



**INTERIM MEASURE WORK PLAN
IN-SITU GROUNDWATER TREATMENT**

**Former Rod and Wire Mill Area
Tradepoint Atlantic
Sparrows Point, Maryland**

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1.0 INTRODUCTION

Advanced GeoServices Corp. (Advanced GeoServices) has prepared this Interim Measure Work Plan (R&W Mill IM Workplan) to support the approval and implementation of an upgraded interim measure designed to remediate elevated dissolved cadmium and zinc metals within groundwater at the A3 parcel of property owned by Tradepoint Atlantic. Tradepoint Atlantic is currently redeveloping the 3100 acre property at Sparrows Point Maryland formerly occupied by an integrated steel mill complex that was operated chiefly by Bethlehem Steel Corporation since 1916. The A-3 parcel was the site of a rod and wire mill complex located as shown on Figure 1 and is more commonly known as the Rod and Wire Mill Area. Groundwater from a portion of the Rod and Wire Mill Area has been undergoing pump and treat interim measure actions for a significant period of time.

Environmental cleanup and associated interim measures are being conducted at the Tradepoint Atlantic property in compliance with requirements pursuant to the following:

- Administrative Consent Order (ACO) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the Maryland Department of the Environment (effective September 12, 2014); and
- Settlement Agreement and Covenant Not to Sue (SA) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the United States Environmental Protection Agency (effective November 25, 2014).

Parcel A3 is also part of the acreage that remains subject to the requirements of the Multimedia Consent Decree between Bethlehem Steel Corporation, the United States Environmental Protection Agency (EPA), and the Maryland Department of the Environment (MDE) (effective October 8, 1997) as documented in correspondence received from EPA on September 12, 2014.



A development plan for Parcel A-3 is underway that consists of a proposed structure spanning approximately 301,500 SF. The northern limit of the proposed building is proximal to an existing groundwater pumping well. A 5 acre parking area is proposed for the remainder of the parcel to the north of the proposed building. The developer (Tradepoint Atlantic) has expressed a desire to begin site work and grading as soon as possible.

The planned interim measure for the A-3 Parcel will consist of the treatment of groundwater by in-situ neutralization and attenuation of dissolved metals by mineral precipitation. Selection of this remedy was supported by several pre-design investigation programs more fully described in following sections. This document provides background information used to select and design the interim measure including the site description, summary and highlights of recent investigation findings and the conceptual site model, details for the proposed remedial approach and associated implementation and schedule and reporting elements.

1.1 SITE DESCRIPTION

Sparrows Point housed large scale iron and steel production operations from the 1800's until 2012 based on the historical information presented in "Phase II and Pre-Design Investigation Workplan, Parcel A-3, Former Rod and Wire Mill Area" (EAG, Sept 17, 2015). This included raw material handling, coke production, sinter production, iron production, steel production, and semi-finished and finished product separation. In 1970, Sparrows Point was the largest steel facility in the United States. Steelmaking operations at the Facility ceased in fall 2012.

The Rod and Wire Mill Area encompasses about 67 acres on the northwestern portion of the property (Site, see Figure 1). The mills that were formerly located in this area produced rods and wire products from the 1940's into the early 1980's. The area is bounded to the west by Riverside Drive and Bear Creek, to the north by Bethlehem Boulevard and Interstate 695, and to the east by the former Pipe Mill Area. After the operations activities ceased in the early 1980's, the demolition of the remnant structures occurred between 1994 and 2000.



Manufacturing operations at the Wire Mill included leaching of zinc ore along with additional treatment processes to remove cadmium impurities. These activities resulted in elevated levels of zinc and cadmium in the soil and groundwater. The leaching process was implemented in large tanks located inside the north end of the former Rod and Wire Mill building. In 1959 filters were installed to dewater the residues. Filtrate from the dewatering process was typically recycled to the wire plating process. The dewatered sludge was temporarily stored on the ground north of the mill buildings in the Former Sludge Bin Storage Area (see Figure 2). Excess filtrate is assumed to have been discharged to an adjacent pond (East Pond) until 1971; after which it was sent to the onsite waste water treatment plant. The Rod and Wire Mill operation terminated in the early 1980s.

During a period in the mid-1980s to early 1990s, eight (8) Solid Waste Management Units (SWMUs) were identified in the vicinity of the Rod and Wire Mill during a series of investigations and interim measures to address conditions were performed by the then owner, Bethlehem Steel. Three (3) of these SWMUs are the focus of this R&W Mill IM Workplan and associated remedial action and include:

- SWMU 27: Sludge Bin Storage Area;
- SWMU 28: Northwest Pond; and
- SWMU 29: East Pond.

1.2 CURRENT INTERIM MEASURES

The historical operations at the Rod and Wire Mill Area resulted in releases of acidic liquids, cadmium and zinc to the soil and groundwater. In 1986 a soil and groundwater remediation program was initiated to address elevated levels of cadmium and zinc in the groundwater and residual soil contamination in the Sludge Bin Storage Area. Remediation included a soil-flushing program and associated pumping and treatment of groundwater from shallow and intermediate wells. Groundwater pumping was discontinued in 1999 as part of the Rod and Wire Mill demolition.



Following a reassessment, pumping and treatment of groundwater resumed in September 2001 and has continued to the present date. A plume of dissolved cadmium and zinc is observed in the sandy subsurface from approximately 20 to 30 feet below ground surface (bgs). The average depth of water has been observed at shallow as approximately 3 to 5 feet bgs. Sandy and clayey subsoils exist down to approximately 50-60 feet bgs. There is currently no indication that there is a significant plume of dissolved cadmium and zinc at depths greater than 30-ft bgs.

The current Interim Measure Remedy operations are summarized as follows:

- Institutional controls for soils to limit worker exposure provide a “Restricted Work Area” at the Former Sludge Bin Storage Area.
- A groundwater monitoring network that includes 31 wells to collect water level and groundwater quality data.
- A groundwater pump and treat system that utilizes two intermediate depth zone recovery wells (RW10-PZM020 and RW15-PZM020) that typically operate at a combined pumping rate of 5.0-12.0 gallons per minute (gpm). A total of 4,487,659 gallons of water were extracted from the Former Rod and Wire Mill Area pumping wells and treated during 2015. The average pumping rate for the pump and treat system was 12,295 gpd, or 8.5 gpm. A total of 210 pounds (lbs) of cadmium and 10,630 pounds (lbs) of zinc were removed and treated during 2015.

1.3 RECENT INVESTIGATIONS/FINDINGS

In late April 2016 field work associated with the “*Interim Remedial Measures Workplan, Pre-Design Investigation Supplement, Parcel A-3*” (Advanced GeoServices, April 1, 2016) was performed. Subsequently, data was received and evaluated in early May 2016. Concurrently the “*Pre-Design Investigation, Rod and Wire Mill Area, Characterization Report,*” ARM Group; April 1, 2016 (ARM PDI Report) was received. The key findings from these investigations are presented in this section.



1.3.1 ARM Group PDI Report

The ARM PDI Report characterized the soils and groundwater beneath the former Rod and Wire Mill area. Key information and understandings presented in the report included the 3D contours of cadmium and zinc in soil and intermediate groundwater isocontours for cadmium and zinc (See Appendix A, figures 6,7, 9 and 10). These figures indicate

- The primary source of zinc is the western portion of the northwest pond (just west of the existing transformer pad)¹.
- A secondary zinc source is located further west near the former sludge bin location.
- The former sludge bin location also appears to be the primary cadmium source.

These areas will be the target of the R&W Mill IM Workplan.

An extensive groundwater model of Site conditions was also completed by ARM Group. The following information was developed as part of this model.

- The groundwater modeling completed and presented on Figure 11 of the ARM PDI Report, along with the subsurface characterizations confirms the presence of a higher permeability sand zone within which the relatively higher concentrations of dissolved cadmium and zinc concentrations in groundwater have been identified.
- Figure 12 of the ARM PDI Report depicts the groundwater elevations in this area with the existing pumping system in operation at RW10-PZM020 and RW15-PZM020 (RW-10 and RW-15).
- A seepage velocity of 10 feet per year, or less is anticipated when the pumping system is turned off based on the information presented in the ARM PDI report on Figure 11 (permeability), Figure 17, (hydraulic gradient), and Table 6 (porosity).

¹ Note that a significant portion of the former East Pond is inaccessible due to the new electrical transformer station.



- When the pumping system is turned on the combination of a larger hydraulic gradient and the presence of a zone of elevated hydraulic conductivity outside of the source zone (green zone on ARM PDI report Figure 11) will result in higher seepage velocities for groundwater entering the source zone during pumping.

1.3.2 Advanced GeoServices Field Investigation

Advanced GeoServices developed the “*Interim Remedial Measures Work Plan, Pre-Design Investigation Supplement, Parcel A-3*” (Advanced GeoServices, April 1, 2016) and performed the associated field work. The field work consisted of several test pit excavations, soil sample analysis, groundwater sample analysis, soil-reagent treatability study, and a groundwater pH adjustment titration study. The observations and results of the treatability study in conjunction with updated findings from the ARM PDI Report were used to modify the conceptual site model (CSM) and support the selection of an appropriate Interim Measure to address the identified dissolved zinc and cadmium in the intermediate zone groundwater at the Site.

The goal of the Advanced GeoServices field investigation was to answer the following specific questions:

- *What are the background groundwater conditions (up-gradient of source areas)?*
- *What are the most efficient reagent(s) for neutralizing groundwater?*
- *What is the acidic potential of the source area(s) that is available to continue to contribute acidity (flux) to the groundwater?*
- *What are the most efficient reagent(s) for neutralizing soils and/or stabilizing zinc and cadmium within the soils?*
- *What other metals/constituents are potentially mobilized as a result of pH neutralization?*
- *What are the physical soil properties that need to be addressed as part of a remedy that involves reagent addition to subsurface soils?*



1.3.2.1 Up-Gradient Groundwater Findings

The field work to assess the groundwater conditions consisted of the installation of two (2) up-gradient wells to assess the background aquifer conditions. The shallow well is identified as CW-MW-1(S). The intermediate depth well is identified as CW-MW-2(I).

Both wells have acidic pH values of 4.09 (CW-MW-1, shallow) and 4.23 (CW-MW-2, intermediate). The shallow well had a dissolved iron concentration of 49.9 mg/L. The intermediate well had a dissolved iron concentration of 126 mg/L. Cadmium total and dissolved concentrations were non-detect and zinc total and dissolved concentrations less than 100 µg/L. The analytical groundwater data for these wells is presented on Table 1 (as well as “in plume wells” RW-2 and RW-10 and titration study). The acidity is also much less than the wells in the plume. These wells suggest the source of acidity may be up-gradient groundwater. This was further supported by the test pit study performed (see Section 1.4.2.4). Local shallow and intermediate pH conditions are presented on Figures 3 and 4.

1.3.2.2 In-Plume Well Findings

Groundwater samples were collected from the intermediate zone well at the RW-2 location (RW-2I) and pumping well RW-10 to represent the down-gradient aquifer conditions. The analytical data gathered from these wells generally corroborates existing data for the aquifer in this area. Notable observations include:

- RW-10 has elevated dissolved cadmium, nickel, and zinc, whereas RW-2I has only elevated zinc. The level of dissolved zinc in RW-10 (447 mg/L) is less than that in RW-2I (653 mg/L); and
- Both RW-10 and RW-2I have high levels of dissolved iron and manganese with the levels in RW-2I (Iron: 690 mg/L; Manganese: 24.9 mg/L) higher than those in RW-10 (Iron: 217 mg/L; Manganese: 18.7 mg/L).



1.3.2.3 Groundwater Reagent/Titration Study

Select groundwater samples from RW-2I, RW-10, CW-MW-1(S) and CW-MW-2(S) were delivered to ALS Analytical Laboratory in Middletown, Pennsylvania in unpreserved containers. Three aliquots from each well were then separated and sodium hydroxide was used to raise the pH to 7.5, 9, and 10.5. At each pH point dissolved metals analysis was performed. The data is presented on Table 1. The pH-adjusted samples are indicated as such. For example the aliquot from RW-10 that was adjusted to pH 10.5 is identified as “RW-10 pH 10.5”.

As expected as pH increased the dissolved concentrations of iron, cadmium, and zinc decreased. The decrease was moderate at pH 7.5 and became more effective and pronounced at pH 9 and 10.5.

Jar testing was also performed with up-gradient groundwater mixed with a variety of alkaline reagents. The following observations were made:

- Agricultural Lime remained relatively insoluble and was slow to react. A table spoon (approximately) of agricultural lime added to a cup of up-gradient groundwater produced an initial pH increase to 5.9. After a few days, the lime addition increased the pH to 7. Over a period of three weeks the pH increased as high as 8.7. No additional increase was observed after several days.
- Enviroblend, a proprietary Magnesium Oxide reagent, was also relatively insoluble, but was quick to react. A teaspoon of Enviroblend added to a cup of up-gradient groundwater produced an initial pH increase to 10.7. Within 24 hours the pH had increased to 11.17.
- Terrabond^{MG}, a proprietary Magnesium Carbonate product, was more soluble and quick to react and raised the pH to between 9.5 and 10 within a few minutes.



The removal of dissolved cadmium and zinc from solution may be by precipitation of hydroxide minerals, carbonate minerals, or adsorption onto iron and manganese hydroxides or a combination of processes. The dissolved iron concentrations are reduced as pH increases in a manner similar to dissolved cadmium and zinc. In-situ reactions may be greater than those observed in bench scale tests due to the longer residence time and adsorption reactions with the soil. The available data indicated no additional contaminants appear to be mobilized at the evaluated pH values in the testing completed.

1.3.2.4 Source Area Soil Study

The investigation plan proposed that five (5) test pits would be excavated in and around the three source areas. However, the test pit excavation went much better than expected. A total of 5 test pits were excavated in the accessible portion of the Former East Pond; 2 test pits were excavated near the former Sludge Bin Area, and 2 test pits were excavated near the former Northwest Pond Area (see Figure 2).

In addition to the test pits, four (4) Geoprobe soil borings were performed and soil samples were collected during the up-gradient well installation. The approximate locations of the soil borings are shown on Figure 2 as well.

The general observations of the soils study are:

- Subsurface is a mixture of clay lenses and sand layers (as indicated on ARM PDI Report cross sections Figures 8 and 9).
- Test pit excavation sidewalls were very stable to depths of 20-22 feet bgs.
- Water infiltration was not significant and primarily occurred within the upper 10 feet bgs (perched water zone).



- The clay encountered was relatively stiff. Excavated soils when mixed were not highly plastic based on the Atterberg test results.
- Depending on location high concentrations of total iron, cadmium, zinc, magnesium, and manganese were observed (as expected).
- Zinc and cadmium leaching was observed in SPLP samples collected at intermediate depth in boring locations B2 (20-30 feet bgs) and B3 (15-25 feet bgs).
- Arsenic was not detected in any SPLP sample.
- Acidity from soils was not as high as expected with measured pH values of 6 to 7.

1.4 UPDATED CONCEPTUAL SITE MODEL

As a result of the findings from the field investigation performed by Advanced GeoServices, the CSM has been updated to reflect the following unexpected positions:

- The up-gradient wells had a very low pH (both less than 4.23) and very high iron (greater than 50 mg/L) concentrations.
- pH in the shallow groundwater is approximately 4 - 4.2 in the up-gradient well locations and remains approximately 5.52 at RW-006 and 5.1 at SWM-2; both immediately south of the substation. As previously described, the pH of the shallow groundwater increases in wells within the source area and west towards the shoreline (approximately pH 11.5). Figure 3 depicts the pH in and around the IRM treatment area.
- pH in the intermediate groundwater is approximately 4 - 4.2 in the up-gradient well locations and remains approximately 4 – 5 in the area immediately west of the substation (RW-063, RW-067, RW-02). It increases to slightly over 6 in the current



pumping well (RW10) and ranges from 5 to 7 approaching the shoreline (TS04, RW20 and RW19 respectively). Figure 4 depicts the pH in and around the IRM treatment area.

- The source of the acidity in the up-gradient groundwater does not appear to be related to previous acid washing or other known operations on the A3 parcel. The up-gradient wells are approximately 1,400 feet east of the past acid washing operations. The specific cause of the low pH is unknown at this time. Due to the low groundwater flow rate and seepage velocity, in conjunction with the distances from up-gradient locations to the IRM work areas, the source of the up-gradient conditions does not have a significant bearing on the proposed remedy within the A3 parcel.
- The test pit soils collected from the source areas and in particular from the east pond are not nearly as acidic as expected.
- Based on the testing completed, the zinc and cadmium in those soils do not appear to be a significant source of the dissolved cadmium, zinc, or the low pH found in the groundwater.
- The clay encountered in the test pits was stiff enough to allow the pits to maintain remain open for several hours until they were backfilled.



2.0 PROPOSED INTERIM MEASURES REMEDIAL APPROACH

2.1 OVERVIEW

2.1.1 Interim Measures Remedial Process

The strategy for addressing the elevated dissolved cadmium and zinc in the intermediate groundwater zone is to precipitate the dissolved metals in-situ by raising the groundwater pH from approximately 4 to approximately 9.5 to 10. This will be accomplished by adding alkaline reagents into the intermediate groundwater zone at select high concentration areas. Excavated soils will be replaced with alkaline charges that will react with acidic groundwater to create slightly alkaline conditions within the aquifer and remove the dissolved cadmium and zinc from solution. The alkaline charges will utilize a combination of fast acting Terrabond^{MG} (40% by weight) in conjunction with limestone aggregate (60% by weight). The reagents will be in trenches in a staggered/offset alignment that is perpendicular to the current groundwater flow under pumping conditions and also under non-pumping conditions. The remainder of this work plan describes the implementation of this interim remedy.

