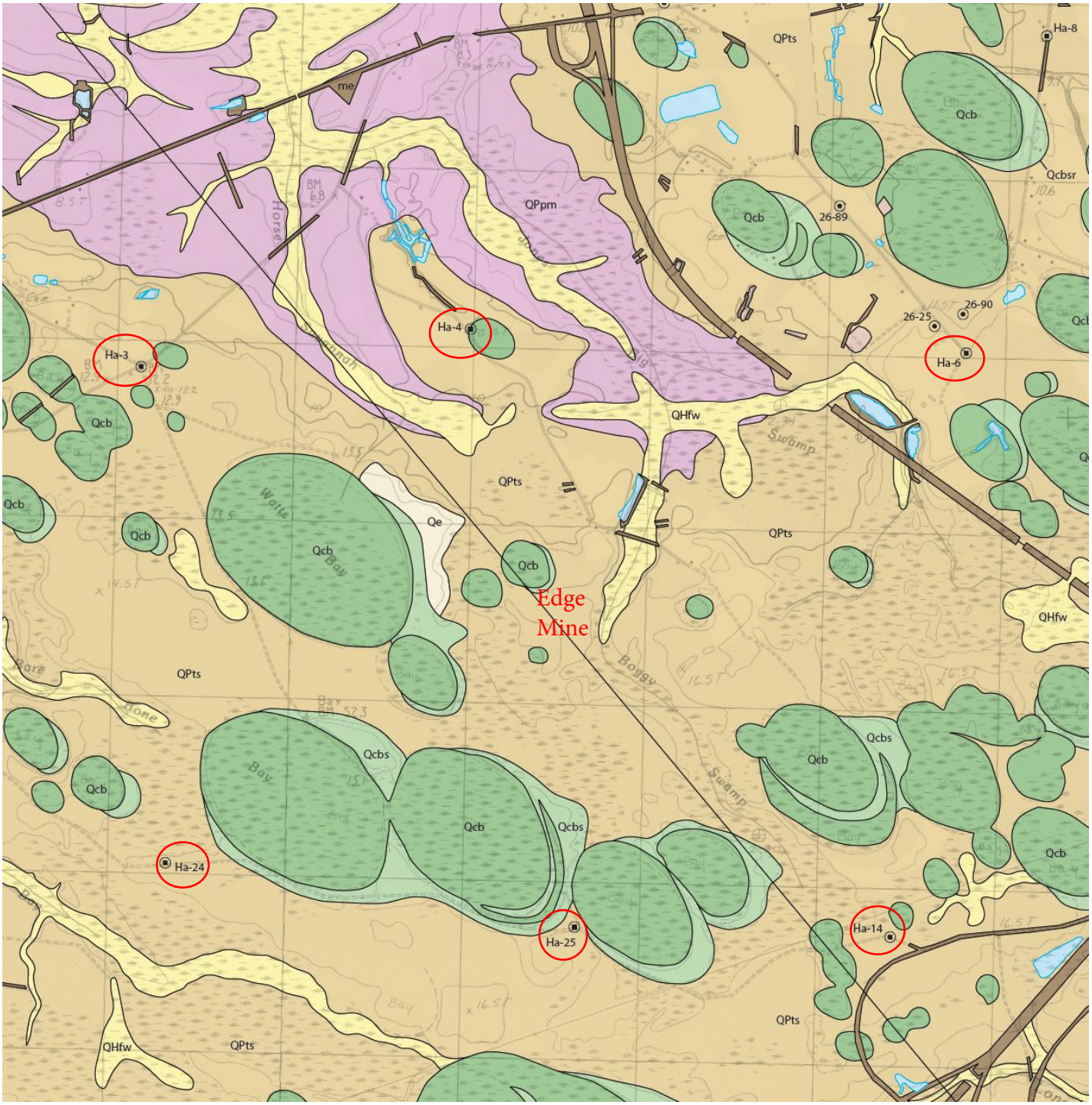
As stated in the revised mine plan (Appendix F), Soilutions has committed to limit mining depth in Phase I to 30 feet. This will minimize the groundwater drawdown during initial mining. Also, once mining is completed in Phase I (segment 1), mine dewatering in Phase II, segments 2 – 4, will be pumped into the mined-out Phase I for increased sediment control and to serve as a groundwater recharge basin during mining in Phase II, segments 2 - 4.

To estimate the extent of groundwater drawdown, the first calculation will be to estimate the drawdown from mining in Phase I to a depth of 30 feet. The initial depth to groundwater before dewatering is 5 feet below ground surface. The aquifer thickness in the vicinity of the mine is approximately 55 feet. The top of the Pee Dee formation is considered the base of the surficial aquifer in the area of the mine. The saturated thickness of the surficial aquifer is therefore 50 feet.

2.2.1 Phase I Mine Dewatering to 30 Feet Calculation

To solve the equation, use the following values in equation **Eq. (1):**

h_o = 15.24 m (the total head of the water table aquifer in meters)
h = 7.62 m (the total head of the dewatered aquifer in meters)
K = 2.0 x10^{-4} m/s (hydraulic conductivity of unconfined aquifer in meters/sec);



SCGS Borehole Locations
Section of SCGS Hand 7.5' Quadrangle Geologic Map
Scale 1" = +/-2,700'

- Results: R_o = 323 m (1,060 feet) calculated radius of influence as measured from the edge of the excavation. Because the mine is an approximate rectangle and not a well, apply **Eq. (2)** to adjust the equivalent radius of influence (r_e) as measured from the approximate center of the excavation. The approximate rectangle dimension of the pit is:
  a = 213 m (length of excavation (meters)) (700 feet)
  b = 116 m (width of excavation (meters)) (380 feet)
- Results: r_e = 89 m (291 ft) – Add r_e results to R_o to determine total distance
- **Result for 30-foot groundwater drawdown in Phase I:**
  $R_o + r_e$ = 323 m + 89 m = 412 m **(1,351 feet)**

The estimated groundwater drawdown radius for the 30-foot pit dewatering is shown on the attached *Edge Road Mine Estimated Groundwater Drawdown* map (Appendix E).

2.2.2 Phase II Mine Dewatering to 50 Feet Calculation

Upon completion of mining in Phase I, mining will progress to Phase II as previously described. For ease of calculation, the effects of having a segment of the mine at a 30-foot depth (Phase I) and the recharge to the shallow groundwater system from a flooded Phase I segment are ignored. The calculations will assume a 50-foot depth for all phases of mining and no recharge to the groundwater from Phase I. This provides an additional level of conservatism to the estimated final groundwater drawdown distance because there is no doubt that some recharge will occur which will further limit the effects on surrounding wetlands.

The initial depth to groundwater before dewatering is 5 feet below ground surface. The depth of mining is 50 feet. The aquifer thickness in the vicinity of mine is approximately 55 feet. The top of the Pee Dee formation is considered the base of the surficial aquifer in the mine area.

Plug in the following values into equation **Eq. (1**):
  h_o = 15.24 m (the total head of the water table aquifer in meters)
  h = 1.52 m (the total head of the dewatered aquifer in meters)
  K = 2.0 x10^{-4} m/s (hydraulic conductivity of unconfined aquifer in meters/sec).
- Results: R_o = 580 m (1,903 ft) - calculated radius of drawdown as measured from the edge of the excavation. Because the mine is an approximate rectangle and not a well, apply Eq. (2) to adjust the equivalent radius of influence (*re*) as measured from the approximate center of the excavation. The approximate rectangle dimension of Phase I segment:
  a = 351 m (length of excavation meters) (1,150 feet)
  b = 305 m (width of excavation meters) (1,000 feet)
- Results: r_e = 184 m (605 ft) – Add r_e results to R_o to determine total distance.

Final Result for 50-foot pit dewatering (not taking into account any recharge to groundwater from Phase I seg – Maximum Extent of Drawdown:
  $R_o + r_e$ = 580 m + 184 m = 764 m **(2,507 feet)**

The estimated groundwater drawdown radius for the 50-foot pit dewatering is shown on the attached *Edge Road Mine Estimated Groundwater Drawdown* map (Appendix E).

References

1. Reference for Sichardt equation – *Powers, J.P. 1992. Construction Dewatering: New Methods and Applications, 2nd ed., John Wiley & Sons, New York, NY.*

2. Reference for hydraulic conductivity – *Representative Values of Hydraulic Properties*; by Glenn M. Duyffield, President, HydroSOLVE, Inc.; http://www.aqtesolv.com/aquifer-tests/aquifer_properties.htm

3.0 Limited Effects to Wetlands from Mining

The groundwater drawdown from the mine dewatering will extend into the two wetlands on-site. Types of wetlands are isolated wetlands of the Carolina Bays and wetlands associated with Boggy Swamp. No mining will occur within wetlands. Buffers, 50- feet wide, are established along wetlands to protect against physical disturbances.

Hydrologic effects to wetlands will be minimal. Wetlands by their nature experience dry cycles that are not detrimental to the functionality of the wetlands. Wetlands within Boggy Swamp in the vicinity of the mine are within a 1,500-acre (approximate) watershed. Surface water within the watershed flows through the Boggy Swamp wetlands. This surface water, particularly during storm events, provides hydration that can maintain saturation of the hydric soils. Furthermore, dewatering discharge from the mine will flow into Boggy Swamp and provide additional hydration for the wetlands downstream of the mine. (Water discharged will meet water quality standards required by the NPDES permit.)

The groundwater hydrology of nearby wetlands will be monitored by piezometers. Refer to discussion on Wetland Monitoring for location, specific details and contingency plans of the wetland monitoring plan.

As the distance increases from the center of the mine dewatering, the influence from the mine dewatering diminishes. As demonstrated in the *Estimating the Extent of Groundwater Drawdown by the Edge Road Mine*, it is shown that the estimated maximum drawdown distance is 2,500 feet. This is conservative because the drawdown calculations assume continuous pumping and no groundwater recharge which is not realistic or expected. As described in the revised mine plan, Phase I (segment 1) of the pit is mined first and once completed, Phase I pit will be a 6 acre, 30-foot- deep sediment/groundwater recharge facility. Mining in Phase II, segments 2 – 4, will route the mine water into the Phase I sediment/recharge basin. This will provide groundwater recharge in the south and southeast directions toward the Lewis Ocean Bay Preserve thus lessening the drawdown effects and distance. See the *Edge Road Mine Estimated Groundwater Drawdown* map attached with this submission.

There will be no adverse impacts to Carolina Bays inside the LOB. As demonstrated, the maximum extent of groundwater drawdown is estimated to be no more than 2,500 feet from the center of the mine. The closest Bay in LOB to the mine is approximately 1,700 feet southwest of the mine. The groundwater drawdown will only extend to the northeast edge of this closest bay. Other bays south of the mine are approximately 2,700 feet and 4,000 feet from the mine site and are beyond the maximum drawdown.