2.1.2 Locations

The staggered/offset treatment trenches will be constructed down-gradient of the 24 mg/l cadmium isopleth and 465 mg/L zinc isopleth as depicted in the ARM PDI Report and as shown in Figures 6A and 6B. The trench constructed down-gradient of the cadmium source will measure approximately 530 feet in length. The trench constructed down-gradient of the zinc source will be approximately 500 feet in length. In addition, since the pending redevelopment of the site will significantly limit future access to certain areas of the site, two additional short trenches will also be installed near the highest concentrations of dissolved cadmium and zinc (trench lengths approximately 175 feet and 240 feet, respectively). The general locations of the two primary trenches and two smaller trenches are shown on Figures 6A and 6B. The final locations of the trenches will be field located and may be altered slightly to accommodate redevelopment considerations.



2.1.3 Additives

The reagent mix will include fast acting and long acting alkaline materials. The fast acting reagent, Terrabond^{MG}, reacts quickly within the aquifer to create alkaline conditions (as well as chemical bonds) which reduce the mobility of the metals in groundwater. The fast acting reagent is being used to help facilitate the near term ability to shutdown the current groundwater extraction system. The long acting reagent, limestone aggregate (#57 stone gradation), reacts much more slowly within in the aquifer and is being used to address the long term need due to the up-gradient groundwater's low pH. The limestone aggregate will provide a structurally stable frame for the Terrabond reagent. The Terrabond^{MG} will account for 40% (by weight) of the reagent mix. The limestone aggregate will make up the remaining 60% of the reagent mix. The allowable tolerance on the reagent blend will be $\pm 10\%$.

Groundwater modeling within the ARM PDI Report shows that once the groundwater extraction system is shutdown the groundwater seepage velocity in the impacted areas will be significantly reduced and thus greatly increase the residence time of any impacted groundwater.

2.1.4 Phased Pump and Treat Modification/Shutdown

The primary purpose of implementing this new interim remedial measure is to reduce dissolved concentrations of metals in the groundwater and eliminate the potential for future unacceptable discharges to surface water. In addition, this IM will allow for the shutdown and replacement of the ineffective existing groundwater extraction system. However, it is believed that in the immediate time period after the treatment trenches installation, the groundwater extraction system will help to spread the reagents down-gradient due to the higher seepage velocity created by the pumping.

The current schedule for redevelopment will require the re-location of RW-10 since it is within the planned footprint of the new building. The new location of RW-10, renamed RW-10A, is shown on Figure 11A/B. The plan is to operate RW-10A on an interim basis until the post-installation groundwater data shows the results of the alkaline reagents. The operation of RW-



10A is expected to facilitate the spread of the Terrabond^{MG} due to the increased hydraulic gradient caused by the pumping. The expected operational period is 4 to 6 months after the source interim action is installed. RW-15 may also need to be re-located; however, a final decision has not been made. RW-15 will continue to operate after the shutdown of RW-10A until sufficient data has been collected on the performance of the treatment walls.

2.2 TREATMENT DESIGN AND INSTALLATION

2.2.1 Reagent Mix Optimization Testing

Initially, jar testing was performed using alkaline reagents and materials to evaluate the effects when mixed with Site soils and groundwater. The results of the soil jar testing are summarized on Table 2. The soil jar testing confirmed that Lime products can have an impact on pH, but have a slow reaction time; and that Enviroblend and Terrabond have a more pronounced and rapid effect on raising the pH. Table 3 presents a summary of the jar testing performed on Site groundwater which had similar results to the soil jar testing.

In order to better evaluate the long term effectiveness of alkaline reagents, a modified multiple extraction SPLP test (SW846 Method 1312) was performed using four(4) different mix ratios:

- Batch A - 5% Terrabond^{MG}/98% Agricultural Lime,
- Batch B - 30% Terrabond^{MG}/70% Agricultural Lime,
- Batch C - 10% EnviroblendCS/90% sand, and
- Batch D - 20% EnviroblendCS/80% sand.

Site in-plume groundwater from RW-10 was used instead of synthetic rain water as the leaching water. The testing objective was to evaluate the long term capacity of the reagent mixes to neutralize the low pH groundwater, precipitate the dissolved cadmium and zinc, and assess whether any increases in other metals occurs due to the change in pH. The leachate from each SPLP test is being analyzed for pH, Alkalinity, Acidity, and dissolved TAL metals. The



groundwater that was used as the extraction fluid had initial dissolved concentrations of 11 mg/L for cadmium and 710 mg/L for zinc.

The testing demonstrated that the reagent mixtures based on 5% Terrabond^{MG} and 10% Enviroblend^{CS} did not produce satisfactory treatment results. Zinc reduction for these blends was less than 65% on the initial extraction. Subsequent extractions resulted in decreased effectiveness, as expected.

Testing demonstrated that the reagent mixtures based on 30% Terrabond and 20% Enviroblend were able to produce satisfactory results. Both reagent blends produced greater than 99% reduction for dissolved cadmium (0.014 mg/L and 0.024 mg/L respectively) and zinc (1 mg/L and 0.72 mg/L respectively) during the first extraction cycle. The 30% Terrabond produced a reduction in both dissolved cadmium and zinc of approximately 96% on the second extraction cycle; 20% Enviroblend produced a reduction in both dissolved cadmium and zinc of approximately 99% on the second extraction cycle. On the third extraction cycle, the 30% Terrabond achieved a reduction for dissolved cadmium of 85% and a reduction for dissolved zinc of 60%; a reagent mixture with 20% Enviroblend reduced the dissolved concentrations of cadmium by 31% and dissolved zinc by 92%. A summary of the reagent treatability study is provided on Table 4.

Terrabond was able to cost effectively meet the project criteria and has been selected for the reagent blend on the following basis:

- Similar performance at reducing concentrations of dissolved cadmium and zinc through the first two extraction cycles.
- Better performance at reducing dissolved cadmium concentration on the third extraction cycle.

2.2.2 Treatment Installation

The location of the primary treatment trenches were selected based on the ARM Group PDI Report which showed the highest zinc intermediate groundwater concentrations at RW-067-PZ and RW-



57-PZ and highest total cadmium intermediate groundwater concentration at RW-057-PZ. These locations also correlate to the highest soil concentrations and the location of the Former East Pond and Former Sludge Bin Storage areas.

Four additional shorter (approximately 80 - 160 feet long) treatment trenches will be installed. Two of the walls will be up-gradient of the primary zinc wall and within the 635 mg/L isopleth. The second set of two short treatment trenches will be between the primary zinc and primary cadmium treatment trenches and within the zinc 550 mg/L isopleth. Locations of the trenches are shown on Figures 6A and 6B. The final locations of the trenches will be field located and may be altered slightly to accommodate redevelopment considerations

The treatment trenches are initially intended to be approximately 35 feet deep and 3 feet wide. Actual dimensions may be modified as field conditions and field equipment dictate to facilitate installation of the reagent materials. An excavator will be used to install the treatment trenches. The primary zinc trench will be 500 feet long, the primary cadmium trench will be 530 feet long and the four shorter trenches will each be 80 - 160 feet long. The side walls of the test pits stayed open up to 22 feet for a short period of time before the influx of perched groundwater started to occur. The proposed approach takes advantage of these understandings to minimize the need for benching.

The trench installations will not produce a continuous “wall”. The trench installations will be performed in lengths of 50-100 feet. The lengths of excavation that make up a trench will be offset in two staggered rows approximately 10 - 15 feet apart (edge to edge). Each section will be excavated and the lower 20 feet (15 to 35 foot depth interval) will be backfilled with the final reagent mix. The remaining trench will be backfilled up to the last 2 feet with soil spoils from the trench (pending TCLP results, see Section 2.2.3) before the next section is started. Two feet of clean fill will be placed at the end of the day in the remaining portion of the trench to help avoid subsurface materials getting mixed into the clean fill. In locations that will not be paved a geotextile marker will be placed between the trench spoils backfill and the 2 foot thick clean soils layer.



The non-reagent backfill will be placed in controlled area and managed based on the available analytical results. See Figure 7 and 8 for a cross-section of the treatment trench. The locations and alignment of the treatment trenches will be accurately surveyed. The depth of the treatment trenches will be measured using field methods (markings on excavator boom, etc.) to determine the approximate depth of excavation since personnel will be prohibited from entering the excavation or approaching the excavation sidewall.

In the event subsurface obstructions are encountered that cannot be easily removed, the trench will be offset laterally to avoid the obstruction. The remaining wall will continue along this new alignment and parallel to the initial trench layout.

In the event the treatment trenches will not stay open at the target depths, the reagent mix will be mixed into the native soils using the excavator bucket to the extent possible. In these instances the Terrabond reagent will be added to the native soils at a ratio of approximately 1:1 (50% by weight). The limestone aggregate will not be used for mixing with collapsed soils. The trench will subsequently be backfilled according to the original design (see Figure 7).

2.2.3 Materials Management

A materials management area will be setup north of the primary cadmium treatment trench. This area will be used to stockpile and mix the reagents. Prior to the start of excavation a soil characterization study will be performed along the proposed trench alignment. Geoprobe borings will be performed at approximately 100 foot intervals along the alignment of the treatment trenches. Each boring will be performed for the zero to 15 foot depth interval. The entire interval will be used to create a composite sample to represent that portion of the treatment trench. The composite sample will be analyzed for TCLP metals to determine if the soils in the zero to 15 foot depth interval may be used as backfill within the treatment trench excavations.



Soils from locations that have hazardous TCLP results will not be used as backfill and will be managed as a hazardous material. Sampling based on a 15 foot depth and 100 foot spacing along the treatment trench will result in one sample per 166 CY of material to be excavated. Each sample will represent the soil from that sample location to a distance half-way to the next sample location. Soils from the zero to 15 foot depth interval that are not hazardous will be used as backfill above the reagent blend in the 2 foot to 15 foot depth interval. Soils excavated from deeper than 15 feet will be managed as waste and tested for appropriate parameters to allow disposal at the Gray's landfill onsite.

Soils/spoils that are determined to be hazardous based on the pre-excavation sampling (or post-excavation sampling) will be segregated for disposal at an appropriately permitted disposal facility. Onsite stabilization of hazardous soils/materials to render them non-hazardous will not occur without the approval of MDE. If onsite stabilization is proposed details on the treatment process will be provided to MDE for review and approval.

Soils that are removed from beneath the water table may be saturated. These soils will be allowed to dewater naturally by being placed in stockpiles that allow the water to drain out of the stockpiles. If substantial quantities of pore water are encountered, this water will be collected and transported to the on-site wastewater treatment plant for treatment. . If solidification is required to satisfy transportation and disposal requirements it will be performed in accordance with a plan that is approved by MDE. Figures 9 and 10 show the preliminary layout of the Materials Management Area and general construction layout, respectfully. The final layout may be modified by the Contractor.

2.2.4 Dust Control

The individual stockpiles within the Materials Management area will remain covered whenever they are not being used to minimize dust and prevent them from becoming wet. A weighted cover system shall be used to keep the covers inplace. Given the silty gradation of the Terrabond MG, only the working face of the stockpile will be uncovered to access the material. Each stockpile will be covered at the end of each day.



2.2.5 Water Management

A 20,000 Frac tank and associated pumps and hoses will be setup next to the Materials Management Area on-site prior to the start of the treatment trench installation as a contingency measure.

2.2.6 Erosion and Sediment Control

Erosion and sediment controls will be established in accordance with the overall redevelopment plan for Parcel A3 by the Owner.

2.3 HEALTH AND SAFETY

The existing Health and Safety Plan (HASP) for the Sparrows Point site will be followed by the prime remediation contractor. Appendix B includes copies of the Material Safety Data Sheets (MSDS) for the two planned reagents. If other reagents/suppliers are used the SDS sheets will be updated. The remediation contractor will develop, as necessary, addendums to the existing site HASP.

2.4 GROUNDWATER MONITORING

As a result of the proposed development and future usage of the property, as well as the locations of the alkaline charges, the existing groundwater monitoring well network must be modified. Figure 11A depicts the proposed modifications to the shallow groundwater monitoring well network. Seven (7) shallow wells must be abandoned because they are inside of or extremely close to the proposed building footprint. An additional three (3) shallow wells will be abandoned due to their location relative to a proposed stormwater basin located along Riverside Drive. Six (6) new shallow wells will be installed north of the proposed building footprint and four (4) new shallow wells will be installed west of the proposed stormwater basin along Riverside Drive.



Figure 11B depicts the proposed modifications to the intermediate groundwater monitoring well network. Five (5) intermediate wells must be abandoned because they are inside of the proposed building footprint. An additional five (5) intermediate wells will be abandoned due to their location relative to a proposed stormwater basin located along Riverside Drive. Six (6) new intermediate wells will be installed north of the proposed building footprint and four (4) new intermediate wells will be installed west of the proposed stormwater basin along Riverside Drive. In addition, RW-10 will be relocated (replacement well ID RW-10A). Table 5 presents a summary of the proposed modifications to the groundwater monitoring network.

The groundwater monitoring program to evaluate the performance of the treatment trenches and subsequent shutdown of the extraction wells will utilize intermediate zone wells summarized in Table 6. The locations of the existing and new wells relative to the treatment trenches are shown on Figures 11A and 11B. The final locations of the new wells will be field located and may be altered slightly to accommodate redevelopment considerations. The new wells will be 2-inch diameter PVC wells with 2 inch Schedule 40 slotted screens with a sand pack and 2.8 inch diameter, 5 foot long stainless steel mesh screen on the outside of the sand (i.e., GeoProbe Slim Prepack). The wells will be installed using a GeoProbe drill rig to minimize the generation of soil cuttings.

2.4.1 Interim Treatment Goals

The interim groundwater treatment goals are to increase the pH above 7 to affect a > 90% reduction in dissolved concentrations of cadmium and zinc within the source areas as compared to existing conditions. The existing conditions will be established based on Interim Measure monitoring results and Pre-Design Investigation data collected in the 2 quarters prior to the implementation of the treatment trenches.

If monitoring demonstrates a decrease in cadmium and zinc concentrations over two consecutive quarters, EAG will request permission to shut off the RW-10A pumping well.



2.4.2 Long Term Treatment Goals

Ultimately the treatment goal will be to demonstrate that the concentration of groundwater discharges of the primary contaminants (cadmium and zinc) at the shoreline/property boundary are acceptable when compared to the *Maryland Department of the Environment Ambient Water Quality Criteria, Toxic Substances Criteria for Ambient Surface Waters – Inorganic Substances, Aquatic Life Saltwater Chronic Exposure Limits (COMAR 26.08.02.03-2)*.

- Cadmium: 8.8 ug/L
- Zinc: 81 ug/L

It is also anticipated that as part of a final corrective measures process a surface water mixing zone will be established with more specific treatment goals that will be defined at that time and that those goals will be evaluated in the longer term as part of a Monitoring Natural Attenuation remedy.



3.0 REPORTING

A Construction Completion Report (CCR) will be submitted to the US EPA and Maryland Department of the Environment approximately 45 days after the completion of the installation work. The CCR will provide the following information:

- Summary of overall work performed;
- As-built vertical and horizontal alignments of the treatment walls;
- Summary of reagents volumes/tonnage used;
- Locations of new wells and associated well construction logs;
- Summary of soil spoils managed and final disposal;
- Summary of water managed and final disposal; and
- Description of Significant Problems Encountered and Resolutions.

A groundwater monitoring report will be provided approximately 6 months after the installation of the treatment trenches and new wells. The groundwater monitoring report will provide the following:

- Performance monitoring data and evaluation; and
- Conclusions and Recommendations.

Subsequent semi-annual reports will be submitted as appropriate to document the performance of the interim measure.



4.0 SCHEDULE

Below is a tentative schedule for the implementation of this work plan:

- Reagent Mix Optimization Testing: Complete
- Work Plan, Permitting, Submittals, MDE Approval: August 19, 2016
Pre-Excavation Soil TCLP Characterization: August 22 – 23, 2016
- Mobilization and Site Preparation: Week of September 5, 2016
- Treatment Trench Install: September 12 – October 14
- New MW and RW-10A Installation including abandonment of existing wells:
Complete by October 21
- Construction Completion Report (CCR) Submittal: December 23, 2016
 - Short-Term Groundwater Monitoring – November 2016 through February 2017 (See Table 6)
- Groundwater Monitoring Report: March 2017
- RW-10A Tentative Shutdown: April 2017 (pending 2 consecutive months of observed Cd/Zn decreases)
- RW-15 Continued Operation: TBD



5.0 CONTINGENCY

Provisions are in place to support implementation of additional groundwater treatment at the Rod and Wire Mill Area if necessary to support the final closure process required for the ACO, SE and associated Multimedia Consent Decree. Following the completion of in-situ R&W Mill IM Work, groundwater conditions will continue to be evaluated to determine if an additional down-gradient treatment is needed to achieve cleanup objectives. In anticipation of this contingency, and in coordination with the property redevelopment, an area parallel to Riverside Road (see Figure 12) has been designated. This designated area will not be impacted by the development of the site.

The injection of alkaline reagents such as sodium hydroxide at locations up-gradient from the alignment of the alkaline charges is also a contingency that will be evaluated following installation of the alkaline charges. This contingency could be implemented to relieve some of the solids loading on the alkaline charge media as dissolved metals precipitate out of the groundwater. The location of these injection points is not identified at this time.



TABLES

TABLE 1
PDI SUPPLEMENT GROUNDWATER DATA AND TITRATION STUDY
Former Rod and Wire Mill Pilot Scale Work Plan
Sparrows Point, Maryland

Sample Location		RW-10			RW-21			RW-2D			CW-MW-1 (S)		
Lab ID		2140225001			2140225002			2140225003			2140225004		
Sample Date		4/27/2016			4/27/2016			4/27/2016			4/27/2016		
Matrix		Groundwater			Groundwater			Groundwater			Groundwater		
Remarks													
Parameter	Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Total Metals													
Aluminum, Total	mg/L		U	5.6		U	11.1		U	11.1	0.83		0.11
Antimony, Total	mg/L		U	1.1		U	2.2		U	2.2		U	0.022
Arsenic, Total	mg/L		U	0.45		U	0.9		U	0.9		U	0.009
Cadmium, Total	mg/L	9.9		0.11		U	0.22		U	0.22		U	0.0022
Calcium, Total	mg/L	198		5.6	261		11.1	262		11.1	10.4		0.11
Copper, Total	mg/L		U	0.56		U	1.1		U	1.1		U	0.011
Iron, Total	mg/L	209		3.3	736		6.7	700		6.7	51.2		0.067
Lead, Total	mg/L		U	0.33		U	0.67		U	0.67		U	0.0067
Magnesium, Total	mg/L	100		5.6	171		11.1	167		11.1	3.7		0.11
Manganese, Total	mg/L	18.2		0.28	26.2		0.56	25.5		0.56	0.41		0.0056
Nickel, Total	mg/L	1.1		1.1		U	2.2		U	2.2		U	0.022
Potassium, Total	mg/L		U	27.8		U	55.6		U	55.6	1.1		0.56
Silicon, Total	mg/L	13.1		0.05	13.5		0.05	13.7		0.05	23.1		0.05
Sodium, Total	mg/L	244		27.8	104		55.6	96		55.6	11.6		0.56
Zinc, Total	mg/L	444		1.1	712		2.2	679		2.2	0.068		0.022
Dissolved Metals													
Aluminum, Dissolved	mg/L		U	5		U	10		U	10		U	0.1
Antimony, Dissolved	mg/L		U	1		U	2		U	2		U	0.02
Arsenic, Dissolved	mg/L		U	0.4		U	0.8		U	0.8		U	0.008
Barium, Dissolved	mg/L		U	0.5		U	1		U	1	0.037		0.01
Beryllium, Dissolved	mg/L		U	0.2		U	0.4		U	0.4		U	0.004
Cadmium, Dissolved	mg/L	10		0.1		U	0.2		U	0.2		U	0.002
Calcium, Dissolved	mg/L	201		5	255		10	260		10	10.5		0.1
Chromium, Dissolved	mg/L		U	0.25		U	0.5		U	0.5		U	0.005
Cobalt, Dissolved	mg/L		U	0.25		U	0.5		U	0.5		U	0.005
Copper, Dissolved	mg/L		U	0.5		U	1		U	1		U	0.01
Iron, Dissolved	mg/L	217		3	690		6	716		6	49.9		0.06
Lead, Dissolved	mg/L		U	0.3		U	0.6		U	0.6		U	0.006
Magnesium, Dissolved	mg/L	103		5	162		10	168		10	3.7		0.1
Manganese, Dissolved	mg/L	18.7		0.25	24.9		0.5	25.8		0.5	0.4		0.005
Mercury, Dissolved	mg/L		U	0.0005		U	0.0005		U	0.0005		U	0.0005
Nickel, Dissolved	mg/L	1.2		1		U	2		U	2		U	0.02
Potassium, Dissolved	mg/L		U	25		U	50		U	50	0.99		0.5
Selenium, Dissolved	mg/L		U	1		U	2		U	2		U	0.02
Silver, Dissolved	mg/L		U	0.2		U	0.4		U	0.4		U	0.004
Sodium, Dissolved	mg/L	249		25	79.1		50	79.8		50	12.3		0.5
Thallium, Dissolved	mg/L		U	1		U	2		U	2		U	0.02
Vanadium, Dissolved	mg/L		U	0.25		U	0.5		U	0.5		U	0.005
Zinc, Dissolved	mg/L	447		1	653		2	679		2	0.069		0.02
Conventionals													
Acidity, Total	mg/L	1170		25	2900		125		NA		130		25
Alkalinity, Total	mg/L	5		5		U	5		NA		86		5
Chloride	mg/L	413		5	32.4		5	33.3		5	22.5		5
Nitrate/Nitrite-N	mg/L		U	0.5		U	0.5		U	0.5		U	0.5
Phosphorus, Total	mg/L	0.11		0.1	0.27		0.1	0.19		0.1	1.1		0.1
Sulfate	mg/L	2080		50	3900		100	3820		100		U	5

TABLE 1
PDI SUPPLEMENT GROUNDWATER DATA AND TITRATION STUDY
Former Rod and Wire Mill Pilot Scale Work Plan
Sparrows Point, Maryland

Sample Location		CW-MW-2 (I)			RW-10 pH 7.5			RW-10 pH 9			RW-10 pH 10.5			
Lab ID		2140225005			2140225006			2140225007			2140225008			
Sample Date		4/27/2016			4/27/2016			4/27/2016			4/27/2016			
Matrix		Groundwater			Groundwater			Groundwater			Groundwater			
Remarks				P										
Parameter	Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	
Total Metals														
Aluminum, Total	mg/L	1.6		0.11		NA				NA			NA	
Antimony, Total	mg/L		U	0.022		NA				NA			NA	
Arsenic, Total	mg/L		U	0.009		NA				NA			NA	
Cadmium, Total	mg/L		U	0.0022		NA				NA			NA	
Calcium, Total	mg/L	34.5		0.11		NA				NA			NA	
Copper, Total	mg/L		U	0.011		NA				NA			NA	
Iron, Total	mg/L	130		0.067		NA				NA			NA	
Lead, Total	mg/L		U	0.0067		NA				NA			NA	
Magnesium, Total	mg/L	13		0.11		NA				NA			NA	
Manganese, Total	mg/L	3.3		0.0056		NA				NA			NA	
Nickel, Total	mg/L		U	0.022		NA				NA			NA	
Potassium, Total	mg/L	3.3		0.56		NA				NA			NA	
Silicon, Total	mg/L	30.2		0.05		NA				NA			NA	
Sodium, Total	mg/L	39.3		0.56		NA				NA			NA	
Zinc, Total	mg/L	0.035		0.022		NA				NA			NA	
Dissolved Metals														
Aluminum, Dissolved	mg/L		U	0.1		U	1			U	1		U	1
Antimony, Dissolved	mg/L		U	0.02		U	0.2			U	0.2		U	0.2
Arsenic, Dissolved	mg/L		U	0.008		U	0.08			U	0.08		U	0.08
Barium, Dissolved	mg/L	0.15		0.01		U	0.1			U	0.1		U	0.1
Beryllium, Dissolved	mg/L		U	0.004		U	0.04			U	0.04		U	0.04
Cadmium, Dissolved	mg/L		U	0.002	7.4		0.02	0.42		0.02	0.031		0.02	
Calcium, Dissolved	mg/L	34.5		0.1	177		1	170		1	148		1	
Chromium, Dissolved	mg/L		U	0.005		U	0.05			U	0.05		U	0.05
Cobalt, Dissolved	mg/L		U	0.005	0.056		0.05			U	0.05		U	0.05
Copper, Dissolved	mg/L		U	0.01		U	0.1			U	0.1		U	0.1
Iron, Dissolved	mg/L	126		0.06	50		0.6			U	0.6		U	0.6
Lead, Dissolved	mg/L		U	0.006		U	0.06			U	0.06		U	0.06
Magnesium, Dissolved	mg/L	12.9		0.1	88.2		1	67.8		1	29.9		1	
Manganese, Dissolved	mg/L	3.3		0.005	15.9		0.05	4.2		0.05	0.21		0.05	
Mercury, Dissolved	mg/L		U	0.0005		U	0.0005			U	0.0005		U	0.0005
Nickel, Dissolved	mg/L		U	0.02	0.21		0.2			U	0.2		U	0.2
Potassium, Dissolved	mg/L	3.4		0.5	15.2		5	14.7		5	14.2		5	
Selenium, Dissolved	mg/L		U	0.02		U	0.2			U	0.2		U	0.2
Silver, Dissolved	mg/L		U	0.004		U	0.04			U	0.04		U	0.04
Sodium, Dissolved	mg/L	40.6		0.5	570		5	747		5	834		5	
Thallium, Dissolved	mg/L		U	0.02		U	0.2			U	0.2		U	0.2
Vanadium, Dissolved	mg/L		U	0.005		U	0.05			U	0.05		U	0.05
Zinc, Dissolved	mg/L	0.052		0.02	82.8		0.2	0.43		0.2			U	0.2
Conventionals														
Acidity, Total	mg/L	243		25		NA				NA			NA	
Alkalinity, Total	mg/L	42		5		NA				NA			NA	
Chloride	mg/L	144		5		NA				NA			NA	
Nitrate/Nitrite-N	mg/L		U	0.5		NA				NA			NA	
Phosphorus, Total	mg/L	0.45		0.1		NA				NA			NA	
Sulfate	mg/L	127		5		NA				NA			NA	

TABLE 1
PDI SUPPLEMENT GROUNDWATER DATA AND TITRATION STUDY
Former Rod and Wire Mill Pilot Scale Work Plan
Sparrows Point, Maryland

Sample Location		RW-2I pH 7.5			RW-2I pH 9			RW-2I pH 10.5			RW-2D pH 7.5		
Lab ID		2140225009			2140225010			2140225011			2140225012		
Sample Date		4/27/2016			4/27/2016			4/27/2016			4/27/2016		
Matrix		Groundwater			Groundwater			Groundwater			Groundwater		
Remarks													
Parameter	Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Total Metals													
Aluminum, Total	mg/L		NA			NA			NA			NA	
Antimony, Total	mg/L		NA			NA			NA			NA	
Arsenic, Total	mg/L		NA			NA			NA			NA	
Cadmium, Total	mg/L		NA			NA			NA			NA	
Calcium, Total	mg/L		NA			NA			NA			NA	
Copper, Total	mg/L		NA			NA			NA			NA	
Iron, Total	mg/L		NA			NA			NA			NA	
Lead, Total	mg/L		NA			NA			NA			NA	
Magnesium, Total	mg/L		NA			NA			NA			NA	
Manganese, Total	mg/L		NA			NA			NA			NA	
Nickel, Total	mg/L		NA			NA			NA			NA	
Potassium, Total	mg/L		NA			NA			NA			NA	
Silicon, Total	mg/L		NA			NA			NA			NA	
Sodium, Total	mg/L		NA			NA			NA			NA	
Zinc, Total	mg/L		NA			NA			NA			NA	
Dissolved Metals													
Aluminum, Dissolved	mg/L		U	1		U	1		U	1		U	1
Antimony, Dissolved	mg/L		U	0.2		U	0.2		U	0.2		U	0.2
Arsenic, Dissolved	mg/L		U	0.08		U	0.08		U	0.08		U	0.08
Barium, Dissolved	mg/L		U	0.1		U	0.1		U	0.1		U	0.1
Beryllium, Dissolved	mg/L		U	0.04		U	0.04		U	0.04		U	0.04
Cadmium, Dissolved	mg/L	0.077		0.02		U	0.02		U	0.02	0.05		0.02
Calcium, Dissolved	mg/L	219		1	203		1	209		1	218		1
Chromium, Dissolved	mg/L		U	0.05		U	0.05		U	0.05		U	0.05
Cobalt, Dissolved	mg/L	0.054		0.05		U	0.05		U	0.05		U	0.05
Copper, Dissolved	mg/L		U	0.1		U	0.1		U	0.1		U	0.1
Iron, Dissolved	mg/L	250		0.6	2.5		0.6		U	0.6	180		0.6
Lead, Dissolved	mg/L		U	0.06		U	0.06		U	0.06		U	0.06
Magnesium, Dissolved	mg/L	130		1	115		1	69.1		1	138		1
Manganese, Dissolved	mg/L	19.9		0.05	7.7		0.05	0.46		0.05	20.8		0.05
Mercury, Dissolved	mg/L		U	0.0005		U	0.0005		U	0.0005		U	0.0005
Nickel, Dissolved	mg/L		U	0.2		U	0.2		U	0.2		U	0.2
Potassium, Dissolved	mg/L	11		5	10.7		5	11.4		5	10.9		5
Selenium, Dissolved	mg/L		U	0.2		U	0.2		U	0.2		U	0.2
Silver, Dissolved	mg/L		U	0.04		U	0.04		U	0.04		U	0.04
Sodium, Dissolved	mg/L	672		5	904		5	1110		5	739		5
Thallium, Dissolved	mg/L		U	0.2		U	0.2		U	0.2		U	0.2
Vanadium, Dissolved	mg/L	0.056		0.05		U	0.05		U	0.05	0.061		0.05
Zinc, Dissolved	mg/L	57.9		0.2	1		0.2		U	0.2	45		0.2
Conventionals													
Acidity, Total	mg/L		NA			NA			NA			NA	
Alkalinity, Total	mg/L		NA			NA			NA			NA	
Chloride	mg/L		NA			NA			NA			NA	
Nitrate/Nitrite-N	mg/L		NA			NA			NA			NA	
Phosphorus, Total	mg/L		NA			NA			NA			NA	
Sulfate	mg/L		NA			NA			NA			NA	

TABLE 1
PDI SUPPLEMENT GROUNDWATER DATA AND TITRATION STUDY
Former Rod and Wire Mill Pilot Scale Work Plan
Sparrows Point, Maryland

Sample Location		RW-2D pH 9			RW-2D pH 10.5			CW-MW 1(S) pH 7.5			CW-MW 1(S) pH 9		
Lab ID		2140225013			2140225014			2140225015			2140225016		
Sample Date		4/27/2016			4/27/2016			4/27/2016			4/27/2016		
Matrix		Groundwater			Groundwater			Groundwater			Groundwater		
Remarks													
Parameter	Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Total Metals													
Aluminum, Total	mg/L		NA			NA			NA			NA	
Antimony, Total	mg/L		NA			NA			NA			NA	
Arsenic, Total	mg/L		NA			NA			NA			NA	
Cadmium, Total	mg/L		NA			NA			NA			NA	
Calcium, Total	mg/L		NA			NA			NA			NA	
Copper, Total	mg/L		NA			NA			NA			NA	
Iron, Total	mg/L		NA			NA			NA			NA	
Lead, Total	mg/L		NA			NA			NA			NA	
Magnesium, Total	mg/L		NA			NA			NA			NA	
Manganese, Total	mg/L		NA			NA			NA			NA	
Nickel, Total	mg/L		NA			NA			NA			NA	
Potassium, Total	mg/L		NA			NA			NA			NA	
Silicon, Total	mg/L		NA			NA			NA			NA	
Sodium, Total	mg/L		NA			NA			NA			NA	
Zinc, Total	mg/L		NA			NA			NA			NA	
Dissolved Metals													
Aluminum, Dissolved	mg/L		U	0.1		U	1		U	1		U	1
Antimony, Dissolved	mg/L		U	0.02		U	0.2		U	0.2		U	0.2
Arsenic, Dissolved	mg/L		U	0.008		U	0.08		U	0.08		U	0.08
Barium, Dissolved	mg/L		U	0.01		U	0.1		U	0.1		U	0.1
Beryllium, Dissolved	mg/L		U	0.004		U	0.04		U	0.04		U	0.04
Cadmium, Dissolved	mg/L		U	0.002		U	0.02		U	0.02		U	0.02
Calcium, Dissolved	mg/L	20.4		0.1	201		1	9.6		1	8.2		1
Chromium, Dissolved	mg/L		U	0.005		U	0.05		U	0.05		U	0.05
Cobalt, Dissolved	mg/L		U	0.005		U	0.05		U	0.05		U	0.05
Copper, Dissolved	mg/L		U	0.01		U	0.1		U	0.1		U	0.1
Iron, Dissolved	mg/L	0.12		0.06		U	0.6		U	0.6		U	0.6
Lead, Dissolved	mg/L		U	0.006		U	0.06		U	0.06		U	0.06
Magnesium, Dissolved	mg/L	11.8		0.1	62.9		1	3.4		1	3.1		1
Manganese, Dissolved	mg/L	0.43		0.005	0.31		0.05	0.16		0.05		U	0.05
Mercury, Dissolved	mg/L		U	0.0005		U	0.0005		U	0.0005		U	0.0005
Nickel, Dissolved	mg/L		U	0.02		U	0.2		U	0.2		U	0.2
Potassium, Dissolved	mg/L	1		0.5	10.7		5		U	5		U	5
Selenium, Dissolved	mg/L		U	0.02		U	0.2		U	0.2		U	0.2
Silver, Dissolved	mg/L		U	0.004		U	0.04		U	0.04		U	0.04
Sodium, Dissolved	mg/L	93.1		0.5	1070		5	74.8		5	81.9		5
Thallium, Dissolved	mg/L		U	0.02		U	0.2		U	0.2		U	0.2
Vanadium, Dissolved	mg/L		U	0.005		U	0.05		U	0.05		U	0.05
Zinc, Dissolved	mg/L	0.043		0.02		U	0.2		U	0.2		U	0.2
Conventionals													
Acidity, Total	mg/L		NA			NA			NA			NA	
Alkalinity, Total	mg/L		NA			NA			NA			NA	
Chloride	mg/L		NA			NA			NA			NA	
Nitrate/Nitrite-N	mg/L		NA			NA			NA			NA	
Phosphorus, Total	mg/L		NA			NA			NA			NA	
Sulfate	mg/L		NA			NA			NA			NA	

TABLE 1
PDI SUPPLEMENT GROUNDWATER DATA AND TITRATION STUDY
Former Rod and Wire Mill Pilot Scale Work Plan
Sparrows Point, Maryland