Carolina Bays typically have isolated groundwater hydrology from the surficial groundwater system due to accumulation of lower permeability sediments (organics and clastics) at their base. The primary source of water within bays is precipitation. There can be a connection between the groundwater within the bay and the surficial groundwater system but the rate of groundwater flow between the bay and surficial groundwater system is retarded due to the lower permeability sediments. Additional, but infrequent, subsurface interactions can occur via the sand rim, but only when Carolina Bays experience extreme inundation from heavy rainfall. Therefore, the connection is weak.

The closest Carolina Bays within the LOB is located at the outer fringe of the maximum estimated groundwater drawdown distance. With the Bay's generally isolated but weak hydrologic connection to the surficial groundwater system, little if any groundwater drawdown will occur within the Carolina Bays from the mine dewatering at the Edge Road Mine. Overall,

considering the maximum estimated potential groundwater drawdown distance from the mine (2,500 ft) and not considering any positive effects from recharge, approximately 220 acres of the LOB property will experience minor groundwater drawdowns. This represents only 2% of the reported 10,000 acres in the LOB Preserve.

In summation, little or no effects to the LOB groundwater system is anticipated based on the science used to compute worst case scenario drawdown distance.

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EXHIBIT III

CALCULATION METHODS FOR RADIUS OF INFLUENCE AND DEWATERING FLOW RATE FROM AQUIFER TEST DATA

Radius of Influence

The most accurate method of estimating Radius of Influence (R_o) is to perform an aquifer test at the same flow rate at which dewatering will occur; however, an aquifer test conducted at such a high flow rate may itself cause a contaminant plume to migrate. Therefore, the dewatering flow rate required to achieve the necessary drawdown and the associated value of R_o must be estimated from an empirical relationship developed by Sichardt (Powers, 1992). Using values of hydraulic conductivity calculated directly from a site-specific aquifer test or from the EAR aquifer test database (see SOP Section II.C.1.), the R_o for an unconfined aquifer can be readily calculated using the following equation:

$$R_o = 3000(H - h)\sqrt{K}$$

where R_o and (H - h) are in meters and K is in meters per second (m/s). Note that in calculating hydraulic conductivity (K) from aquifer test data, the Division utilizes the base of the Biscayne Aquifer as depicted in Figure A-11 of SFWMD's *A Three Dimensional Finite Difference Groundwater Flow Model of the Surficial Aquifer System, Broward County, Florida* (1992), as the saturated thickness (H). When R_o from Sichardt's equation is added to the effective radius of the wellpoint configuration, and if the resulting value is less than the distance of the dewatering perimeter to the edge of the nearest contaminant plume, then it is reasonable to assume that the proposed dewatering will not cause the contaminant plume to migrate. If the resulting value is greater than the distance to the nearest contaminant plume, then further information is required for approval. The Dewatering Plan may be modified to include further hydraulic control, and analysis may be performed using a three-dimensional computer model.

Dewatering Flow Rate

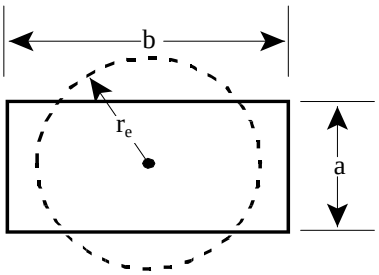
A direct calculation of flow rate may be derived from the following equation:

$$H^2 - h^2 = \frac{n \cdot q}{\pi \cdot k}(\ln R_o - \ln r_e)$$

where n = the number of wellpoints,
q = flow rate per wellpoint in m^3/sec,
r_e = effective radius of dewatering in m,
H = the total head of the water table aquifer in m,
h = the total head of the dewatered aquifer in m,
R_o = radius of influence in m, calculated via Sichardt's equation, and
k = hydraulic conductivity, in m/s

This equation is particularly useful to determine not only the total flow rate from all points (the value nq) but also the flow rate from each point (q). To correctly calculate R_o, equations generally assume that water is withdrawn from a circular area. Most dewatering activities, however, are from rectangular areas. Therefore, an equivalent radius of influence (r_e) must be calculated to make rectangular projects applicable:

$$r_e = \sqrt{\frac{ab}{\pi}}$$



Example:

Dewatering is required at a site in Broward County where Figure A-11 of SFWMD's report indicates a total saturated aquifer thickness of 150ft (45.7m). The closest contaminant plume is identified at 1000ft (304.8m) away. It is proposed to depress the water table 15ft (4.6m) to excavate an area 100 feet (30.5m) long by 50 feet (15.2m) wide. The groundwater table is to be lowered to the base of the excavation using a pattern of wells along the rectangular perimeter. A total of 26 wells, each connected to the pumping system, are to be used. The hydraulic conductivity of the aquifer is 100ft/day (3.528×10^{-4}m/s).

From Sichardt's equation, the resulting radius of influence would be:

h = 45.7m – 4.6m = $41.1m$

$$R = 3000(45.7m - 41.1m)\sqrt{3.528x10^{-4}\,m/s}$$

$$R_o = 259m = 850\,ft$$

To calculate the effective radius of the dewatering wellpoint configuration:

$$r_e = \sqrt{\frac{(30.5m)(15.2m)}{\pi}}$$

$r_e = 12.1m = 40\,ft$. When added to R_o, the total radius of influence is 890ft from the center of the dewatered area. Because the radius of influence is less than 1000ft (the distance to the nearest contaminant plume), the dewatering plan may be submitted to the Division for approval. And using

$$H^2 - h^2 = \frac{nq}{\pi k}\left(\ln R_o - \ln r_e\right),$$

$$(45.7m)^2 - (41.1m)^2 = \frac{nq}{\pi(3.528x10^{-4}\,m/s)}\left(\left(\ln(259m) - \ln(12.1m)\right)\right)$$

$$nq = 0.144\frac{m^3}{s} = 439{,}313\frac{ft^3}{d} = 2{,}282\frac{gal}{\min}$$

For n = 26 (i.e., 26 wells), the pump rate per well must be:

$$q = \frac{439{,}313\frac{ft^3}{d}}{26} = 16{,}397\frac{ft^3}{d} = 87.8\frac{gal}{\min}$$

	HydraulicConductivity			
	K (Ft/Sec)	**K (Ft/Sec)**	**(M/S)**	**(M/S)**
Description	**Min**	**Max**	**Min**	**Max**
Fine Sand	6.56E-07	6.56E-04	2.00E-07	2.00E-04
Medium Sand	2.95E-06	1.64E-03	9.00E-07	5.00E-04
Corse Sand	2.95E-06	1.97E-02	9.00E-07	6.00E-03
Sand; Clean; Good Aquifer	3.28E-05	3.28E-02	1.00E-05	1.00E-02
Sand/Gravelly Sand; Poorly Graded; Little to No Fines	8.37E-05	1.76E-03	2.55E-05	5.35E-04
Sand/Gravelly Sand; Well Graded; Little to No Fines	3.28E-08	3.28E-06	1.00E-08	1.00E-06
Inorganic Silty Fine Sand/Clayey Fine Sand; Slight Plasticity	1.64E-08	3.28E-06	5.00E-09	1.00E-06
Silty Sand	3.28E-08	1.64E-05	1.00E-08	5.00E-06
Clayey Sand	1.80E-08	1.80E-05	5.50E-09	5.50E-06
Alluvial Gravel/Sand	1.31E-03	1.31E-02	4.00E-04	4.00E-03
Sand/Gravel; Uniform	1.31E-02	1.31E+00	4.00E-03	4.00E-01
Sand/Gravel; Well Graded; No fines	1.31E-04	1.31E-02	4.00E-05	4.00E-03
Gravel	9.84E-04	9.84E-02	3.00E-04	3.00E-02
Gravel/Sandy Gravel; Well Graded; Little to No Fines	1.64E-03	1.64E-01	5.00E-04	5.00E-02
Gravel/Sandy Gravel; Poorly Graded; Little to No Fines	1.64E-03	1.64E-01	5.00E-04	5.00E-02
Silty Gravel/Silty Sandy Gravel	1.64E-07	1.64E-05	5.00E-08	5.00E-06
Clayey Gravel/Clayey Sandy Gravel	1.64E-08	1.64E-05	5.00E-09	5.00E-06
Inorganic Silt; High Plasticity	3.00E-10	1.64E-07	1.00E-10	5.00E-08
Silt; Compacted	2.30E-09	2.30E-07	7.00E-10	7.00E-08
Inorganic Clay/Silty Clay/Sandy Clay; Low Plasticity	1.60E-09	1.64E-07	5.00E-10	5.00E-08
Organic Clay/Silty Clay; Low Plasticity	1.64E-08	3.28E-07	5.00E-09	1.00E-07
Marine Clay; Unweathered	2.62E-12	6.56E-09	8.00E-13	2.00E-09
Organic Clay; High Plasticity	1.60E-09	3.28E-07	5.00E-10	1.00E-07
Inorganic Clay; High Plasticity	3.00E-10	3.28E-07	1.00E-10	1.00E-07
Clay	3.28E-11	1.54E-08	1.00E-11	4.70E-09
Clay; Compacted	3.28E-10	3.28E-09	1.00E-10	1.00E-09
Limestone / Dolomite	3.28E-09	1.97E-05	1.00E-09	6.00E-06
Sandstone	9.84E-10	1.97E-05	3.00E-10	6.00E-06
Siltstone	3.28E-11	4.59E-08	1.00E-11	1.40E-08
Anhydrite	1.31E-12	6.56E-08	4.00E-13	2.00E-08
Shale	3.28E-13	6.56E-09	1.00E-13	2.00E-09
Permeable Basalt	1.31E-06	6.56E-02	4.00E-07	2.00E-02
Igneous/Metamorphic Rock; Fractured	2.62E-08	9.84E-04	8.00E-09	3.00E-04
Granite; Weathered	1.08E-05	1.71E-04	3.30E-06	5.20E-05
Gabbro; Weathered	1.80E-06	1.25E-05	5.50E-07	3.80E-06
Basalt	6.56E-11	1.38E-06	2.00E-11	4.20E-07
Igneous/Metamorphic Rock; Unfractured	9.84E-14	6.56E-10	3.00E-14	2.00E-10

https://structx.com/Soil_Properties_007.html

SC Geological Survey Borehole Log

Drill Hole ID: 26-397	Date (mm/dd/yyyy): 03/12/2015	County: Horry	Total Depth: 50 ft.
Field ID: Ha-3	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample #:
Collar Elevation: 12.2 m 40 ft		Drilled by: Joe koch	Photo #:
UTMCoordinates: 699126 E	3745847 N	Helpers: Renaldo Jones, Brian Mixon	
Location Description: south end of Old Reaves Ferry road, 1 mile south of SC Hwy 90 at old SC 90 at gate.			