Sample Location		CW-MW 1(S) pH 10.5			CW-MW 2(I) pH 7.5			CW-MW 2(I) pH 9			CW-MW 2(I) pH 10.5		
Lab ID		2140225017			2140225018			2140225019			2140225020		
Sample Date		4/27/2016			4/27/2016			4/27/2016			4/27/2016		
Matrix		Groundwater			Groundwater			Groundwater			Groundwater		
Remarks													
Parameter	Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Total Metals													
Aluminum, Total	mg/L		NA			NA			NA			NA	
Antimony, Total	mg/L		NA			NA			NA			NA	
Arsenic, Total	mg/L		NA			NA			NA			NA	
Cadmium, Total	mg/L		NA			NA			NA			NA	
Calcium, Total	mg/L		NA			NA			NA			NA	
Copper, Total	mg/L		NA			NA			NA			NA	
Iron, Total	mg/L		NA			NA			NA			NA	
Lead, Total	mg/L		NA			NA			NA			NA	
Magnesium, Total	mg/L		NA			NA			NA			NA	
Manganese, Total	mg/L		NA			NA			NA			NA	
Nickel, Total	mg/L		NA			NA			NA			NA	
Potassium, Total	mg/L		NA			NA			NA			NA	
Silicon, Total	mg/L		NA			NA			NA			NA	
Sodium, Total	mg/L		NA			NA			NA			NA	
Zinc, Total	mg/L		NA			NA			NA			NA	
Dissolved Metals													
Aluminum, Dissolved	mg/L		U	1		U	0.1		U	1		U	1
Antimony, Dissolved	mg/L		U	0.2		U	0.02		U	0.2		U	0.2
Arsenic, Dissolved	mg/L		U	0.08		U	0.008		U	0.08		U	0.08
Barium, Dissolved	mg/L		U	0.1		U	0.01		U	0.1		U	0.1
Beryllium, Dissolved	mg/L		U	0.04		U	0.004		U	0.04		U	0.04
Cadmium, Dissolved	mg/L		U	0.02		U	0.002		U	0.02		U	0.02
Calcium, Dissolved	mg/L	6.5		1	3		0.1	30.1		1	26.2		1
Chromium, Dissolved	mg/L		U	0.05		U	0.005		U	0.05		U	0.05
Cobalt, Dissolved	mg/L		U	0.05		U	0.005		U	0.05		U	0.05
Copper, Dissolved	mg/L		U	0.1		U	0.01		U	0.1		U	0.1
Iron, Dissolved	mg/L		U	0.6		U	0.06		U	0.6		U	0.6
Lead, Dissolved	mg/L		U	0.06		U	0.006		U	0.06		U	0.06
Magnesium, Dissolved	mg/L	2.6		1	1.1		0.1	10.7		1	9		1
Manganese, Dissolved	mg/L		U	0.05	0.16		0.005	0.37		0.05		U	0.05
Mercury, Dissolved	mg/L		U	0.0005		U	0.0005		U	0.0005		U	0.0005
Nickel, Dissolved	mg/L		U	0.2		U	0.02		U	0.2		U	0.2
Potassium, Dissolved	mg/L		U	5		U	0.5		U	5		U	5
Selenium, Dissolved	mg/L		U	0.2		U	0.02		U	0.2		U	0.2
Silver, Dissolved	mg/L		U	0.04		U	0.004		U	0.04		U	0.04
Sodium, Dissolved	mg/L	145		5	11.5		0.5	138		5	194		5
Thallium, Dissolved	mg/L		U	0.2		U	0.02		U	0.2		U	0.2
Vanadium, Dissolved	mg/L		U	0.05		U	0.005		U	0.05		U	0.05
Zinc, Dissolved	mg/L		U	0.2		U	0.02		U	0.2		U	0.2
Conventionals													
Acidity, Total	mg/L		NA			NA			NA			NA	
Alkalinity, Total	mg/L		NA			NA			NA			NA	
Chloride	mg/L		NA			NA			NA			NA	
Nitrate/Nitrite-N	mg/L		NA			NA			NA			NA	
Phosphorus, Total	mg/L		NA			NA			NA			NA	
Sulfate	mg/L		NA			NA			NA			NA	

TABLE 2
PDI SUPPLEMENT SOIL REAGENT JAR TESTING
Former Rod and Wire Mill, Pilot Scale Work Plan
Sparrows Point, Maryland

Material	Paste PH	Date
Soil	4.99	12-May
	5.07	13-May
	5.09	16-May
Agricultural Lime w/ Soil (1:5)	6.15	12-May
	6.12	13-May
	6.34	16-May
Agricultural Lime w/ Soil (2:5)	6.3	12-May
	6.17	13-May
Agricultural Lime w/ Soil (3:5)	6.3	12-May
	6.45	13-May
Agricultural Lime w/ Soil (1:1)	6.4	12-May
	6.67	13-May
	7.07	16-May
	8.2	6-Jun
Enviroblend w/ Soil (1:4)	8.4	12-May
	10.55	13-May
	10.38	16-May
Terrabond w/ Soil (1:10)	9.2	24-May
	10.2	25-May
	8.82	6-Jun
Terrabond w/ Soil (1:5)	11.3	24-May
	11.3	25-May
	11.6	6-Jun
Terrabond w/ Soil (1:2)	11.8	24-May
	11.8	25-May
	11.98	6-Jun

TABLE 3
PDI SUPPLEMENT GROUNDWATER REAGENT JAR TEST
Former Rod and Wire Mill Pilot Scale Work Plan
Sparrows Point, Maryland

Material	PH	Date
Groundwater	5.9	12-May
	5.9	13-May
Groundwater/Lime	7	12-May
	7.8	13-May
	8.7	6-Jun
Groundwater/Enviroblend	10.7	12-May
	11.17	13-May
	9.2 *	6-Jun
Groundwater/Terrabond	11.4	1-Jun
	11.4	6-Jun

* Possible calibration error on pH probe.

TABLE 4
 REAGENT MEP/SPLP STUDY SUMMARY
 Former Rod and Wire Mill Area
 Sparrows Point Terminal, Sparrows Point, Maryland
 2016-3421

Sample	Units	Groundwater	Terra 5% (Rot 1)	Reduction	Terra 5% (Rot 2)	Reduction	Terra 5% (Rot 3)	Reduction
PH	s.u.		7.02		6.81		NA	
Cadmium, dis	mg/L	11	1.1	90.00%	4	63.64%	5.9	46.36%
Zinc, dis	mg/L	710	253	64.37%	331	53.38%	398	43.94%
Arsenic, dis	mg/L	ND	ND	NA	ND	NA	0.0084	NA
Iron, dis	mg/L	140	ND	100.00%	ND	ND	33	ND
Magnesium, dis	mg/L	96	159	-65.63%	100	-4.17%	129	-34.38%
Manganese, dis	mg/L	24	14.5	39.58%	14.1	41.25%	19.7	17.92%

Sample	Units	Groundwater	Terra 30% (Rot 1)	Reduction	Terra 30% (Rot 2)	Reduction	Terra 20% (Rot 3)	Reduction
PH	s.u.		8.44		7.64		NA	
Cadmium, dis	mg/L	11	0.014	99.87%	0.44	96.00%	1.6	85.45%
Zinc, dis	mg/L	710	1	99.86%	22.8	96.79%	279	60.70%
Arsenic, dis	mg/L	ND	ND	NA	ND	NA	ND	NA
Iron, dis	mg/L	140	ND	100.00%	ND	ND	0.12	99.91%
Magnesium, dis	mg/L	96	204	-112.50%	280	-191.67%	188	-95.83%
Manganese, dis	mg/L	24	0.043	99.82%	16.1	32.92%	22.7	5.42%

Sample	Units	Groundwater	EB 10% (Rot 1)	Reduction	EB10% (Rot 2)	Reduction	EB 10% (Rot 3)	Reduction
PH	s.u.		7.04		6.97	NA	7	
Cadmium, dis	mg/L	11	6.7	39.09%	10.1	8.18%	12	-9.09%
Zinc, dis	mg/L	710	261	63.24%	533	NA	720	-1.41%
Arsenic, dis	mg/L	ND	ND	NA	ND	ND	0.023	NA
Iron, dis	mg/L	140	ND	100.00%	ND	100.00%	ND	NA
Magnesium, dis	mg/L	96	184	-91.67%	158	-64.58%	155	-61.46%
Manganese, dis	mg/L	24	13.4	44.17%	19.1	20%	20.1	16.25%

Sample	Units	Groundwater	EB 20% (Rot 1)	Reduction	EB20% (Rot 2)	Reduction	EB20% (Rot 3)	Reduction
PH	s.u.		9.23		9.1	NA	7.44	
Cadmium, dis	mg/L	11	0.024	99.78%	0.051	99.54%	7.6	30.91%
Zinc, dis	mg/L	710	0.72	99.90%	0.29	99.96%	56.5	92.04%
Arsenic, dis	mg/L	ND	ND	NA	ND	ND	ND	NA
Iron, dis	mg/L	140	ND	100.00%	ND	100.00%	ND	NA
Magnesium, dis	mg/L	96	255	-165.63%	373	-288.54%	302	-214.58%
Manganese, dis	mg/L	24	0.044	99.82%	0.84	97%	24.7	-2.92%

TABLE 5
MONITORING WELL NETWORK MODIFICATIONS
Former Rod and Wire Mill Area
Sparrows Point Terminal, Sparrows Point, Maryland
2016-3421

	Existing Monitoring Well to Remain	Existing Monitoring Well to be Abandoned and Replaced
<i>Shallow Zone</i>		
RW02-PZM000	X	
RW03-PZM003	X	
RW04-PZM003	X	
RW05-PZP001	X	
RW06-PZM001	X	
RW07-PZM004	X	
RW08-PZM003		X
RW09-PZM004		X
RW10-PZM004		X
RW11-PZM004		X
RW12-PZM004		X
RW19-PZP000	X	
RW20-PZP000		X
RW22		X
RW23		X
RW24		X
TS04-PDM004		X
TS04-PPM007	X	

<i>Intermediate Zone</i>		
RW01-PZM020	X	
RW02-PZM020	X	
RW07-PZM017	X	
RW10-PZM020		X
RW13-PZM020		X
RW14-PZM020	X	
RW15-PZM020		X
RW16-PZM020		X
RW17-PZM019		X
RW19-PZM020	X	
RW20-PZM020		X
RW21-PZM023		X
RW22		X
RW23		X
RW24		X
TS04-PZM023	X	

TABLE 6
 ENHANCED GROUNDWATER MONITORING PROGRAM
 Former Rod and Wire Mill Area
 Sparrows Point Terminal, Sparrows Point, Maryland
 2016-3421

GROUNDWATER WELL	FREQUENCY	PARAMETERS
Existing Wells		
RW-O2-PZM020	Monthly	pH, Zn, Cd
RW-01-PZM020	Monthly	pH, Zn, Cd
RW-07-PZ017	Monthly	pH, Zn, Cd
RW-14-PZ020	Monthly	pH, Zn, Cd
RW-15-PZM020	Monthly	pH, Zn, Cd
RW-19-PZM020	Quarterly	pH, Zn, Cd
TS04-PZM023	Quarterly	pH, Zn, Cd
Re-Located Wells		
RW-10A	Monthly	pH, Zn, Cd
New Wells		
A thru P	Monthly	pH, Zn, Cd

Notes:

1. Sampling frequency to be integrated into current site-wide monitoring program.
2. All new/replacement wells to be sampled at least once prior to a shutdown of the pump and treat system (unless otherwise approved by MDE and/or USEPA).
3. Sampling frequency to be re-evaluated after one year



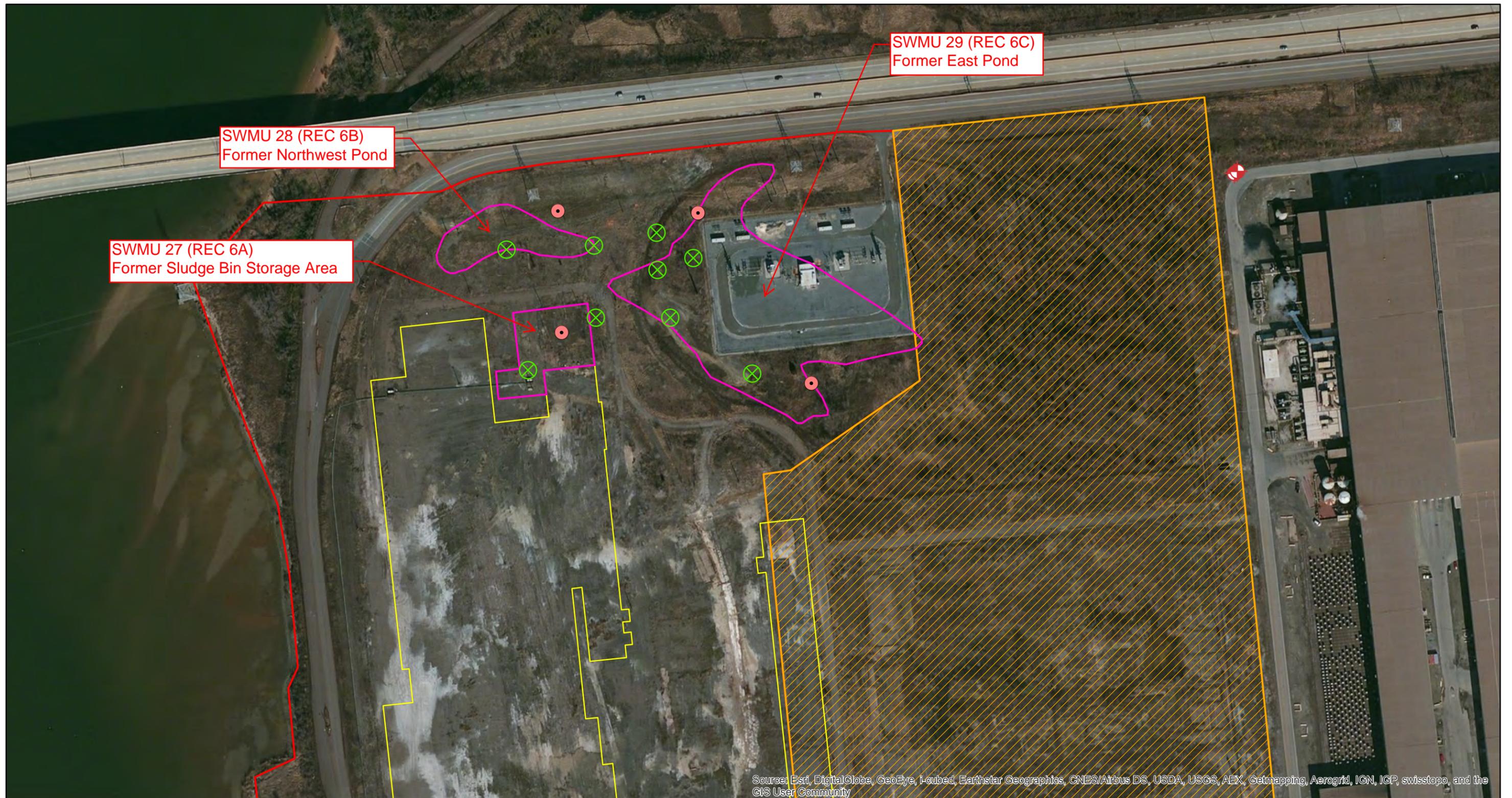
FIGURES



Former Rod and Wire Mill Area

Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

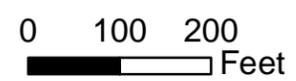
 <p>Environmental Engineers</p>	<p align="center"> Site Location Map PDI Supplemental Data Collection Parcel A-3, Former Rod and Wire Mill Area </p> <p align="center"> 0 1,000 2,000 3,000 4,000 Feet </p>	<p align="center">Legend</p> <p>  Parcel A-1  Parcel A-3  Property Boundary </p>	<p align="center">  Figure 1 </p>
--	--	--	--