Notes	Color	Depth	Description
	10YR 6/2	0- 21	light brownish gray, silty, moderately sorted, subrounded, medium to vc quartz sand. gains humate downward.
			below 5 ft grades to a well sorted fine to medium sand with well rounded, vc quartz sand.
	5YR 2.5/2	10	dark reddish brown, humate rich. loses humate downward.
	10YR 5/4		yellowish brown
			15 to 16 ft, well rounded, elliptical, quartz granule zone.
			gains few fine opaques below 16 ft.
	10YR 6/4	20 21-26	light yellowish brown, well sorted, subrounded, fine to medium, quartz sand with few fine opaques.
	5Y 4/2	at 26 ft	olive gray, stiff, clayey silt.
	N6	26-29	Medium gray, silt matrix, poorly sorted, subangular to subrounded, fine to vc quatrz saned with scattered well rounded coarse blue quartz. loses silt downward.
	N5	29- 33	Medium gray, well sorted, subrounded, fine quartz sand with few fine opaques.
	N5	30 33-38	Medium gray, very poorly sorted, sub to well rounded, fine to vc, granular, quartz sand with minor well rounded, coarse, blue quartz.
	N9	38- 42	White, CaCO3 silt, very poorly sorted, very angular to well rounded, fine to vc, granular, quartz, shell fragment, sand with minor vf glauconite sand. by 39 feet it loses the CaCO3 silt matrix and much of the shell, predominately medium quartz sand, but still fine to vc. by 40 feet gains CaCO3 silt matrix support, and is a sandy shell hash
Lag	N5/N9	40	
	N4	42-	medium gray, stiff, dense, clayey silt; silty clay with 20 % microfossils, forams.
			46-47 feet, light gray (N8), dry, dense, CaCO3 silt with vc quartz silt.
boh		50	
		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 03/12/2015	County: Horry	Total Depth: 60 ft
Field ID: Ha 4	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample #:
Collar Elevation: 10 m 33 ft		Drilled by: Joe Koch	Photo #:
UTMCoordinates: 700979 E	3746099 N	Helpers: Renaldo Jones, Brian Mixon	
Location Description: Edge Road, east side, 1/2 miles south of Old Hwy 90 road.			

Notes	Color	Depth	Description
estuarine	5YR 5/8	0-36	yellowish red, stiff, well sorted, subrounded, medium to coarse quartz sandy, clayey silt.
			streaks of red (7.5R 4/8) at 3 feet.
	N7		light gray.
			loses most of the clay by 6 feet. Wet silty matrix supported sand downward.
		10	
	N6		medium gray, fine downward slightly to a fine to coarse sub to well rounded sand by 12 feet.
	10YR 8/6		pale yellowish orange, no silt matrix from 13-14 ft.
			few fine opaques.
	N6		light gray.
	10YR 8/6	20	pale yellowish orange, clean, no silt.
	N9		white, gains moderately sorted, fine to medium garnet sand, fine to medium opauqes, scattered vc quartz sand downward.
		30	
poor recovery 30 to 36 ft	N5		medium gray, poorly sorted, fine to vc quartz sand. few to no opaques.
	N5	36-42	Medium gray, silty, poorly sorted, very angular to subrounded, fine to vc quartz sand with minor f-medium opaques and shell fragments, few phosphates, trace vf pyrite grains.
		40	
crunch at 42 ft clasts similar to borrow pit limestone off SC31	N7.5	42- 50	clasts of silica-cements, very well sorted, vf foram, quartz sand from 41 to 42 ft. light gray, CaCO3 silt matrix, moderately sorted, subangular to subrounded, fine to medium, with some coarse, phosphate, quartz, CaCO3 sand/shell fragments, broken echinod spines, with clasts of medium gray (N5), silica cemented, well sorted, fine CaCO3, quartz sand with minor phosphate sand (<4 cm).
pee Dee?	5GY 9/1	50 50-54.5	Greenish white, CaCO3 matrix supported, well sorted, fine CaCO3, quartz sand with minor fine phosphate sand, scattered echinoid spines, no clasts.
	10Y 7/2	54.5-60	pale olive, silt matrix supported, well sortedm subangular to subrounded, fine phosphate, CaCO3, quartz sand.
boh		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 03/10/2015	County: Horry	Total Depth: 60 ft
Field ID: Ha 6	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 14.2 m 47 ft		Drilled by: Joe Koch	Photo#:
UTMCoordinates: 703776 E	3746023 N	Helpers: Renaldo Jones, Brian Mixon	
Location Description: Monaca Road, south end at cul-du-sac. 2 miles south of SC Hwy 90.			

Notes	Color	Depth	Description
	7.SYR 5/6	0-21	strong brown, silt matrix, moderately sorted, sub to well rounded, medium to vc quartz sand. Becomes poorly sorted, vf to coarse sand by 5 ft.
	7.SYR 6/2		pinkish gray
	7.SYR 3/2		dark< brown humate rich
		10	rounding varies between subangular and well rounded throughout. sorting varies from moderate to poor throughout. only the c-vc sands stay well rounded.
			quartz granules al 12 f t
	7.5YR 3/2	20 21-	Dark brown, clean, well sorted, well rounded, fine to medium quartz sand with scattered c-vc quartz sand
	10YR 5/4		moderate yellowish brown, less humate. grades down to a medium to coarse sand by 30 ft.
		30	
			gains fine to coarse phosphate sand, vc rose quartz, rutile.
			grades down down to a fine to medium sand by 39 ft.
	SY 8/2		light yellowish gray
		40	
			grades downward to a well sorted fine to medium sand by 40 ft. varies from very angular to well rounded. no phosphate below 40 ft.
	5G 7/1		light greenish gray gains vf opaques, olivine.
		50	
			phosphate granule at 54 ft.
	N4	56-57	medium gray, stiff, silt matrix supported, well sorted, subrounded, fine quartz sand with scattered coarse qtz sand
Pee Dee Fm	N4	57-60	medium gray, dense, stiff, clayey silt with fossiliferous vf sand, forams.
bah		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 0311112015	County: Horry	Total Depth: 80ft
Field ID: Ha 14	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 16.5 m 54 ft		Drilled by: Joe koch	Photo#:
UTMCoordinates: 703417 E	3742724 N	Helpers: Renaldo Jones, Brian Mixon	

Location Description: On dirt road, 600 ft due west of Water Tower Road,1/2 mile north of SC 31 Bays Parkway.

Notes	Color	Depth	Description
fill	2.5YR 25/1	0-1.5 1.5-35	reddish black, moderately sorted, subrounded, fine to medium quartz sand with humate. gains more humate downward
TMH? Ladson?	N1		humate rich Black. humate matrix support.
		10	
	2.5Y 4/6		loses much of the humate by 12 ft. grades downward to a med-coarse quartz sand by 13 fl. olive brown
			gains well rounded vc quartz sand by 18 fl.
		20	
	2.5Y 5/4		light olive brown. Gain fine phosphate sand, vf opaques and garnet, and well rounded, c-vc blue quartz below 25 ft.
		30	
			vf-fine sand 33-34 fl.
	N6	35-47.5	medium gray, clean, poorly sorted, subangular fine to medium, sub to well rounded, c-vc quartz sand with c-vc blue quartz, fine garnet, epidote, opaques, phosphate, coarse iron-stained quartz, amethyst. grades down to a well sorted, fine to medium sand by 37 ft.
		40	
			grades downward to a medium to coarse quartz quartz sand with minor f-medium phosphate, shell fragments
Lag	N6	47.5-49.5	Medium gray, poorly sorted, sub to well rounded, fine to vc, shelly, quartz sand with minor f to coarse phosphate, shell fragments up to 2 cm.
shoreface?	N6	50 49.5- 66	medium gray, silty, well sorted, subrounded, fine to medium, quartz sand with scattered shell fragments. Fines downward to a well sorted fine sand by 52 fl.
	5G4/1		medium greenish gray, gains some vf opaques downward
		60	
	5G 4/1	66-80	Medium greenish gray, silt matrix supported, well sorted, subrounded, fine quartz sand with scattered microfossils and minor vi opaques.
		70	

SC Geological Survey Borehole Log			
Drill Hole ID:	Date (mm/dd/yyyy):	County:	Total Depth:
Field ID: Ha 14 cont	Logged by: W.R. Doar, III	Quadrangle:	Sample#:
Collar Elevation:		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: E	N	Helpers: Brian Mixon	
location Description:			

Notes	Color	Depth	Description
Pee Dee Fm			see previous page.
			clast supported from 76 to 80 ft.
boh		80	
		90	
		100	
		40	
		50	
		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 05/05/2015	County: Horry	Total Depth: 100 ft+ 35
Field ID: Ha 24	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 16m 52 ft		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: 699321 E	3743055 N	Helpers: Quell ,Brian Mixon	

Location Description: Lewis Ocean Bay property. Telephone road

Notes	Color	Depth	Description
	5Y 2/1	0- 11.5	Black, humate rich, well sorted, subrounded, medium quartz sand that gains coarse quartz sand by 8 ft.
	10YR 4/4	11.5- 19	Dark yellowish brown, bimodal, subrounded medium quartz sand with minor blue and milky quartz and well rounded vc quartz sand.
	2.5YR 7/6	19-27	Yellow, well sorted, well rounded, fine quartz sand with vc quartz sand and minor vf opaques, epidote, rutile, rose quartz sand.
	SY 5/2	27- 28.5	Light olive gray, stiff, vf quartz sandy, silt.
	N6	28.5- 38	Medium gray, moderately sorted, well rounded, fine to coarse quartz sand.
	N7		gains medium blue quartz by 32 ft. light gray, gains vi opaques by 33 ft.
	N6	38- 52	Medium gray, moderately sorted, well rounded, fine to coarse quartz sand with minor vf opaques, fine rose quartz and epidote.
			trace medium phosphate.
			wet with poor recovery
	N7	52-65	Light gray, very well sorted, well rounded, fine quartz sand with minor vf opaques, rose quartz, epidote.
	NS N7	65-66 66-72	Medium gray, silt matrix supported, well sorted, subangular, fine quartz sand. Light gray, poorly sorted, subangular to well rounded, fine to vc quartz sand with shell fragments, minor fine opaques, phosphate, vc blue quartz, fine rose quartz.

SC Geological Survey Borehole Log			
Drill Hole ID:	Date (mm/dd/yyyy):	County:	Total Depth:
Field ID: Ha 24 cont	Logged by: W.R. Doar, 111	Quadrangle:	Sample#:
Collar Elevation:		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: E	N	Helpers: Brian Mixon	
Location Description:			

Notes	Color	Depth	Desaiption
estuarine	5YR 4/1	72-76	olive gray, stiff to sticky, silty clay.
	19YR 411	76- 80.5	Dark gray, moderately sorted, sunrounded, fine to medium quartz sand with angular fine opaques, garnet, well rounded medium phosphate: grades downward to a fine to vc sand by 78 ft.
	5G 5/1	80.5-86	Medium greenish gray, stiff, subangular, vf quartz sandy silt.
river channel	NS	86-96	white, very poorly sorted, very angular to well rounded, vf to vc, granular quartz sand with scattered quartz pebble (<2.5cm), and fine to coarse red-brown garnet, pale bright purple garnet or tourmaline, rose quartz, phosphate, epidote, iron-stained quartz, and scattered feldspar. ...reminds me of Sawdust Landing Formation on Lake Marion•..
			94 to 96 fine, becomes fine and then vf sand and silt.
	N5	96-97	Medium gray, vf quartz sandy silt with some CaCO3 silt.
Pee Dee fm	5GY 411	97-100	Dark greenish gray, stiff, foraminiferal sandy silt.
boh			

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 05/05/2015	County: Horry	Total Depth: 100 ft
Field ID: Ha 25	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 16 m 52.5 ft		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: 701635 E	3742742 N	Helpers: Quell Roberson, Brian Mixon	
Location Description: Telephone Rd, Lewis Ocean Bay HP			

Notes	Color	Depth	Description
	NS	0-21	Medium gray, humate rich, moderately sorted, very well rounded, fine to inedium quartz sand with minor blue quartz.
dunes	N1		Black
forrest?			wood fibers at 9 feet.
		10	humate matrix support from 8 lo 13 ft.
			subrounded and poorly sorted, fine to vc sand below 12 feet.
	7.5YR 4/6		strong brown
	5Y 4/3	20 21- 36	Olive, well sorted, sub to well rounded, fine quartz sand with minor medium sand. Sparse opaques and blue quartz.
		30	gains vf opaques. rose quartz, garnet below 31 ft.
	5B 6/1	36-36.5	medium bluish gray, vf quartz sandy, silt.
	5B 5/1	36.5-41	medium bluish gray, poorly sorted, sub to well rounded, fine to vc quartz sand with minor fine opaques, and fine to medium blue quartz, garnet, phoshate.
	N7	4o 41-47	Light gray, well sorted, well rounded, fine quartz sand.
	N7	47-50	light gray, poorly sorted. well rounded, fine to coarse quartz sand with shell fragments and vfto fine opaques.
estuarine	58 5/1	50 50-64	Medium bluish gray, soft, sticky, slightly silly clay.
		60	plant fragments as 62 ft.
swamp?	10YR 4/2	64-68	Light brown, wood fragment rich, very well sorted, sub to well rounded, fine quartz sand with vf opauqes.
			66- no wood, very clean.
river oxbow?	NS	68-76	White, soft to sticky, very silly clay.
		70	

SC Geological Survey Borehole Log				
Drill Hole ID:	Date (mm/dd/yyyy):		County:	Total Depth:
Field ID: Ha 25 cont	Logged by: W.R. Doar, III		Quadrangle:	Sample#:
Collar Elevation:			Drilled by: Renaldo Jones	Photo#:
UTMCoordinates:	E	N	Helpers: Brian Mixon	
Location Description:				

Notes	Color	Depth	Description
			scattered wood fragment every foot or so.
	N6	76- 79	Medium gray, silt matrix supported, well sorted, subangular, fine quartz sand with minor vf opaques.
	N7	79-84	Light gray, poorly sorted, subrounded, fine to vc quartz sand with minor vf opaques, and vc blue quartz, garnet sand, and iron-stained quartz.
	N8	84- 92	Light gray, well sorted, subangular to subrounded, medium quartz sand with minor fine opaques, garnet, iron-stained quartz sand. Fines downward to fine sand by 88 ft.
	N6		medium gray
	5Y 4/1	92-100	dusky olive gray, stiff, silly clay with up to 30% visible microfossils
Pee Dee Fm			
boh			

80
90
100
40
50
60
70

Appendix D

Hand Geologic Map – SC Geological Survey

Uploaded into ePermitting as a separate document

REVISIONS		
Description	Date	By

Kennedy Consulting Services, LLC

Craig Kennedy, P.G.

KCS

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Edge Road Mine Estimated Groundwater Drawdown

Prepared for

Soilutions, LLC

Dogwood Neck Township, Horry County, South Carolina

Project No.: KCS 21-147

DATE: 11-4-2022

Approved by: RCK

Drawn by: B.C.

Scale: 1"=600'

Sheet No. 1 of 1

Revised Mine Plan Narrative for Edge Road Mine

Introduction

The Edge Road Mine will be located on three tracts of land totaling 33.0 acres. With the avoidance of wetlands, upland buffers for wetlands and buffers along property lines, the actual acres to be directly impacted by mining will be 22.6 acres. The 22.6 acres includes 21.7 acres for mining and 0.9 acre of haul road to Edge Road. The material to be mined is a sand/clay that will be used for construction project as fill material. Processing the sand/clay by screening and washing is not necessary. The Edge Road Mine will not have a processing plant. Typically, the mined sand/clay is loaded directly into haul trucks for delivery to the construction site.

Mining will be conducted in two phases. Phase I includes segment 1 and Phase II includes segments 2 – 4. Buffers along the property lines (permit boundary) with LOB in segments 2 & 4 are being increased from 50 feet to 100 feet. Mining will continue to observe 50-foot buffers along the property lines (permit boundary) in segment 1 because a portion of this segment was mined up to the 50-foot buffer under the general mine permit. Delineated wetlands will be protected by 50-buffers. Total wetlands delineated by The Brigman Company and verified by the US Army Corps of Engineers through a delineation concurrence letter is 2.26 acres (SAC-2021-00961). In terms of the mine operating permit, wetlands are considered undisturbed buffers and will be avoided. Total acres for buffers as shown by the mine map will be 10.4 acres. Buffers will remain undisturbed during mining except for a rip rap lined channel extending across the wetland buffer to wetland #1. The channel will convey pit water discharges to nearby wetlands that drain to Boggy Swamp.

Mine Plan

The planned maximum depth of mining is 50 feet in Phase II. The mine plan has been revised to limit the depth of mining in Phase I to 30 feet. The reduction in depth for Phase I will enable Soilutions to transition that segment more quickly from active mining to a sediment/recharge basin. Additionally, the depth may be less in some sections of the pit depending on continuity of sand deposit. Typical of most sand deposits, there are clay layers that will be encountered. Thin clay layers can be stripped to uncover sand deposit below and continue mining. However, thick layers of clay could render sand deposit below uneconomic, and mining would not extend any deeper in that section of the mine.

Mining will be conducted on benches that will range from 10 – 20 feet in height. The initial stripping of overburden will be approximately 5 feet to remove stumps, root mat etc. If the working benches average 15 feet in thickness, there will be three benches to mine to the full depth of 50 feet. To manage the groundwater and stormwater within the pit, a “rim ditch” will be excavated around the perimeter of the pit floor with each mine bench. The rim ditch will intercept groundwater and collect stormwater and route to a collection sump where a pump can remove the pit water from the active pit.

Managing the overburden will consist of temporary storage on the surface during the early phase of mining. Once pit development matures, overburden from later segments can be backfilled into the pit.

Mining will be conducted in two phases. The initial phase will mine segment 1 to create a sediment pond and groundwater recharge basin. As previously described, rim ditch will route pit water to a collection sump. The sump will range in area from 0.25 to 0.5 acre in area and 5 – 8 feet in depth below the bench floor to allow adequate volume for water storage and settling time for sediment. A floating intake will be used to decant the clean water from the top of the water column in the sump for discharge. The discharge will be through NPDES outfall 001 and regulated pursuant to *General NPDES permit for Discharges Associated with Nonmetal Mineral Mining Facilities*, general permit SCG731593.

The second phase of mining, segments 2 – 4, will continue to use the rim ditch technique. The collection sumps within the active portions of mining in segments 2 – 4 will pump the pit water to the sediment pond (segment 1) to contain or if necessary, discharge clean pit water through the NPDES Outfall 001. The sediment pond in segment 1 will be approximately 6.7 acres.

Mining along a terminal wall, i.e., where mining will not advance any further in that direction, will be conducted on a 2:1 slope for stability. To construct the sediment pond in segment 1, a berm will be left in-place between segment 1 and segment 2. The berm will isolate the sediment pond from remaining 15.0 acres of mining in segments 2 – 4. Given the locations of wetlands, mining will generally advance from segment 1 through segment 4.

Reclamation

Reclamation of the site will be to create a pond bordered by grassland graded to blend into the natural land contour. The grassland will be established using a "bird friendly" seed mix as recommended by the South Carolina Department of Natural Resources (SCDNR). The pond design includes a series of littoral zones situated along the wetland buffers and in three of corners of the mine property. The littoral zones will range in depth from 5 to 8 feet below water to allow aquatic vegetation to establish and create suitable shallow habitat for fisheries. The total area of the littoral zones are approximately 2.5 acres which would be approximately 10% to 11% of the pond surface area. See Reclamation Map, sheet 3 of 4 and cross sections, sheet 4 of 4, for general locations of planned littoral zones.

At the end of mining a segment, a 3:1 slope will be graded in the upper 10 feet of the pit wall. The 3:1 slope will extend to approximately 5 feet below the anticipated pool level of the pond. The upper 5 feet of the 3:1 slope will have topsoil placed for seed bed preparation to establish vegetation for erosion control.

Mining in segment 1, creating the sediment pond, will be completed first. Reclamation would begin as described to reclaim the banks around segment 1. As mining is completed on other segments or as feasible, banks of the pond would be sloped and revegetated.

Kennedy

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February 22, 2023

Mr. Jeremy Eddy, PG Manager
Mining and Reclamation Section
SC Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

RE: Soilutions, LLC
Edge Road Mine; Application for Mine Permit
Responses to Comments related to Potential for Sinkholes

Dear Mr. Eddy:

On behalf of Soilutions, LLC, please find below a response to comments received by the Department during the public comment period on the above-referenced permit relating to the potential for sinkholes from dewatering the sand deposit at the Edge Road.

Please feel free to contact me if you have any questions.

Respectfully submitted,

Craig Kennedy

Craig Kennedy, PG
Principal

cc Jessica King
Josh Epps

Response to Sinkhole Concerns from the Edge Road Mine

Introduction

Soilutions, LLC ("Soilutions") is aware that the Department received comments during the public notice period for its application for a permit for the Edge Road Mine concerning a potential for sinkholes to result from dewatering operations at the mine. To address this concern, Soilutions requested the undersigned perform certain geologic studies to determine if there is a legitimate basis for this concern. Based on the information received and as described more fully below, there is only a de minimis risk of sinkhole formation.

Limestone Sediments and Potential for Sinkholes

Comments concerning potential sinkholes is raised on virtually every mining project. However, whether there is a risk of sinkholes at a mine site depends first and foremost on the composition of the rocks or sediments involved in the mining operation. Specifically, the risk of sinkholes is greater if the rock underlying the surface in the area where dewatering occurs is a soluble rock such as limestone. A review of six (6) borehole logs provided by the SC Geological Survey for boreholes located in the vicinity of the Edge Road Mine site was performed to determine if there is limestone present in the area of the mine site. The borehole locations range from approximately 5,000 feet to 9,000 feet from the Edge Road mine site. The six borehole locations outline approximately a 5.5 square mile area. The mine site is located at the approximate center of this 5.5 square mile area. See attached section of the SC Geological Survey Hand Geologic Map showing location of boreholes.