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



1 inch = 200 feet



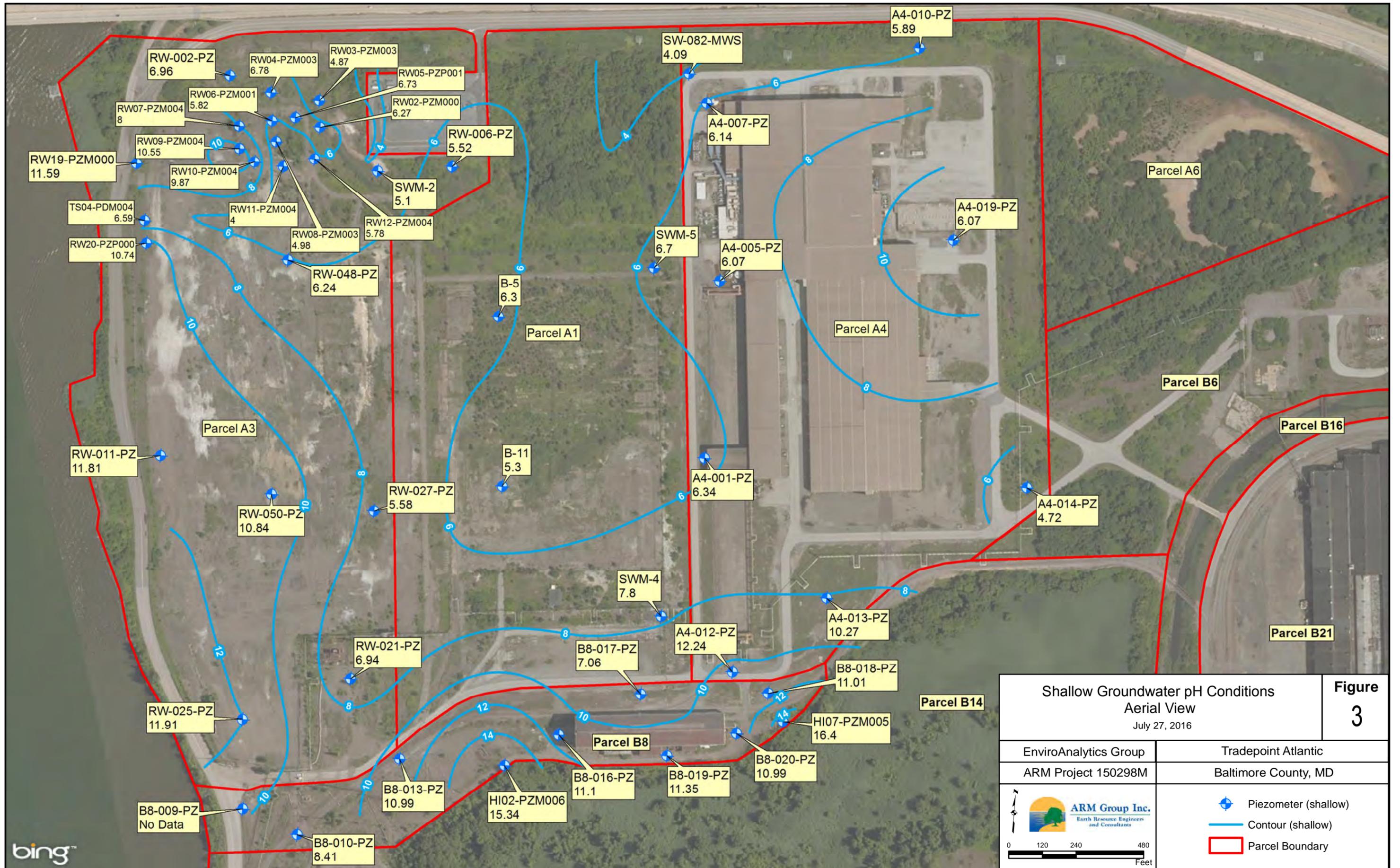
Proposed Investigation Plan

PDI Supplemental Data Collection Parcel A-3, Former Rod and Wire Mill Area

Legend

- ⊗ Proposed Test Pit
- Proposed Soil Boring
- ⊕ Proposed Monitoring Well
- Former Sludge Bin Storage Area
- Former Building Footprint
- Parcel A-1 Boundary
- Parcel A-3 Boundary
- Former East Pond
- Former Northwest Pond

Figure
2



Shallow Groundwater pH Conditions Aerial View July 27, 2016		Figure 3
EnviroAnalytics Group ARM Project 150298M	Tradepoint Atlantic Baltimore County, MD	
		<ul style="list-style-type: none"> Piezometer (shallow) Contour (shallow) Parcel Boundary



Intermediate Groundwater pH Conditions
 Aerial View
 July 27, 2016

Figure
 4

EnviroAnalytics Group	Tradepoint Atlantic
ARM Project 150298M	Baltimore County, MD


 ARM Group Inc.
 Earth Resource Engineers
 and Consultants

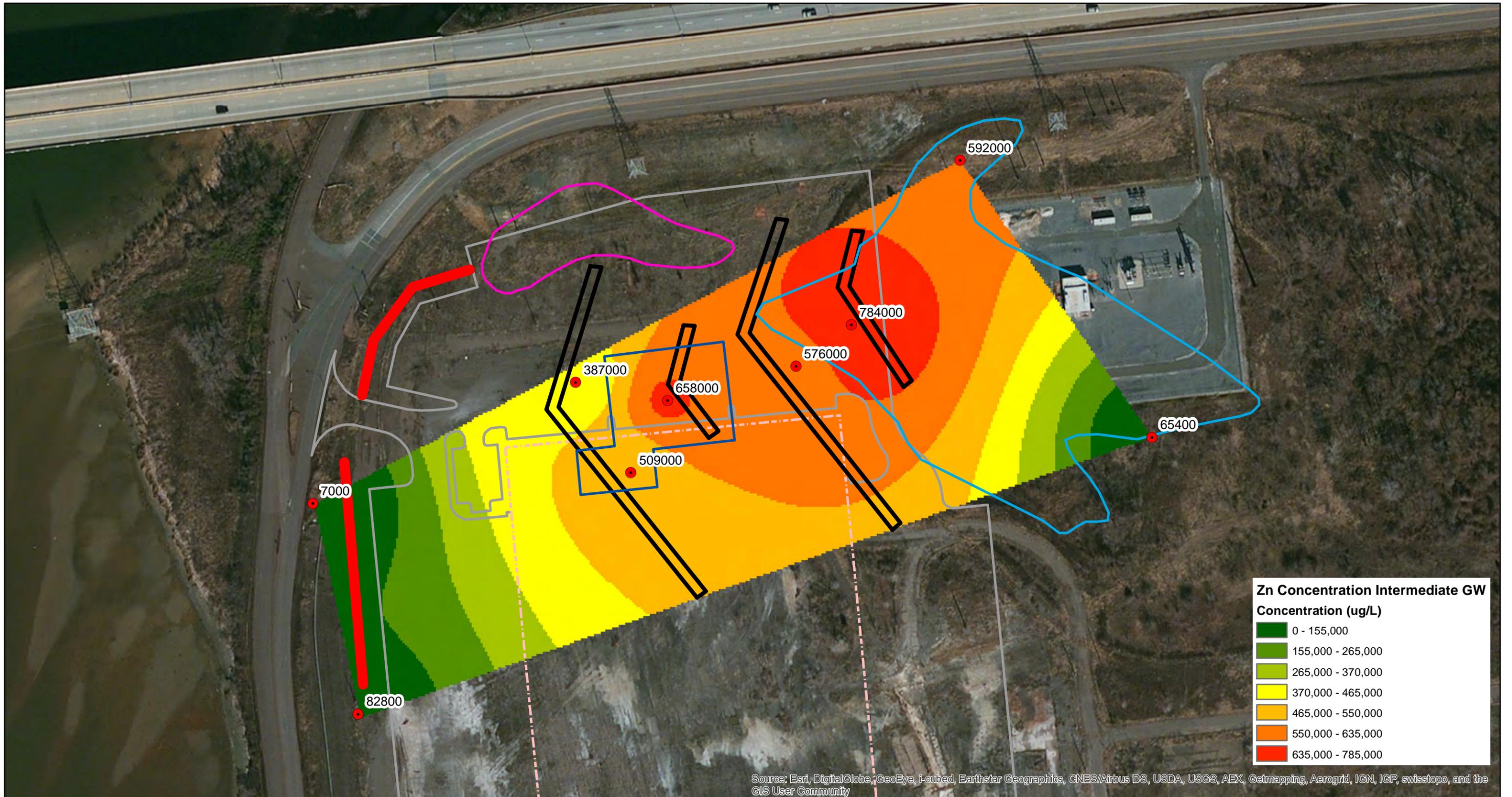

 0 60 120 240
 Feet

-  Piezometer (intermediate)
-  Contour (intermediate)
-  Parcel Boundary



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

		1 inch = 200 feet	<p align="center"> Parcel A-3 Former Rod and Wire Mill Area PDI Supplemental Data Collection Sampling Locations </p>	<p align="center">Legend</p> <ul style="list-style-type: none"> Upgradient Monitoring Well Approximate Soil Boring Location Approximate Test Pit Location Former East Pond Former Northwest Pond Former Sludge Bin Storage Area 	<p align="center">Figure</p> <p align="center">5</p>
	Environmental Engineers				



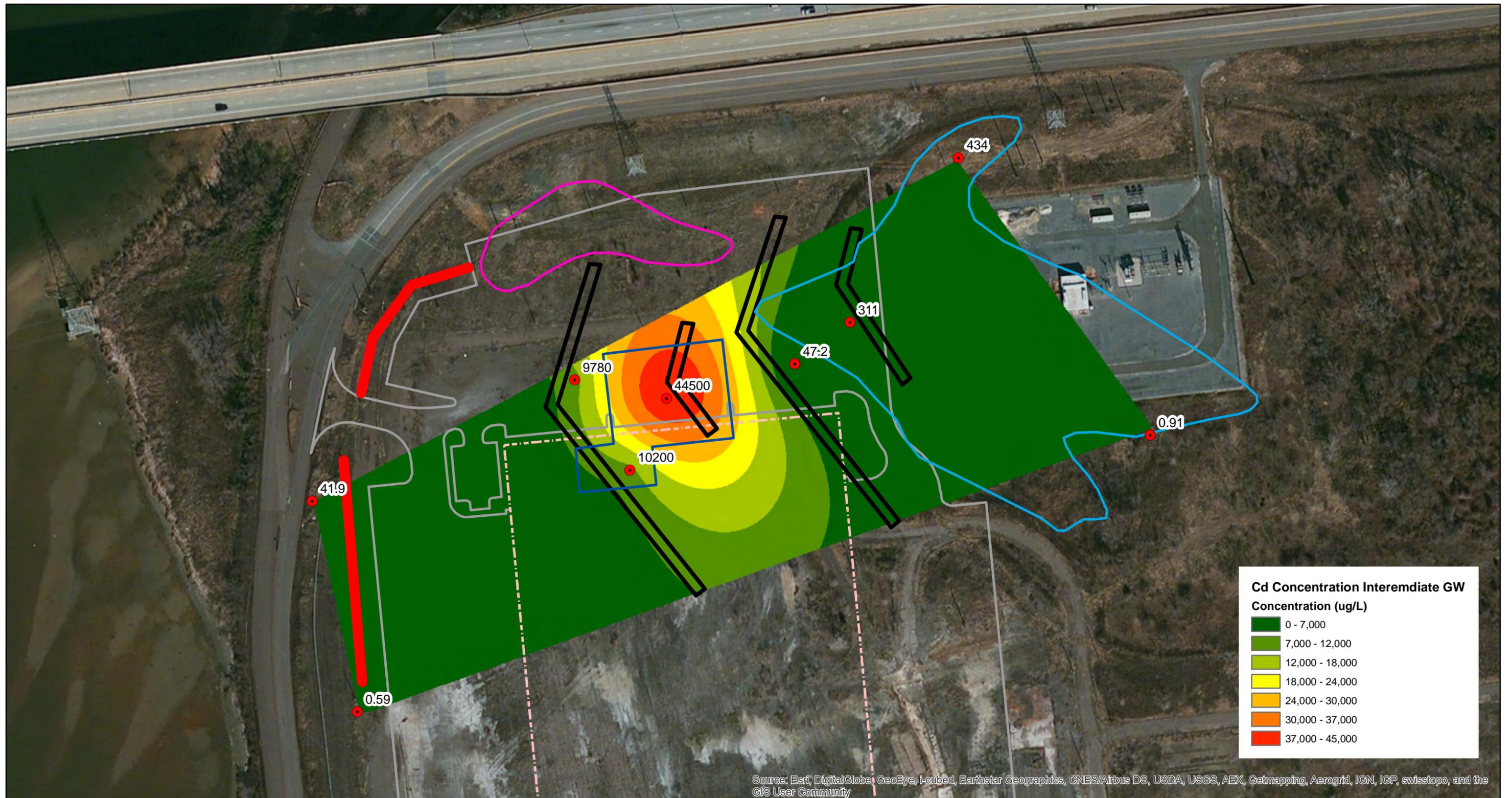
EnviroAnalytics
Group
Environmental Engineers

0 100 200 Feet

Parcel A-3
Former Rod and Wire Mill Area
Treatment Trench Layout - Zinc

- Legend**
- Int GW Sample Location
 - Former East Pond
 - Former Northwest Pond
 - Former Sludge Bin Storage Area
 - Proposed Treatment Trench Location
 - Proposed Treatment Trench Contingency Location
 - Proposed Building Footprint
 - Proposed Paved Area

Figure
6A

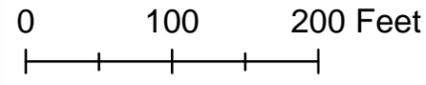


Cd Concentration Intermediate GW Concentration (ug/L)

0 - 7,000
7,000 - 12,000
12,000 - 18,000
18,000 - 24,000
24,000 - 30,000
30,000 - 37,000
37,000 - 45,000



EnviroAnalytics
Group
Environmental Engineers

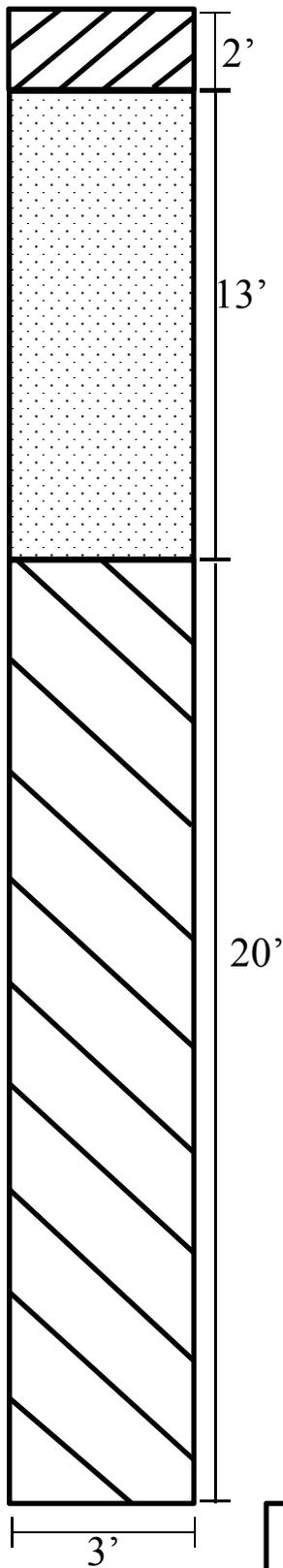


Parcel A-3
Former Rod and Wire Mill Area
Treatment Trench Layout - Cadmium

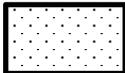
Legend

● Int GW Sample Location	Proposed Treatment Trench Location
Former East Pond	Proposed Treatment Trench Contingency Location
Former Northwest Pond	Proposed Building Footprint
Former Sludge Bin Storage Area	Proposed Paved Area

Figure 6B



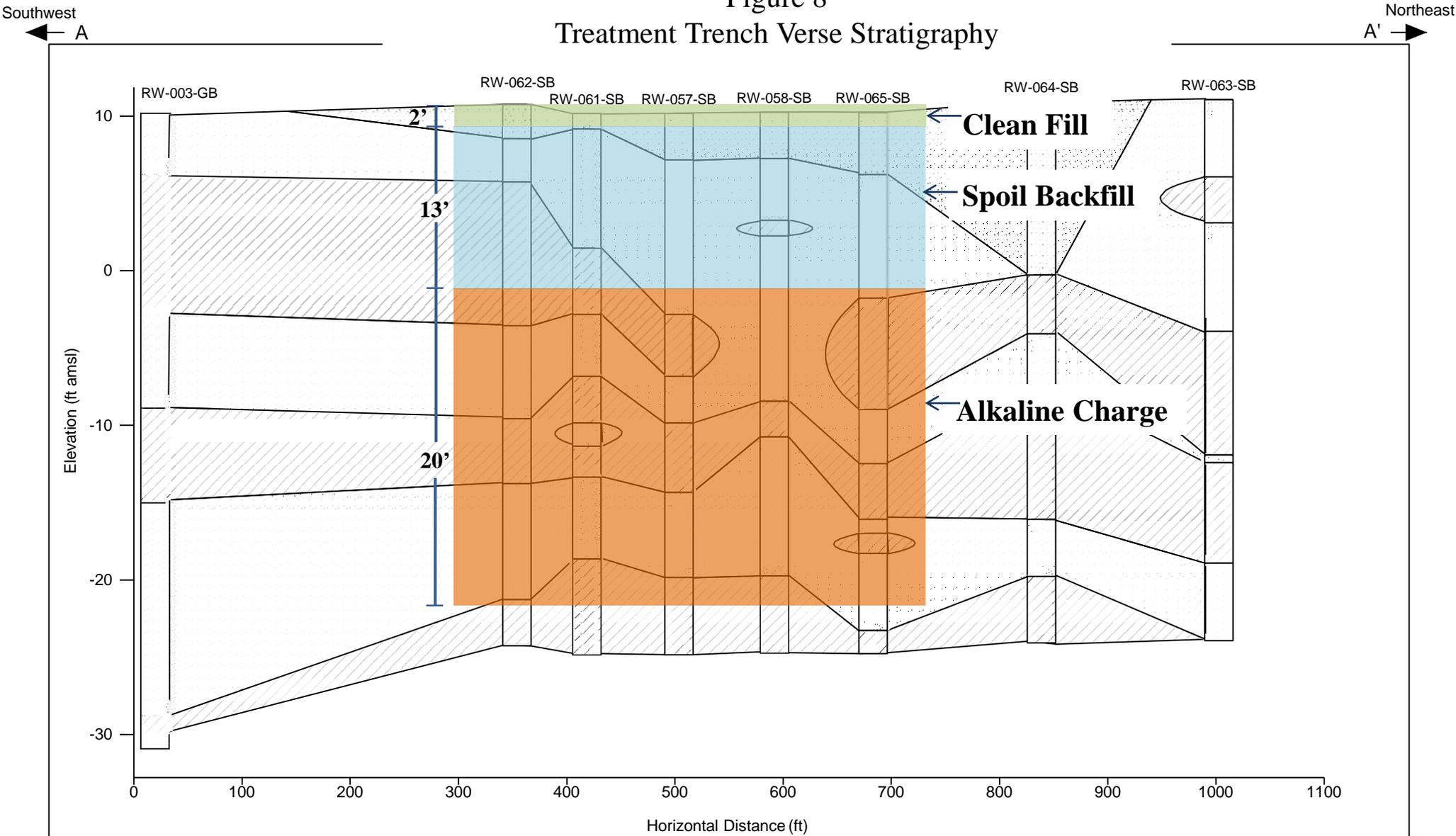
Legend

-  On-Site Clean Fill
-  Backfill Spoils
-  Alkaline Charge

Former Rod and Wire Mill Area Sparrows Point Terminal Sparrows Point, Maryland		
Treatment Trench Cross-Section		
 <small>Engineering for the Environment. Planning for People.[™]</small> <small>1055 Andrew Drive, Suite A West Chester, PA 19380-4293 tel 610.840.9100 fax 610.840.9190 www.advancedgeoservices.com</small>	Project No.: 2016-3421	FIGURE 7