The borehole depths range from 50 feet to 100 feet. The surface and bottom elevations of the mine site are 42 feet msl and -8 feet msl respectively. The boreholes' collar elevations range from approximately 33 ft msl to 54 ft msl. Bottom elevations of the boreholes range from approximately -10 ft msl to -48 ft msl. The stratigraphic horizons that will be mined at the Edge Road Mine are generally represented in the strata shown in the boreholes. Borehole logs are attached.

Only two (2) of the six (6) boreholes intercepted calcium carbonate ($CaCO_3$) sediments indicative of limestone. Borehole Ha-4 (collar elevation 33 ft msl) is located approximately 5,000 feet north of the mine site. Drilling intercepted a $CaCO_3$ matrix with shell fragments, quartz sands and other minor minerals that is approximately 12 feet thick at a depth of 42 feet (-9 feet msl). The borehole log stated that while drilling, a "crunch" feel was noted when the drill bit penetrated into the carbonate sediment. This would indicate the carbonate sediments have some hardness. The borehole log did not indicate if any voids were encountered. The Ha-4 log describes the material at 42 – 54 feet as:

> *"Light gray, $CaCO_3$ silt matrix, sorted, subangular to subrounded, fine to medium, with some coarse, phosphate, quartz, $CaCO_3$ sand/shell fragments, broken echinoid spines, with clasts of medium gray (N5), silica cemented, well sorted, fine $CaCO_3$, quartz sand with minor phosphate sand (<4 cm)."*

> The Ha-4 description describes the material at 50 – 54 feet as:
> *"Greenish white, $CaCO_3$ matrix supported, well sorted, fine $CaCO_3$, quartz sand with minor fine phosphate sand, scattered echinoid spines, no clasts."*

Borehole Ha-3 (collar elevation 40 ft msl) is located approximately 9,000 feet northwest of the mine site. Drilling intercepted a $CaCO_3$ matrix with shell fragments, quartz sands and other minor minerals that is approximately 4 feet thick and at a depth of 38 feet (2 feet msl). The Ha-3 log describes the material as:

> *White $CaCO_3$ silt, very poorly sorted, very angular to well rounded, fine to VC, granular, quartz, shell fragments, sand with minor vf glauconite sand, by 39 feet it loses the $CaCO_3$ silt matrix and much of the shell, predominantly medium quartz sand, but still fine to vc; by 40 feet grains $CaCO_3$ silt matrix support, and is a sandy shell hash*

Boreholes Ha-6, Ha-25, Ha-24 & Ha-14 are located east and south of the mine. These 4 boreholes show shell fragments only within sand, but no carbonate matrix as described in Ha-3 and Ha-4. The carbonate sediments appear to be localized in the vicinity of Ha-3 and Ha-4 and reduce in thickness to non-existent toward the south and east of boreholes Ha-4 and Ha-3. Considering the elevations of the carbonate

sediments in Ha-3 & Ha-4 boreholes and correlating between all the boreholes, it is questionable if there are carbonate sediments at the mine site but if there are any, they would be expected to be deep at the mine, approximately 40-50 feet below ground surface.

In my professional opinion, mining at the Edge Road Mine presents no risk for causing sinkholes from potential carbonate sediments for the following reasons.

1) There is no indication that limestone, a soluble rock, is present in the direct vicinity of the mine site and in fact, limestone is not found in 4 of 6 boreholes surrounding the site. Without soluble rock, there is no risk of sinkholes from dewatering activities.
2) If limestone is in the vicinity of the mine that could be affected by dewatering, it would not likely be the sort that would be reasonably expected to cause a potential for sinkholes. Not all limestone has solution cavities. Not all limestone develops solution cavities to the extent that causes sinkholes. It's questionable that the reported carbonate matrix at the two borehole locations located approximately 5,000 and 9,000 feet from the mine site are part of an extensive limestone bed that extends to the Edge Road Mine site. Furthermore, due to depth, limited thickness and limited areal extent of the carbonate sediments. Without evidence of a limestone bed, there is no technically or reasonably supported concern for sinkholes.
3) Finally, if mining should encounter a significant limestone layer, which is doubtful based on the above factors and the mining plan, mining deeper to extract a limestone product would have to cease because the mine permit requested in the application is for sand only and not limestone. Mining sand could continue, and the depth of mine dewatering would be confined to the sand deposit above any "significant limestone stratum" encountered. If the limestone is not dewatered, there is no chance for sinkhole development. (For this hypothetical limestone layer to generate sinkholes, it would have had to develop solution cavities.)

Comparison with the No. 9 Mine Near Goretown

Comments received by the Department compare the risk of sinkholes at the Edge Road Mine to sinkholes reported in Goretown, South Carolina in the mid-1980s due to the No. 9 Mining Company mine. Comparison of this sand mine with the No. 9 Mine near Goretown is inappropriate for the following reasons.

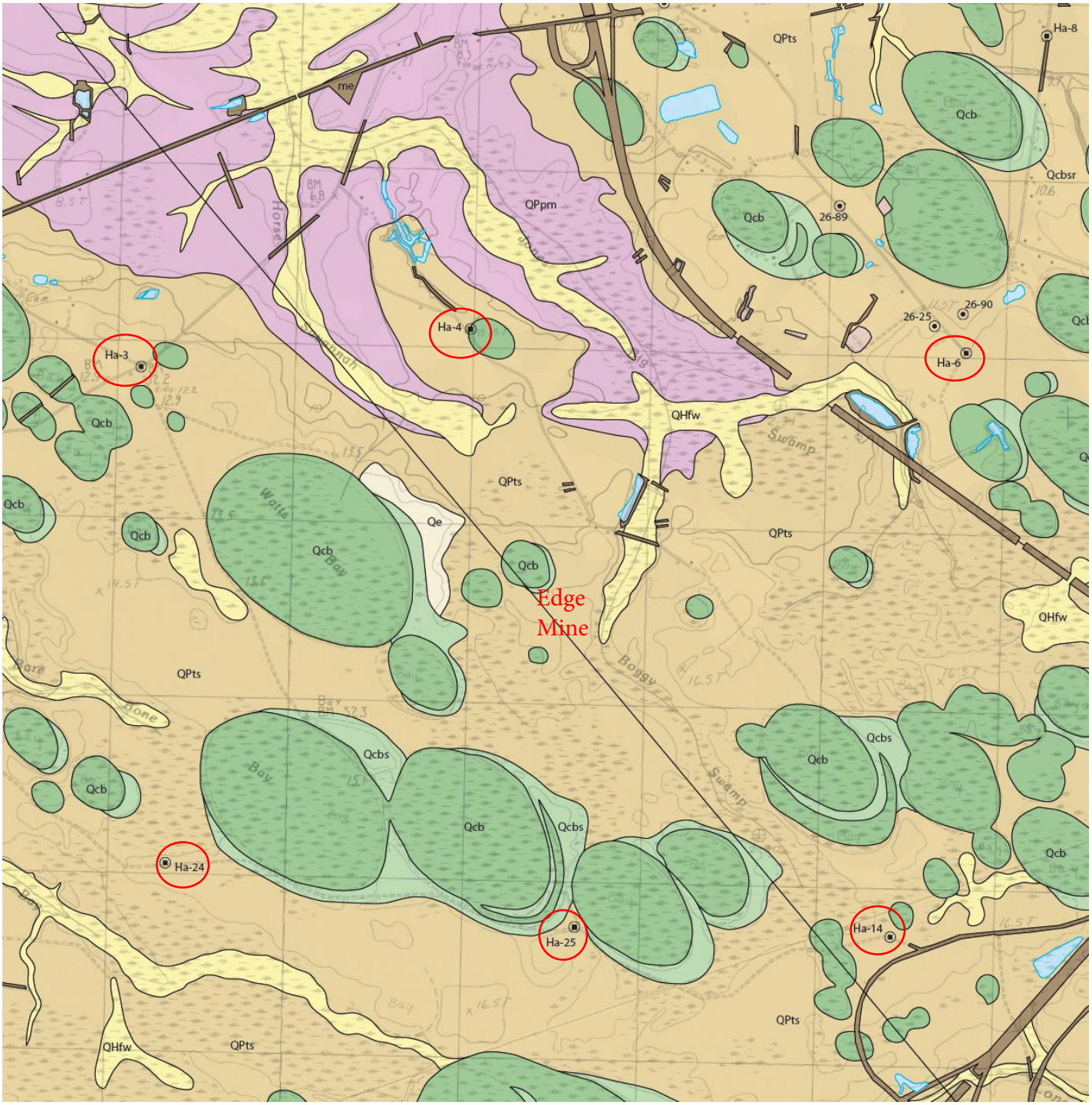
1) The intended purpose of mining at the No. 9 Mine was to dewater and mine limestone as a product. The Edge Road Mine will be mining sand. If limestone is encountered, mining into the limestone will stop.
2) The limestone in the Duplin formation where the No. 9 mine was operating was reported to be 20 – 30 feet below ground surface and 10 – 20 feet thick with well-developed solution cavities. There is no evidence limestone similar to what was mined at No. 9 mine exists at or in the near vicinity of the Edge Road Mine. If there is a form of limestone, e.g., carbonate matrix, at the mine site, based on geologic survey's borehole logs it will be deeper, have a limited areal extent and minimal, if any, significant solution cavities similar to those reported at No. 9 Mine.
3) The limestone at the No. 9 Mine was dewatered to facilitate the mining of limestone. Mine dewatering at the Edge Road Mine will be limited to dewatering a sand deposit, not limestone.

Conclusion

For the reasons stated, the proposed sand mining at the Edge Road Mine will not endanger the public by causing sinkholes. Comparison of the Edge Road Mine to other large limestone mines is not technically or reasonably appropriate when discussing the potential for sinkholes. Furthermore, borehole data in the area of the mine show that soluble rock that can form cavities and lead to sinkholes is not expected to be an issue with the Edge Road mine.

Appendices

Appendix A	Section of SC Geological Survey Hand 7.5’ Quadrangle Geologic Map Showing Borehole Locations
Appendix B	SC Geological Survey Drill Logs for Boreholes- Ha-3, Ha-4, Ha-6, Ha-16, Ha-24, Ha-25



SCGS Borehole Locations
Section of SCGS Hand 7.5' Quadrangle Geologic Map
Scale 1" = +/-2,700'

SC Geological Survey Borehole Log

Drill Hole ID: 26-397	Date (mm/dd/yyyy): 03/12/2015	County: Horry	Total Depth: 50 ft.
Field ID: Ha-3	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample #:
Collar Elevation: 12.2 m 40 ft		Drilled by: Joe koch	Photo #:
UTMCoordinates: 699126 E	3745847 N	Helpers: Renaldo Jones, Brian Mixon	

Location Description: south end of Old Reaves Ferry road, 1 mile south of SC Hwy 90 at old SC 90 at gate.

Notes	Color	Depth	Description
	10YR 6/2	0- 21	light brownish gray, silty, moderately sorted, subrounded, medium to vc quartz sand. gains humate downward.
			below 5 ft grades to a well sorted fine to medium sand with well rounded, vc quartz sand.
	5YR 2.5/2	10	dark reddish brown, humate rich. loses humate downward.
	10YR 5/4		yellowish brown
			15 to 16 ft, well rounded, elliptical, quartz granule zone.
			gains few fine opaques below 16 ft.
	10YR 6/4	20 21-26	light yellowish brown, well sorted, subrounded, fine to medium, quartz sand with few fine opaques.
	5Y 4/2	at 26 ft	olive gray, stiff, clayey silt.
	N6	26-29	Medium gray, silt matrix, poorly sorted, subangular to subrounded, fine to vc quatrz saned with scattered well rounded coarse blue quartz. loses silt downward.
	N5	29- 33	Medium gray, well sorted, subrounded, fine quartz sand with few fine opaques.
	N5	30 33-38	Medium gray, very poorly sorted, sub to well rounded, fine to vc, granular, quartz sand with minor well rounded, coarse, blue quartz.
	N9	38- 42	White, CaCO3 silt, very poorly sorted, very angular to well rounded, fine to vc, granular, quartz, shell fragment, sand with minor vf glauconite sand. by 39 feet it loses the CaCO3 silt matrix and much of the shell, predominately medium quartz sand, but still fine to vc. by 40 feet gains CaCO3 silt matrix support, and is a sandy shell hash
Lag	N5/N9	40	
	N4	42-	medium gray, stiff, dense, clayey silt; silty clay with 20 % microfossils, forams.
			46-47 feet, light gray (N8), dry, dense, CaCO3 silt with vc quartz silt.
boh		50	
		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 03/12/2015	County: Horry	Total Depth: 60 ft
Field ID: Ha 4	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample #:
Collar Elevation: 10 m 33 ft		Drilled by: Joe Koch	Photo #:
UTMCoordinates: 700979 E	3746099 N	Helpers: Renaldo Jones, Brian Mixon	
Location Description: Edge Road, east side, 1/2 miles south of Old Hwy 90 road.			

Notes	Color	Depth	Description
estuarine	5YR 5/8	0-36	yellowish red, stiff, well sorted, subrounded, medium to coarse quartz sandy, clayey silt.
			streaks of red (7.5R 4/8) at 3 feet.
	N7		light gray.
			loses most of the clay by 6 feet. Wet silty matrix supported sand downward.
		10	
	N6		medium gray, fine downward slightly to a fine to coarse sub to well rounded sand by 12 feet.
	10YR 8/6		pale yellowish orange, no silt matrix from 13-14 ft.
			few fine opaques.
	N6		light gray.
	10YR 8/6	20	pale yellowish orange, clean, no silt.
	N9		white, gains moderately sorted, fine to medium garnet sand, fine to medium opauqes, scattered vc quartz sand downward.
		30	
poor recovery 30 to 36 ft	N5		medium gray, poorly sorted, fine to vc quartz sand. few to no opaques.
	N5	36-42	Medium gray, silty, poorly sorted, very angular to subrounded, fine to vc quartz sand with minor f-medium opaques and shell fragments, few phosphates, trace vf pyrite grains.
		40	
crunch at 42 ft clasts similar to borrow pit limestone off SC31	N7.5	42- 50	clasts of silica-cements, very well sorted, vf foram, quartz sand from 41 to 42 ft. light gray, CaCO3 silt matrix, moderately sorted, subangular to subrounded, fine to medium, with some coarse, phosphate, quartz, CaCO3 sand/shell fragments, broken echinod spines, with clasts of medium gray (N5), silica cemented, well sorted, fine CaCO3, quartz sand with minor phosphate sand (<4 cm).
pee Dee?	5GY 9/1	50 50-54.5	Greenish white, CaCO3 matrix supported, well sorted, fine CaCO3, quartz sand with minor fine phosphate sand, scattered echinoid spines, no clasts.
	10Y 7/2	54.5-60	pale olive, silt matrix supported, well sortedm subangular to subrounded, fine phosphate, CaCO3, quartz sand.
boh		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 03/10/2015	County: Horry	Total Depth: 60 ft
Field ID: Ha 6	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 14.2 m 47 ft		Drilled by: Joe Koch	Photo#:
UTMCoordinates: 703776 E	3746023 N	Helpers: Renaldo Jones, Brian Mixon	
Location Description: Monaca Road, south end at cul-du-sac. 2 miles south of SC Hwy 90.			

Notes	Color	Depth	Description
	7.SYR 5/6	0-21	strong brown, silt matrix, moderately sorted, sub to well rounded, medium to vc quartz sand. Becomes poorly sorted, vf to coarse sand by 5 ft.
	7.SYR 6/2		pinkish gray
	7.SYR 3/2		dark< brown humate rich
		10	rounding varies between subangular and well rounded throughout. sorting varies from moderate to poor throughout. only the c-vc sands stay well rounded.
			quartz granules al 12 f t
	7.5YR 3/2	20 21-	Dark brown, clean, well sorted, well rounded, fine to medium quartz sand with scattered c-vc quartz sand
	10YR 5/4		moderate yellowish brown, less humate. grades down to a medium to coarse sand by 30 ft.
		30	gains fine to coarse phosphate sand, vc rose quartz, rutile.
			grades down down to a fine to medium sand by 39 ft.
	SY 8/2		light yellowish gray
		40	grades downward to a well sorted fine to medium sand by 40 ft. varies from very angular to well rounded. no phosphate below 40 ft.
	5G 7/1		light greenish gray gains vf opaques, olivine.
		50	
			phosphate granule at 54 ft.
	N4	56-57	medium gray, stiff, silt matrix supported, well sorted, subrounded, fine quartz sand with scattered coarse qtz sand
Pee Dee Fm	N4	57-60	medium gray, dense, stiff, clayey silt with fossiliferous vf sand, forams.
bah		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 0311112015	County: Horry	Total Depth: 80ft
Field ID: Ha 14	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 16.5 m 54 ft		Drilled by: Joe koch	Photo#:
UTMCoordinates: 703417 E	3742724 N	Helpers: Renaldo Jones, Brian Mixon	

Location Description: On dirt road, 600 ft due west of Water Tower Road,1/2 mile north of SC 31 Bays Parkway.

Notes	Color	Depth	Description
fill		0-1.5	
	2.5YR 25/1	1.5-35	reddish black, moderately sorted, subrounded, fine to medium quartz sand with humate. gains more humate downward
TMH? Ladson?			humate rich
	N1		Black. humate matrix support.
		10	
			loses much of the humate by 12 ft. grades downward to a med-coarse quartz sand by 13 fl.
	2.5Y 4/6		olive brown
			gains well rounded vc quartz sand by 18 fl.
		20	
	2.5Y 5/4		light olive brown. Gain fine phosphate sand, vf opaques and garnet, and well rounded, c-vc blue quartz below 25 ft.
		30	
			vf-fine sand 33-34 fl.
	N6	35-47.5	medium gray, clean, poorly sorted, subangular fine to medium, sub to well rounded, c-vc quartz sand with c-vc blue quartz, fine garnet, epidote, opaques, phosphate, coarse iron-stained quartz, amethyst. grades down to a well sorted, fine to medium sand by 37 ft.
		40	
			grades downward to a medium to coarse quartz quartz sand with minor f-medium phosphate, shell fragments
	N6	47.5-49.5	Medium gray, poorly sorted, sub to well rounded, fine to vc, shelly, quartz sand with minor f to coarse phosphate, shell fragments up to 2 cm.
Lag			
	N6	50 49.5- 66	medium gray, silty, well sorted, subrounded, fine to medium, quartz sand with scattered shell fragments. Fines downward to a well sorted fine sand by 52 fl.
shoreface?			
	5G4/1		medium greenish gray, gains some vf opaques downward
		60	
	5G 4/1	66-80	Medium greenish gray, silt matrix supported, well sorted, subrounded, fine quartz sand with scattered microfossils and minor vi opaques.
		70	

SC Geological Survey Borehole Log			
Drill Hole ID:	Date (mm/dd/yyyy):	County:	Total Depth:
Field ID: Ha 14 cont	Logged by: W.R. Doar, III	Quadrangle:	Sample#:
Collar Elevation:		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: E	N	Helpers: Brian Mixon	
location Description:			

Notes	Color	Depth	Description
Pee Dee Fm			see previous page.
			clast supported from 76 to 80 ft.
boh		80	
		90	
		100	
		40	
		50	
		60	
		70	

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 05/05/2015	County: Horry	Total Depth: 100 ft+ 35
Field ID: Ha 24	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 16m 52 ft		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: 699321 E	3743055 N	Helpers: Quell ,Brian Mixon	

Location Description: Lewis Ocean Bay property. Telephone road

Notes	Color	Depth	Description
	5Y 2/1	0- 11.5	Black, humate rich, well sorted, subrounded, medium quartz sand that gains coarse quartz sand by 8 ft.
	10YR 4/4	11.5- 19	Dark yellowish brown, bimodal, subrounded medium quartz sand with minor blue and milky quartz and well rounded vc quartz sand.
	2.5YR 7/6	19-27	Yellow, well sorted, well rounded, fine quartz sand with vc quartz sand and minor vf opaques, epidote, rutile, rose quartz sand.
	SY 5/2	27- 28.5	Light olive gray, stiff, vf quartz sandy, silt.
	N6	28.5- 38	Medium gray, moderately sorted, well rounded, fine to coarse quartz sand.
	N7		gains medium blue quartz by 32 ft. light gray, gains vi opaques by 33 ft.
	N6	38- 52	Medium gray, moderately sorted, well rounded, fine to coarse quartz sand with minor vf opaques, fine rose quartz and epidote.
			trace medium phosphate.
			wet with poor recovery
	N7	52-65	Light gray, very well sorted, well rounded, fine quartz sand with minor vf opaques, rose quartz, epidote.
	NS N7	65-66 66-72	Medium gray, silt matrix supported, well sorted, subangular, fine quartz sand. Light gray, poorly sorted, subangular to well rounded, fine to vc quartz sand with shell fragments, minor fine opaques, phosphate, vc blue quartz, fine rose quartz.