Figure 8

Treatment Trench Verse Stratigraphy



Parcel A3 (Rod & Wire Mill)
Cross Section

Tradepoint Atlantic
Baltimore County, MD



ARM Group Inc.
Earth Resource Engineers
and Consultants

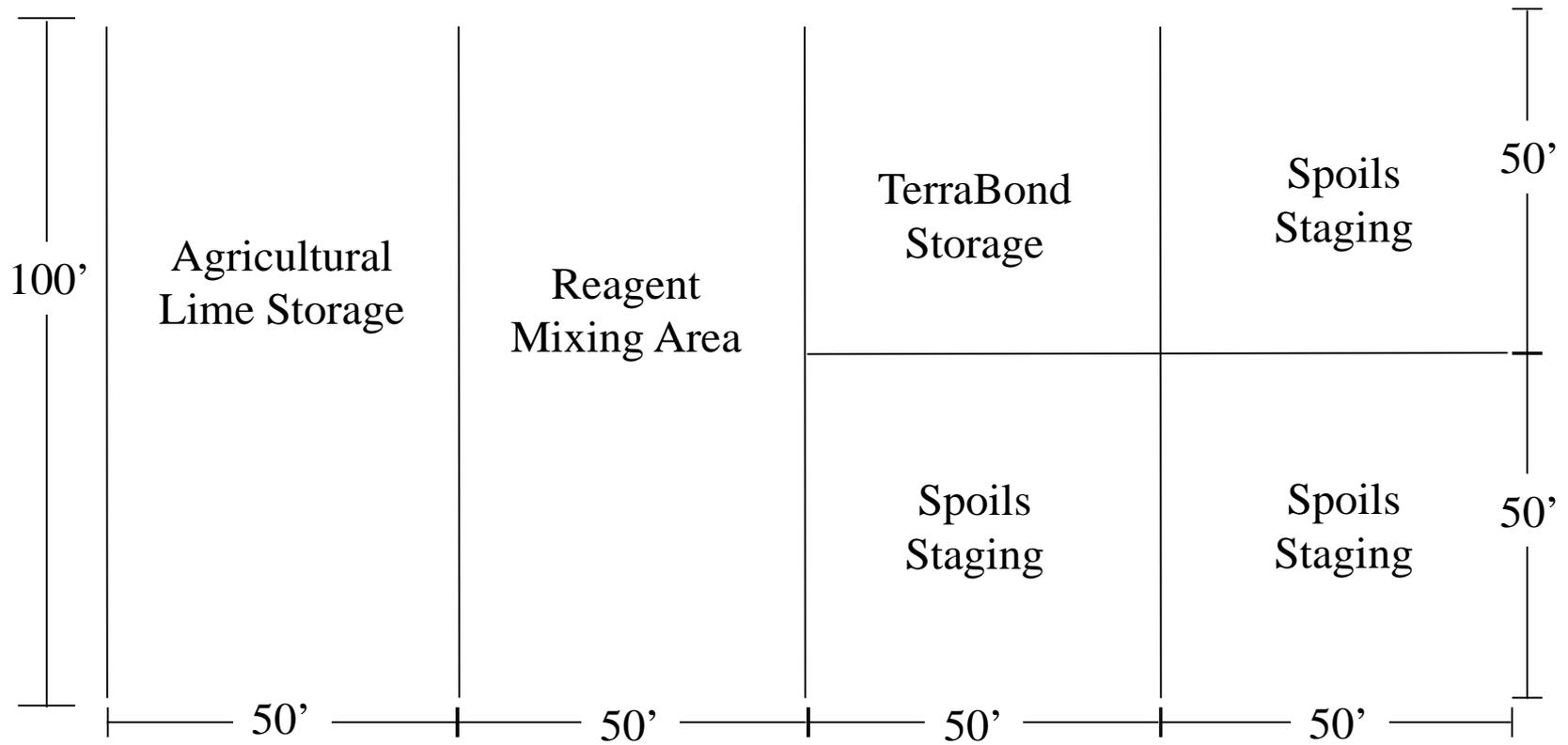
Cross Section A-A'

EnviroAnalytics Group
ARM Project 150298M
March 2016

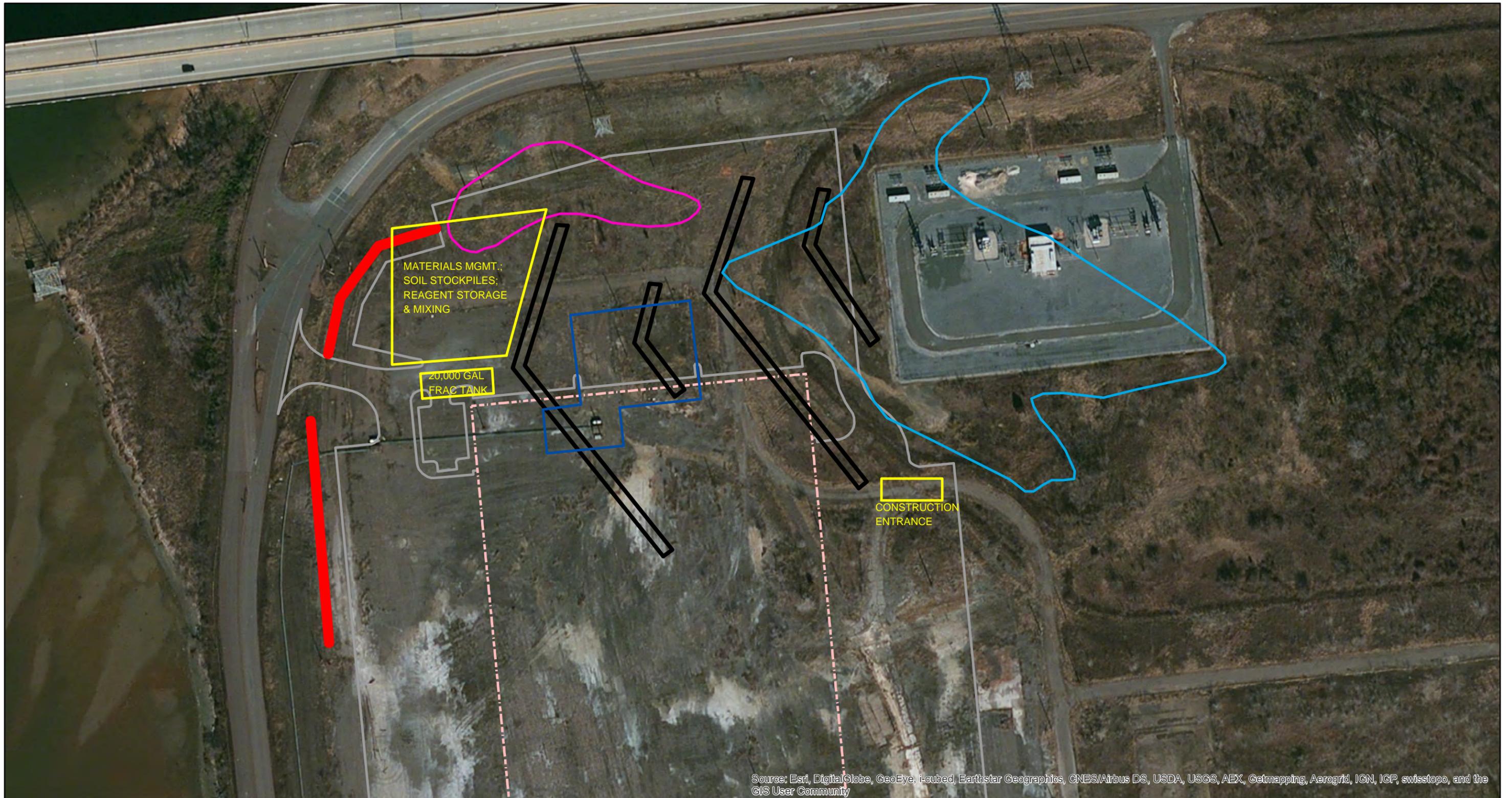
LEGEND

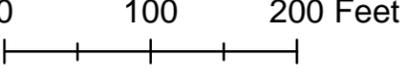
-  Gravel/Slag
-  Sand
-  Clay

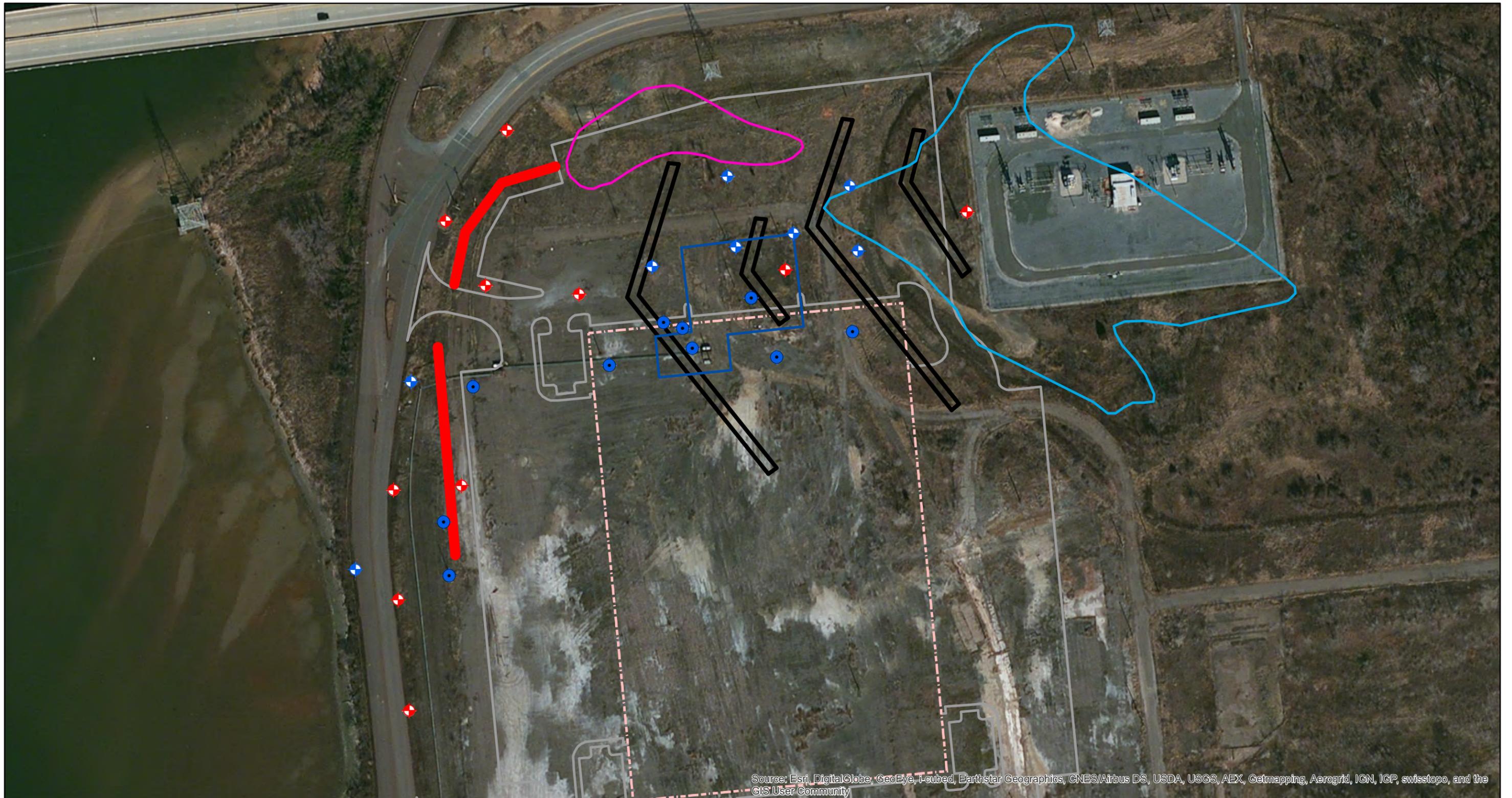
Note: amsl = above mean sea level
Cross-section is vertically exaggerated approximately 14:1



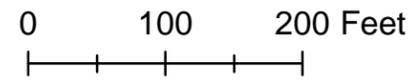
Former Rod and Wire Mill Area Sparrows Point Terminal Sparrows Point, Maryland			
Materials Management Area Preliminary Layout			
		 <small>Engineering for the Environment, Planning for People.TM</small> 1055 Andrew Drive, Suite A West Chester, PA 19380-4293 tel 610.840.9100 fax 610.840.9190 www.advancedgeoservices.com	FIGURE 9
		Project No.: 2016-3421	



		<p>0 100 200 Feet</p> 	<p>Parcel A-3 Former Rod and Wire Mill Area</p> <p>Construction Area Layout</p>	<p>Legend</p> <ul style="list-style-type: none">  Former East Pond  Former Northwest Pond  Former Sludge Bin Storage Area  Construction Support Areas  Proposed Treatment Trench Location  Proposed Treatment Trench Contingency Location  Proposed Building Footprint  Proposed Paved Area 	<p>Figure</p> <p>10</p>
	<p>Environmental Engineers</p>				



Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



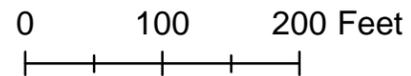
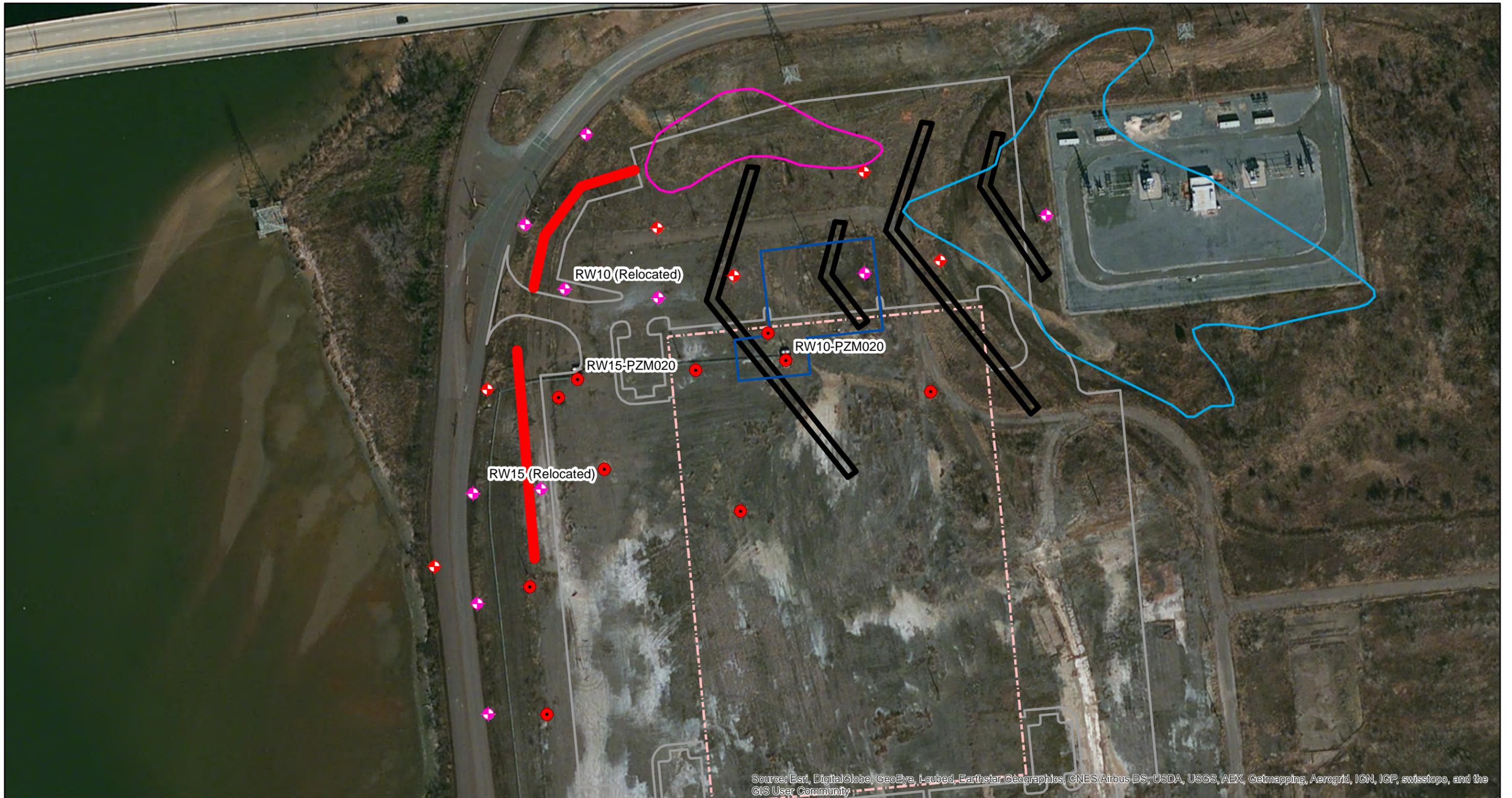
Parcel A-3
Former Rod and Wire Mill Area
Enhanced GW Monitoring Network
Proposed MW Shallow Zone

Legend

- ◆ Proposed New Monitoring Well Shallow Zone
- Proposed Abandoned Monitoring Well Shallow Zone
- ◆ Monitoring Well Shallow Zone
- █ Proposed Treatment Trench Contingency Location
- Former East Pond
- Former Northwest Pond
- Former Sludge Bin Storage Area
- Proposed Treatment Trench Location
- Proposed Building Footprint
- Proposed Paved Area