SC Geological Survey Borehole Log			
Drill Hole ID:	Date (mm/dd/yyyy):	County:	Total Depth:
Field ID: Ha 24 cont	Logged by: W.R. Doar, 111	Quadrangle:	Sample#:
Collar Elevation:		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: E	N	Helpers: Brian Mixon	
Location Description:			

Notes	Color	Depth	Desaiption
estuarine	5YR 4/1	72-76	olive gray, stiff to sticky, silty clay.
	19YR 411	76- 80.5	Dark gray, moderately sorted, sunrounded, fine to medium quartz sand with angular fine opaques, garnet, well rounded medium phosphate: grades downward to a fine to vc sand by 78 ft.
	5G 5/1	80.5-86	Medium greenish gray, stiff, subangular, vf quartz sandy silt.
river channel	NS	86-96	white, very poorly sorted, very angular to well rounded, vf to vc, granular quartz sand with scattered quartz pebble (<2.5cm), and fine to coarse red-brown garnet, pale bright purple garnet or tourmaline, rose quartz, phosphate, epidote, iron-stained quartz, and scattered feldspar. ...reminds me of Sawdust Landing Formation on Lake Marion•..
			94 to 96 fine, becomes fine and then vf sand and silt.
	N5	96-97	Medium gray, vf quartz sandy silt with some CaCO3 silt.
Pee Dee fm	5GY 411	97-100	Dark greenish gray, stiff, foraminiferal sandy silt.
boh			

SC Geological Survey Borehole Log

Drill Hole ID:	Date (mm/dd/yyyy): 05/05/2015	County: Horry	Total Depth: 100 ft
Field ID: Ha 25	Logged by: W.R. Doar, III	Quadrangle: Hand	Sample#:
Collar Elevation: 16 m 52.5 ft		Drilled by: Renaldo Jones	Photo#:
UTMCoordinates: 701635 E	3742742 N	Helpers: Quell Roberson, Brian Mixon	
Location Description: Telephone Rd, Lewis Ocean Bay HP			

Notes	Color	Depth	Description
	NS	0-21	Medium gray, humate rich, moderately sorted, very well rounded, fine to inedium quartz sand with minor blue quartz.
dunes	N1		Black
forrest?			wood fibers at 9 feet.
		10	humate matrix support from 8 lo 13 ft.
			subrounded and poorly sorted, fine to vc sand below 12 feet.
	7.5YR 4/6		strong brown
	5Y 4/3	20 21- 36	Olive, well sorted, sub to well rounded, fine quartz sand with minor medium sand. Sparse opaques and blue quartz.
		30	gains vf opaques. rose quartz, garnet below 31 ft.
	5B 6/1	36-36.5	medium bluish gray, vf quartz sandy, silt.
	5B 5/1	36.5-41	medium bluish gray, poorly sorted, sub to well rounded, fine to vc quartz sand with minor fine opaques, and fine to medium blue quartz, garnet, phoshate.
	N7	4o 41-47	Light gray, well sorted, well rounded, fine quartz sand.
	N7	47-50	light gray, poorly sorted. well rounded, fine to coarse quartz sand with shell fragments and vfto fine opaques.
estuarine	58 5/1	50 50-64	Medium bluish gray, soft, sticky, slightly silly clay.
		60	plant fragments as 62 ft.
swamp?	10YR 4/2	64-68	Light brown, wood fragment rich, very well sorted, sub to well rounded, fine quartz sand with vf opauqes.
			66- no wood, very clean.
river oxbow?	NS	68-76	White, soft to sticky, very silly clay.
		70	

SC Geological Survey Borehole Log				
Drill Hole ID:	Date (mm/dd/yyyy):		County:	Total Depth:
Field ID: Ha 25 cont	Logged by: W.R. Doar, III		Quadrangle:	Sample#:
Collar Elevation:			Drilled by: Renaldo Jones	Photo#:
UTMCoordinates:	E	N	Helpers: Brian Mixon	
Location Description:				

Notes	Color	Depth	Description
			scattered wood fragment every foot or so.
	N6	76- 79	Medium gray, silt matrix supported, well sorted, subangular, fine quartz sand with minor vf opaques.
	N7	79-84	Light gray, poorly sorted, subrounded, fine to vc quartz sand with minor vf opaques, and vc blue quartz, garnet sand, and iron-stained quartz.
	N8	84- 92	Light gray, well sorted, subangular to subrounded, medium quartz sand with minor fine opaques, garnet, iron-stained quartz sand. Fines downward to fine sand by 88 ft.
	N6		medium gray
	5Y 4/1	92-100	dusky olive gray, stiff, silly clay with up to 30% visible microfossils
Pee Dee Fm			
boh			

80
90
100
40
50
60
70

State Protected Species Comment Response prepared by Environs, LLC

Regarding State Protected Species comments from the South Carolina Department of Natural Resources (SCDNR), dated March 30, 2023 and pertaining to Mining Application #I-002375, Soilutions, LLC offers the following response:

Although there are no records of threatened, endangered, or managed species directly on the project site, the spotted turtle (*Clemmys guttata*) and the Southern hognose snake (*Heterodon simus*) are known to occur nearby within the adjacent Lewis Ocean Bay Heritage Preserve (LOBHP).

The spotted turtle is state listed as a threatened species in South Carolina. It is a semi-aquatic turtle and is most active during the spring. Its activity is limited during cold winter days and warm summers months and may aestivate during extended warm periods. This turtle is known to occupy small ponds, small streams, swamps, flooded forests and other shallow bodies of water in the coastal plain region of the state.[i] During aestivation, the spotted turtle may be found in mesic type habitats adjacent to wetlands. Males may be found in various habitats as they tend to move between habitats mainly during their breeding season. The spotted turtle is dormant much of the year during the coolest (winter) and warmest (summer) periods. This species is most active during breeding season. Depending on temperature, spotted turtles in South Carolina usually emerge from hibernation in late February and begin congregating for breeding, which continues through late April.

Spotted turtles often nest in open, mesic habitats within the margins of wetlands and in direct sunlight. The Spotted Turtle lays several clutches of eggs each season, and each clutch usually contains 2 to 6 eggs. Females typically dig shallow nests, but they will also lay eggs onto sedge tussocks, sphagnum hummocks and moss-covered logs.[ii] The Spotted Turtle is primarily carnivorous, feeding on tadpoles, as well as aquatic and terrestrial snails, insects, and crustaceans. It occasionally ingests aquatic vegetation and may feed on carrion.[iii]

The Southern hognose snake is state listed as threatened in South Carolina. It is the smallest of the hognose snakes, a group of snakes that possess a sharply upturned snout, believed to be an adaptation for burrowing. As a member of the Longleaf Pine Reptile guild, this snake is closely associated with, but not necessarily endemic to, natural communities that are part of the Longleaf Pine Ecosystem. The pine snake, Southern hognose snake and coral snake are typically associated with the more xeric longleaf communities and can be found in the same habitat types that support gopher tortoise populations.[iv]

Data from wild caught female Southern hognose snakes suggests that eggs are laid in late spring or early summer. Hatchlings emerge between mid-September to mid-October. The snake is extremely fossorial spending much of its time in underground burrows and in stumps of rotting pines. The Southern hognose snake is strictly diurnal in its aboveground activity, and most observations occur from May to June and from September to October.[v] They prefer to feed on toads (*Bufo* and *Scaphiopus spp.*) but are known to also prey on lizards, frogs and small mammals.[vi]

Environs was engaged by Soilutions to install wetland hydrology monitoring wells, to collect baseline wetland plant data and to conduct visual observations for the spotted turtle and the Southern hognose snake within the proposed mining area. Most of this work took place February 7-8, 2023, and March 14-15, 2023, where Environs staff conducted on-foot surveys of the entire mine property. Weather conditions during both events were partly cloudy with cool mornings (<40°F) trending into warm, slightly humid afternoons (>60°F). Environs has also reviewed letters from Dr. J. H. Carter III & Associates, Inc. (JCA) regarding their previous site investigations and observations related to the spotted turtle and southern hognose snake.

During Environs' on-site work, two on-site wetland areas near the active mine area were noted within the Soilutions mine property. Both wetlands appear to have ephemeral surface hydro-regimes and based on the dominant plant species and depth to hydric soil indicators, also appear to be dry during most of a normal precipitation year. No areas of flowing or standing water or evidence of surface water were observed within either wetland. The shrub and herbaceous layers were extremely dense in wetland area 1. Wetland area 2 is less dense, however its margins are very densely vegetated. The remainder of the property was observed to have an open water pit mine, construction staging areas, managed pine timber and several buildings. No suitable habitat typically used and preferred by spotted turtles was observed within the proposed mine area including the open water pit which was recently excavated with vertical banks making it unlikely that spotted turtles are using it as forage or basking habitat. Wetland area 1 and its margin could be used by female turtles for nesting, however, due to the thickness and density of ground vegetation, the likelihood of a gravid female spotted turtle finding a suitable nesting site within this wetland or its edges, and in direct sunlight, is minimal. Wetland area 2 could also be used by the turtles as it does have small openings in its shrub layer suitable for nesting or aestivation, but the margins are densely vegetated with limited direct sunlight so, again, the likelihood of spotted turtle use is minimal.

The proposed mining plan avoids construction within 50 feet of both on-site wetland areas. Therefore, no land disturbance will occur at any time within or adjacent to these wetland habitats. In Environs opinion, based upon on-site investigations, previous consultants' observations (JCA) and historical land disturbance to the mine property, the preferred shallow water habitat of the spotted turtle does not occur on the mine property. Further, by avoiding work in the wetlands and buffers, the minimal chance of aestivating or nesting turtles will not be affected by mining activities.

Neither the southern hognose snake nor its preferred habitat was observed during Environs' on-site evaluation events. The mine property, except for the open pit and the wetlands, is dominated by a relatively flat, dry and sandy landscape that has been historically disturbed and is intensively managed currently. No mature longleaf pine trees, xeric sandy slopes or large dead or dying pine trees were noted on site. Smaller dead pines (snags) were observed scattered throughout the mine property and seven snags were closely inspected. None of those snags had visible signs of ground burrowing animal use. Additionally, no gopher tortoise burrows were observed on the property.

The preferred habitat of the Southern hognose snake (xeric sandhills dominated by long leaf pine and hammocks dominated by oak) may have historically occurred on the mine property, although previous land disturbance and intensive management appears to have eliminated those habitats on

the mine property. However, transient use of the mine property by this snake could occur during daytime within its more active periods.

Regardless of the lack of suitable habitat for either species within the on-site areas proposed for active mining, Soilutions intends to employ specific practices during the mine's operation period to address SCDNR concerns related to these species. Practices will include the installation and maintenance of silt fencing along the proposed buffers to protect the wetlands and to keep most small animals from entering the site from adjoining properties. Four triangular offsets in the silt fencing will be installed on either side of both wetland areas. The attached mine site plan shows the silt fence offset locations. Soilutions intends to abide by the monitoring of the silt fencing and the offsets as provided in SCDNR's comments. No work or land disturbance will be conducted within the wetland areas or adjacent to them within 50 feet during the operation of the mine.

Furthermore, Soilutions will ensure that in the rare chance a southern hognose snake or spotted turtle makes it onto the property, identification materials such as photographs with species descriptions and dates for their most active periods along with SCDNR phone number will be posted in the on-site office and inside mining equipment so that staff will be able to identify and avoid the species, if encountered.