Proposed MW locations may change slightly based on final site development layout

Figure
11A

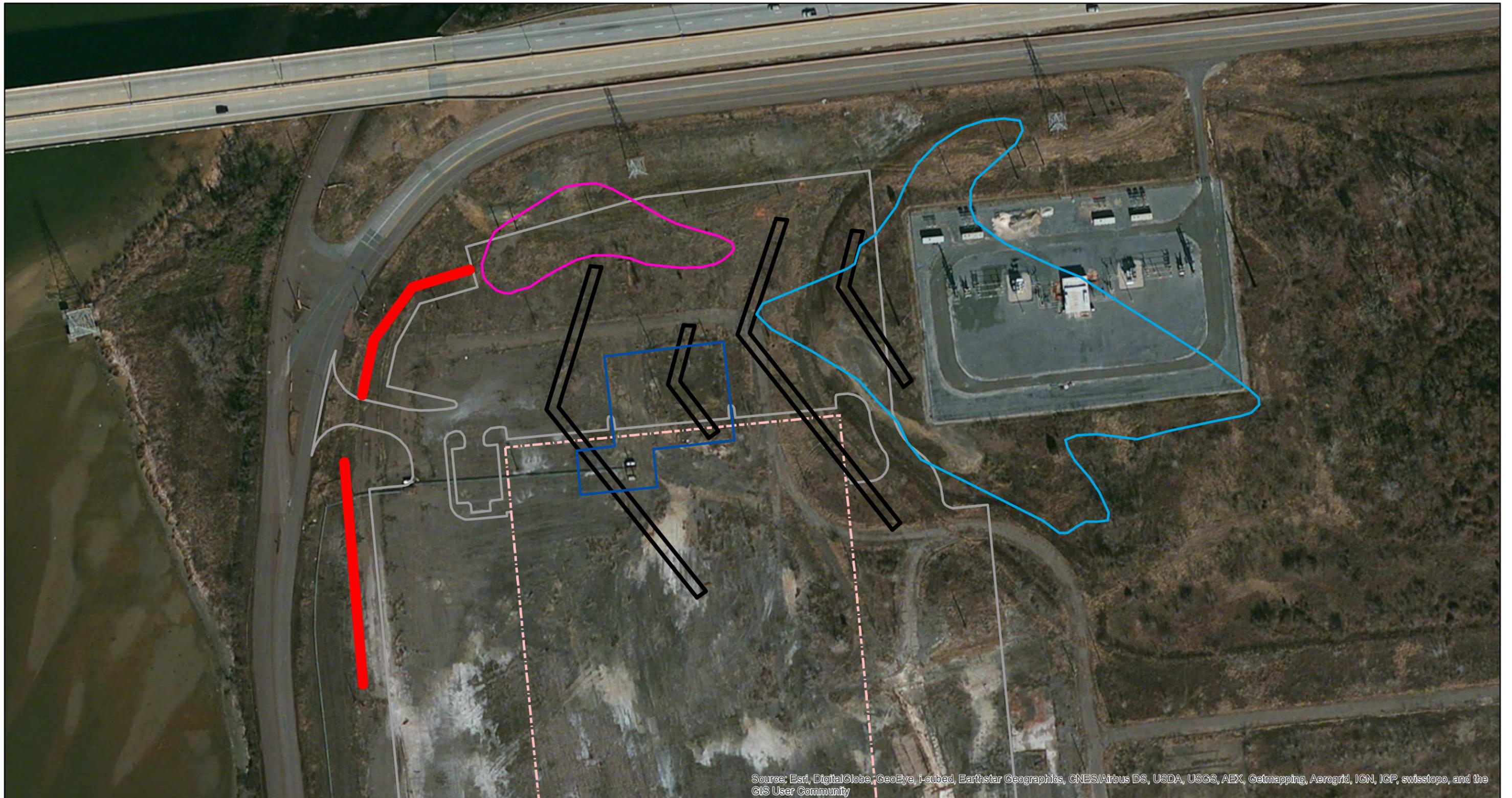


Parcel A-3
Former Rod and Wire Mill Area
Enhanced GW Monitoring Network
Proposed MW Intermediate Zone

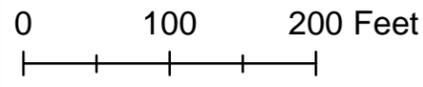
- Legend**
- ◆ Proposed New Monitoring Well Intermediate Zone
 - Proposed Abandoned Monitoring Well Intermediate Zone
 - ◆ Monitoring Well Intermediate Zone
 - Former Sludge Bin Storage Area
 - Proposed Treatment Trench Location
 - Proposed Treatment Trench Contingency Location
 - Proposed Building Footprint
 - Former East Pond
 - Former Northwest Pond
 - Proposed Paved Area

Proposed MW locations may change slightly based on final site development layout

**Figure
11B**



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Group
Environmental Engineers



Parcel A-3
Former Rod and Wire Mill Area
Contingency Treatment Trench Location

- Legend**
- Former East Pond
 - Former Northwest Pond
 - Former Sludge Bin Storage Area
 - Proposed Treatment Trench Location
 - Proposed Treatment Trench Contingency Location
 - Proposed Building Footprint
 - Proposed Paved Area

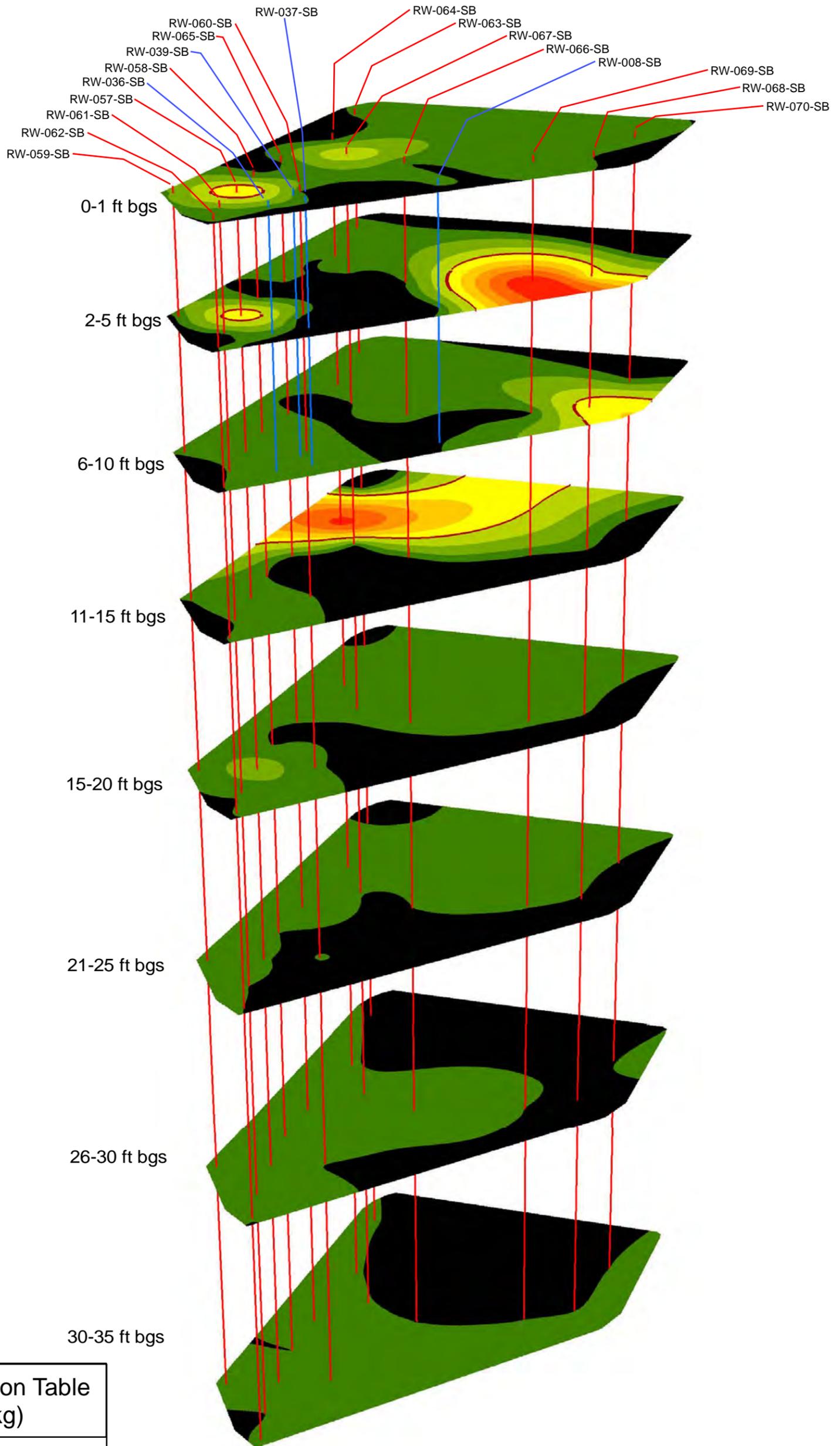
Figure
12



APPENDICES



APPENDIX A



**Concentration Table
(mg/kg)**

■	ND - 0.38 (GW Protection)
■	>0.38 - 200
■	>200 - 550
■	>550 - 980 (PAL)
■	>980 - 1,400
■	>1,400 - 1,900
■	>1,900 - 2,400
■	>2,400 - 3,000
■	>3,000 - 3,600

Parcel A3 (Rod & Wire Mill)
Soil Cadmium Contours (mg/kg)
Pre-Design Investigation (All Depths)
March 15, 2016