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[i] State Wildlife Action Plan. Supplemental Volume: Species of Conservation Concern. SC SWAP 2015.
[ii] Jensen, John B., et.al. *Amphibians and Reptiles of Georgia.* 2008. University of Georgia Press. Athens, GA.
[iii] CCR Environmental, Inc. *Protected Species Survey for the Proposed RDA Mine Site. Williamsburg County, SC* November 2018.
[iv] State Wildlife Action Plan. Supplemental Volume: Species of Conservation Concern. SC SWAP 2015.
[v] Jensen, John B., et.al. *Amphibians and Reptiles of Georgia.* 2008. University of Georgia Press. Athens, GA.
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The Southern hognose snake is state listed as threatened in South Carolina. It is the smallest of the hognose snakes, a group of snakes that possess a sharply upturned snout, believed to be an adaptation for burrowing. As a member of the Longleaf Pine Reptile guild, this snake is closely associated with, but not necessarily endemic to, natural communities that are part of the Longleaf Pine Ecosystem. The pine snake, Southern hognose snake and coral snake are typically associated with the more xeric longleaf communities and can be found in the same habitat types that support gopher tortoise populations.[iv]

Data from wild caught female Southern hognose snakes suggests that eggs are laid in late spring or early summer. Hatchlings emerge between mid-September to mid-October. The snake is extremely fossorial spending much of its time in underground burrows and in stumps of rotting pines. The Southern hognose snake is strictly diurnal in its aboveground activity, and most observations occur from May to June and from September to October.[v] They prefer to feed on toads (*Bufo* and *Scaphiopus spp.*) but are known to also prey on lizards, frogs and small mammals.[vi]

Environs was engaged by Soilutions to install wetland hydrology monitoring wells, to collect baseline wetland plant data and to conduct visual observations for the spotted turtle and the Southern hognose snake within the proposed mining area. Most of this work took place February 7-8, 2023, and March 14-15, 2023, where Environs staff conducted on-foot surveys of the entire mine property. Weather conditions during both events were partly cloudy with cool mornings (<40°F) trending into warm, slightly humid afternoons (>60°F). Environs has also reviewed letters from Dr. J. H. Carter III & Associates, Inc. (JCA) regarding their previous site investigations and observations related to the spotted turtle and southern hognose snake.

During Environs' on-site work, two on-site wetland areas near the active mine area were noted within the Soilutions mine property. Both wetlands appear to have ephemeral surface hydro-regimes and based on the dominant plant species and depth to hydric soil indicators, also appear to be dry during most of a normal precipitation year. No areas of flowing or standing water or evidence of surface water were observed within either wetland. The shrub and herbaceous layers were extremely dense in wetland area 1. Wetland area 2 is less dense, however its margins are very densely vegetated. The remainder of the property was observed to have an open water pit mine, construction staging areas, managed pine timber and several buildings. No suitable habitat typically used and preferred by spotted turtles was observed within the proposed mine area including the open water pit which was recently excavated with vertical banks making it unlikely that spotted turtles are using it as forage or basking habitat. Wetland area 1 and its margin could be used by female turtles for nesting, however, due to the thickness and density of ground vegetation, the likelihood of a gravid female spotted turtle finding a suitable nesting site within this wetland or its edges, and in direct sunlight, is minimal. Wetland area 2 could also be used by the turtles as it does have small openings in its shrub layer suitable for nesting or aestivation, but the margins are densely vegetated with limited direct sunlight so, again, the likelihood of spotted turtle use is minimal.

The proposed mining plan avoids construction within 50 feet of both on-site wetland areas. Therefore, no land disturbance will occur at any time within or adjacent to these wetland habitats. In Environs opinion, based upon on-site investigations, previous consultants' observations (JCA) and historical land disturbance to the mine property, the preferred shallow water habitat of the spotted turtle does not occur on the mine property. Further, by avoiding work in the wetlands and buffers, the minimal chance of aestivating or nesting turtles will not be affected by mining activities.

Neither the southern hognose snake nor its preferred habitat was observed during Environs' on-site evaluation events. The mine property, except for the open pit and the wetlands, is dominated by a relatively flat, dry and sandy landscape that has been historically disturbed and is intensively managed currently. No mature longleaf pine trees, xeric sandy slopes or large dead or dying pine trees were noted on site. Smaller dead pines (snags) were observed scattered throughout the mine property and seven snags were closely inspected. None of those snags had visible signs of ground burrowing animal use. Additionally, no gopher tortoise burrows were observed on the property.

The preferred habitat of the Southern hognose snake (xeric sandhills dominated by long leaf pine and hammocks dominated by oak) may have historically occurred on the mine property, although previous land disturbance and intensive management appears to have eliminated those habitats on

the mine property. However, transient use of the mine property by this snake could occur during daytime within its more active periods.

Regardless of the lack of suitable habitat for either species within the on-site areas proposed for active mining, Soilutions intends to employ specific practices during the mine's operation period to address SCDNR concerns related to these species. Practices will include the installation and maintenance of silt fencing along the proposed buffers to protect the wetlands and to keep most small animals from entering the site from adjoining properties. Four triangular offsets in the silt fencing will be installed on either side of both wetland areas. The attached mine site plan shows the silt fence offset locations. Soilutions intends to abide by the monitoring of the silt fencing and the offsets as provided in SCDNR's comments. No work or land disturbance will be conducted within the wetland areas or adjacent to them within 50 feet during the operation of the mine.

Furthermore, Soilutions will ensure that in the rare chance a southern hognose snake or spotted turtle makes it onto the property, identification materials such as photographs with species descriptions and dates for their most active periods along with SCDNR phone number will be posted in the on-site office and inside mining equipment so that staff will be able to identify and avoid the species, if encountered.

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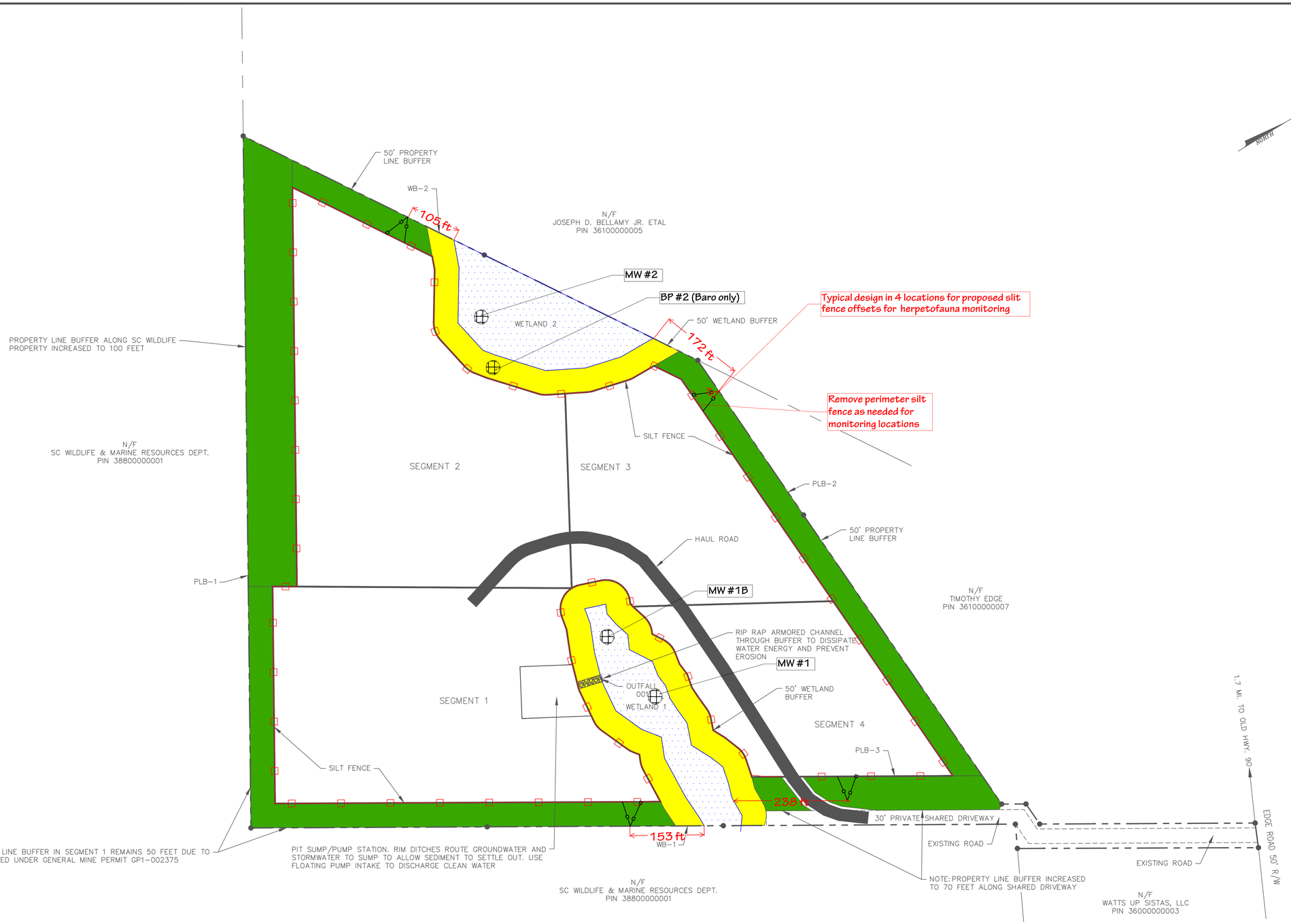
[i] State Wildlife Action Plan. Supplemental Volume: Species of Conservation Concern. SC SWAP 2015.
[ii] Jensen, John B., et.al. *Amphibians and Reptiles of Georgia.* 2008. University of Georgia Press. Athens, GA.
[iii] CCR Environmental, Inc. *Protected Species Survey for the Proposed RDA Mine Site. Williamsburg County, SC* November 2018.
[iv] State Wildlife Action Plan. Supplemental Volume: Species of Conservation Concern. SC SWAP 2015.
[v] Jensen, John B., et.al. *Amphibians and Reptiles of Georgia.* 2008. University of Georgia Press. Athens, GA.
[vi] Jensen, John B., et.al. *Amphibians and Reptiles of Georgia.* 2008. University of Georgia Press. Athens, GA



Note:
Monitoring well locations shown are approximate. Locations and elevations shall be provided upon collection of survey data by total station.

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

REVISIONS

Description	Date	By

Kennedy Consulting Services, LLC
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Edge Road Mine
Prepared for
Soilutions, LLC
Dogwood Neck Township, Horry County, South Carolina

Project No.: KCS 21-147
DATE: 05-25-2022
Approved by: RCK
Drawn by: B.C.
Scale: 1"=100'

Sheet No. 1 of 4