**Figure
6**

EnviroAnalytics Group

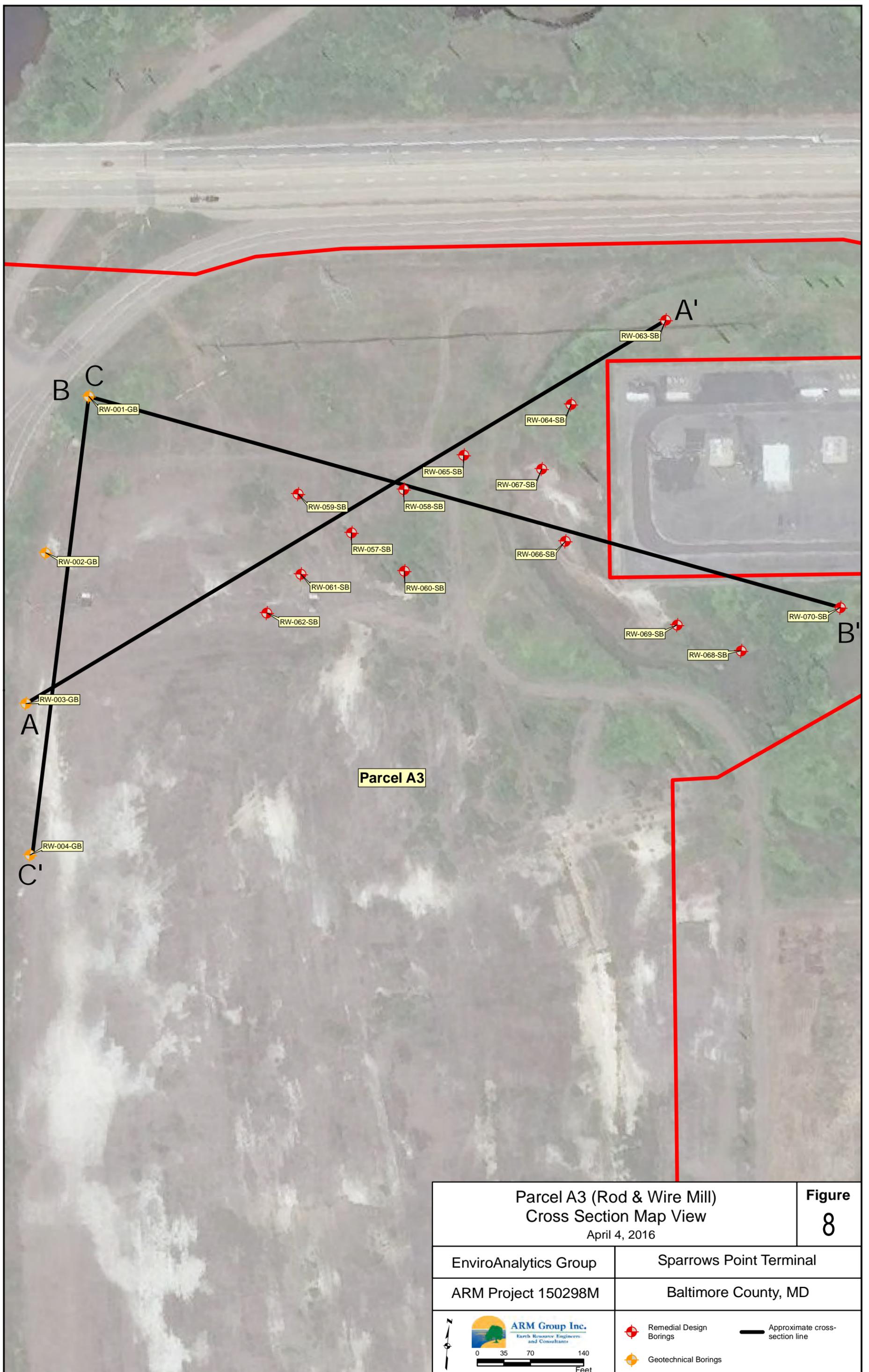
Tradepoint Atlantic

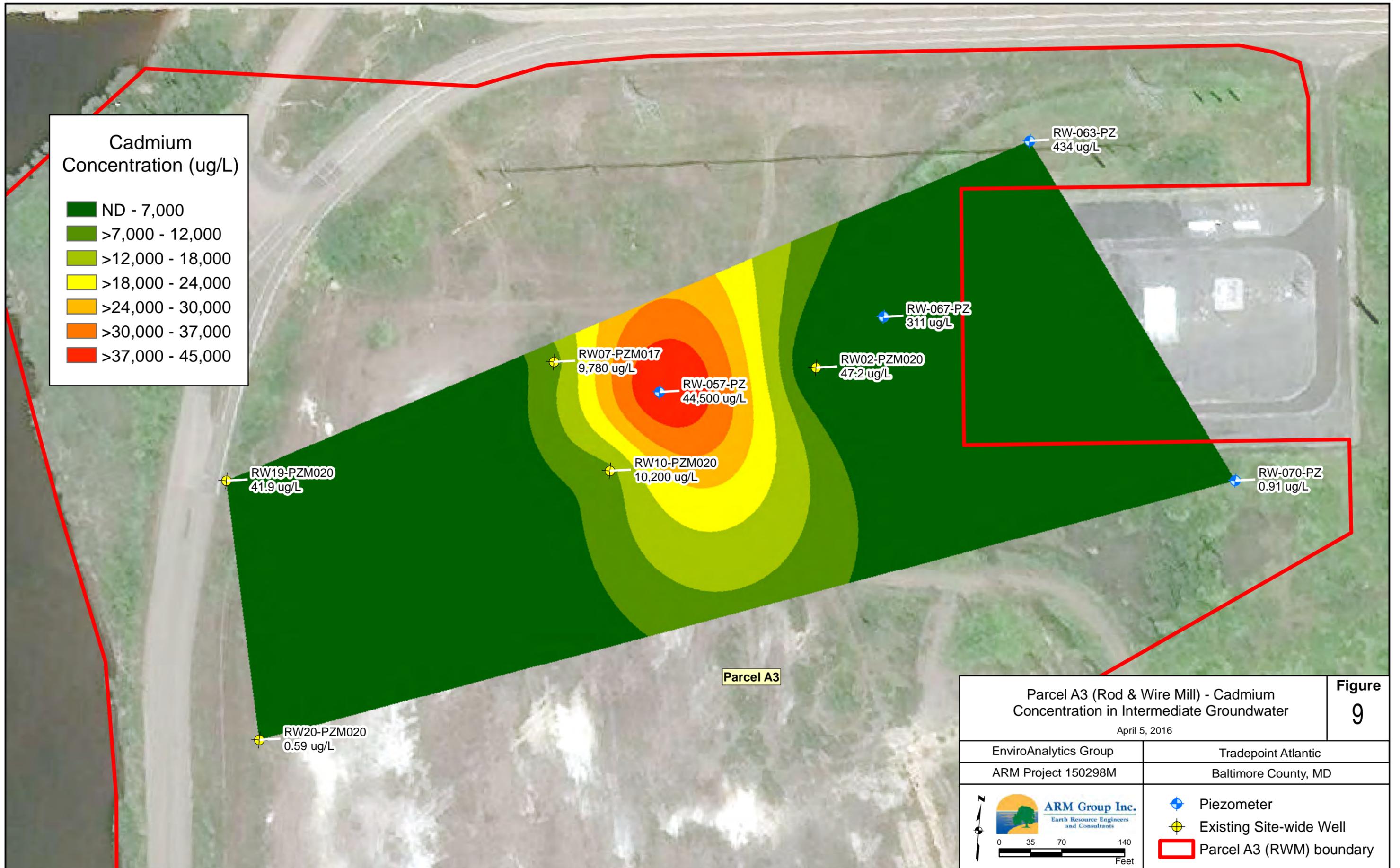
ARM Project 150298M

Baltimore County, MD



- Phase II - Soil Boring
- Remedial Design Boring
- PAL Indicator Line





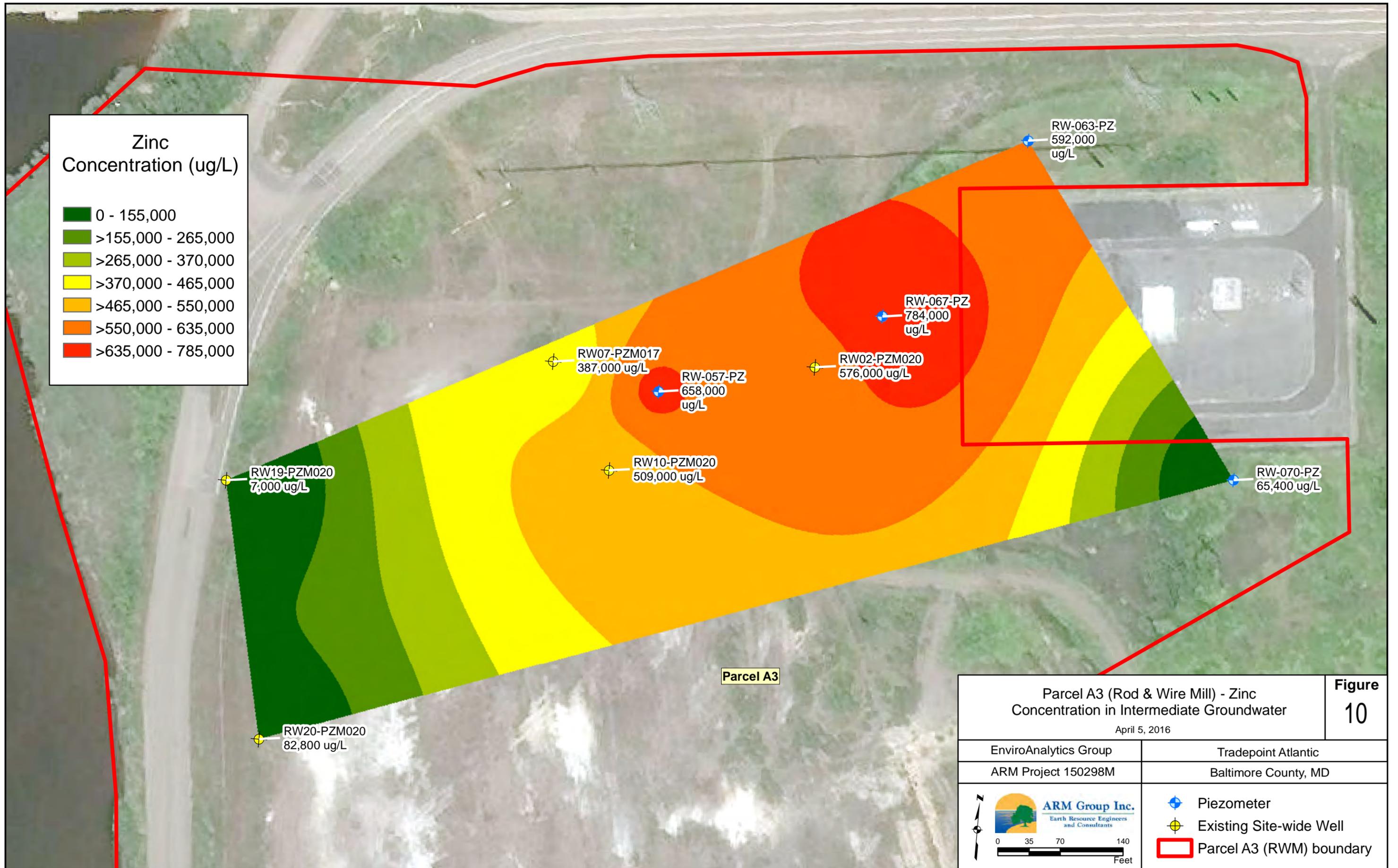
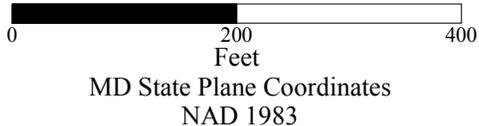
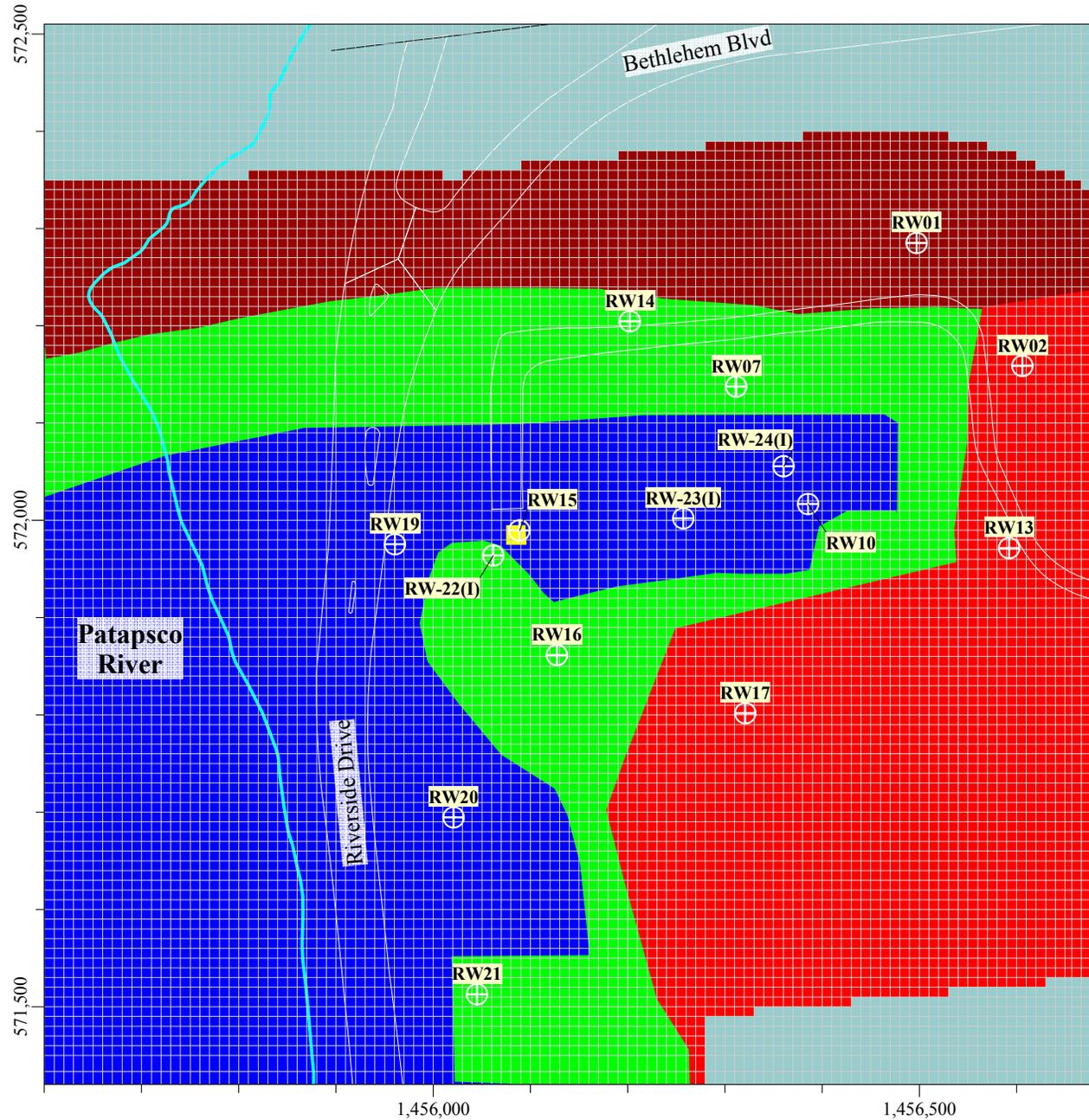


Figure 10

Numerical Groundwater Model
 Model Grid, General Head Boundaries
 and Hydraulic Conductivity Zones

Map Legend

-  Monitoring Well
-  General Head Boundary
- Hydraulic Conductivity Zones**
 (K units = feet per day)
-  K=1.0e4 clean sand to gravel
-  K=26.5 silty sand to clean sand
-  K=24 silty sand to clean sand
-  K=14.7 silty sand to clean sand
-  K=4.3 silty sand to clean sand



ARM Group Inc.
 Earth Resource Engineers
 and Consultants

Numerical Groundwater Model

Pre-Design Investigation
 Rod and Wire Mill Source Area
 Characterization Report

April 2016

150298

Figure
11

Numerical Groundwater Model
RW10 and RW15 ON
Calibrated Results
 Groundwater Elevation Contours
 Posted Measured and Calibrated Water Elevations

Map Legend

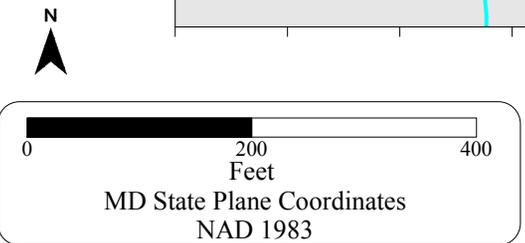
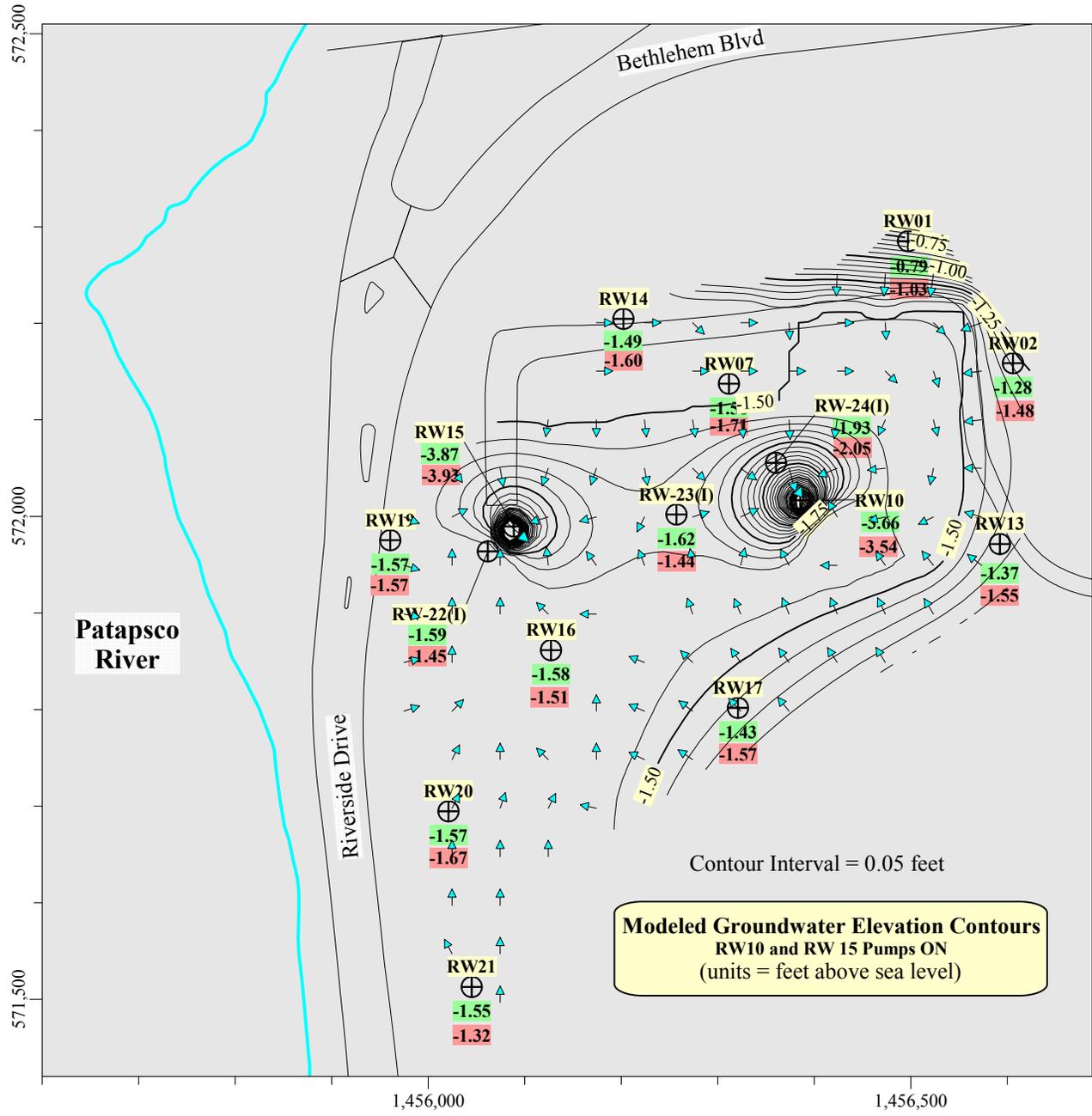
 modeled groundwater elevation
 measured groundwater elevation

Monitoring Well
 with posted modeled and measured groundwater elevations*



Groundwater Flow Vector
 Flow direction indicated by arrow orientation
 Flow magnitude indicated by arrow length

*All modeled groundwater elevations were within 0.25 feet of the measured values.



Numerical Groundwater Model
 Pre-Design Investigation
 Rod and Wire Mill Source Area
 Characterization Report

April 2016
 150298

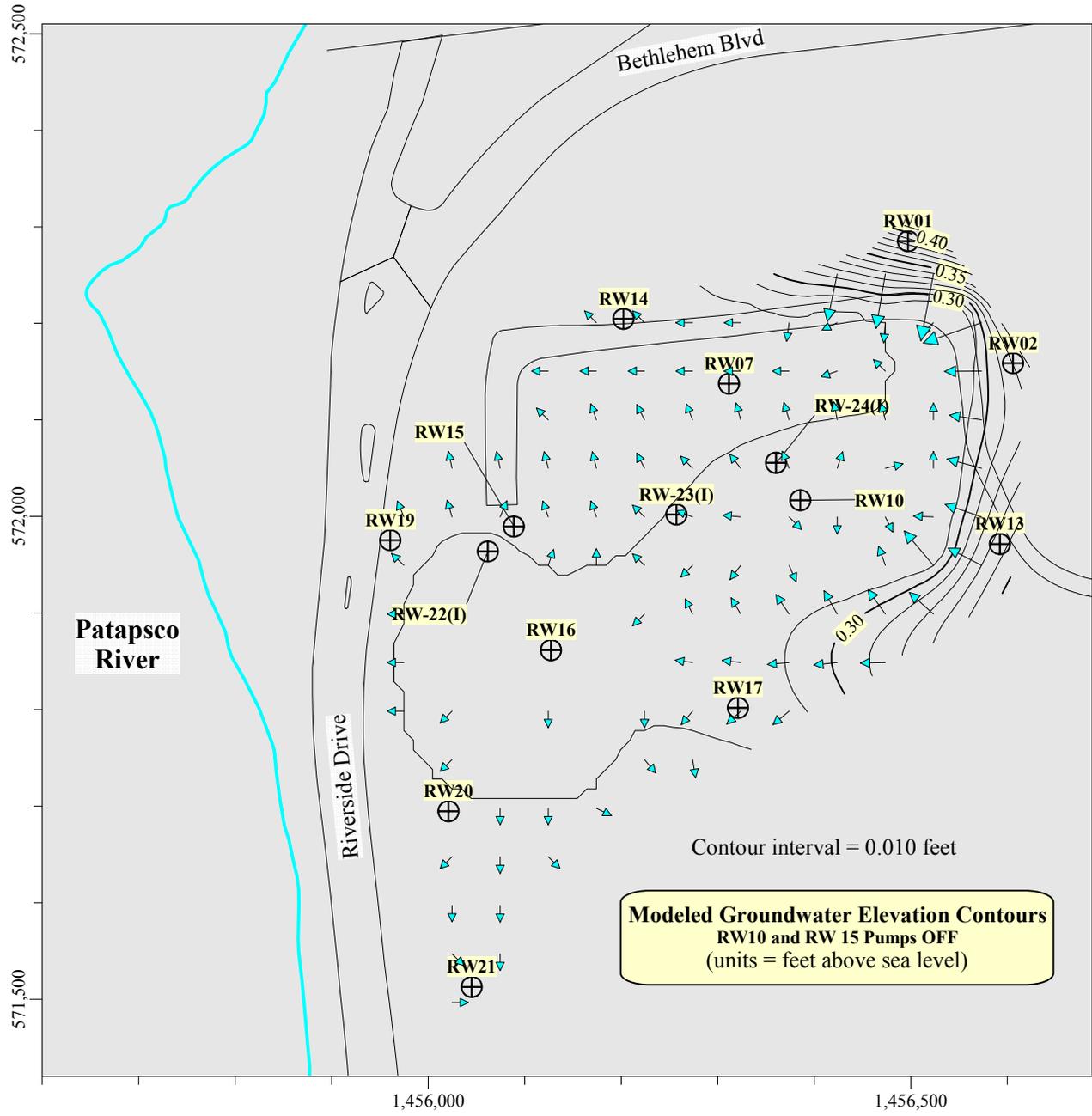
Numerical Groundwater Model
RW10 and RW15 OFF
 Modeled Groundwater Elevation Contours

Map Legend

RW01

Monitoring Well Location

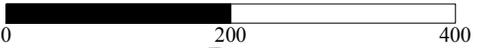

Groundwater Flow Vector
 Flow direction indicated by arrow orientation
 Flow magnitude indicated by arrow length



Modeled Groundwater Elevation Contours
 RW10 and RW 15 Pumps OFF
 (units = feet above sea level)

Contour interval = 0.010 feet

N

0 200 400
 Feet

MD State Plane Coordinates
 NAD 1983



ARM Group Inc.
 Earth Resource Engineers
 and Consultants

Numerical Groundwater Model

Pre-Design Investigation
 Rod and Wire Mill Source Area
 Characterization Report

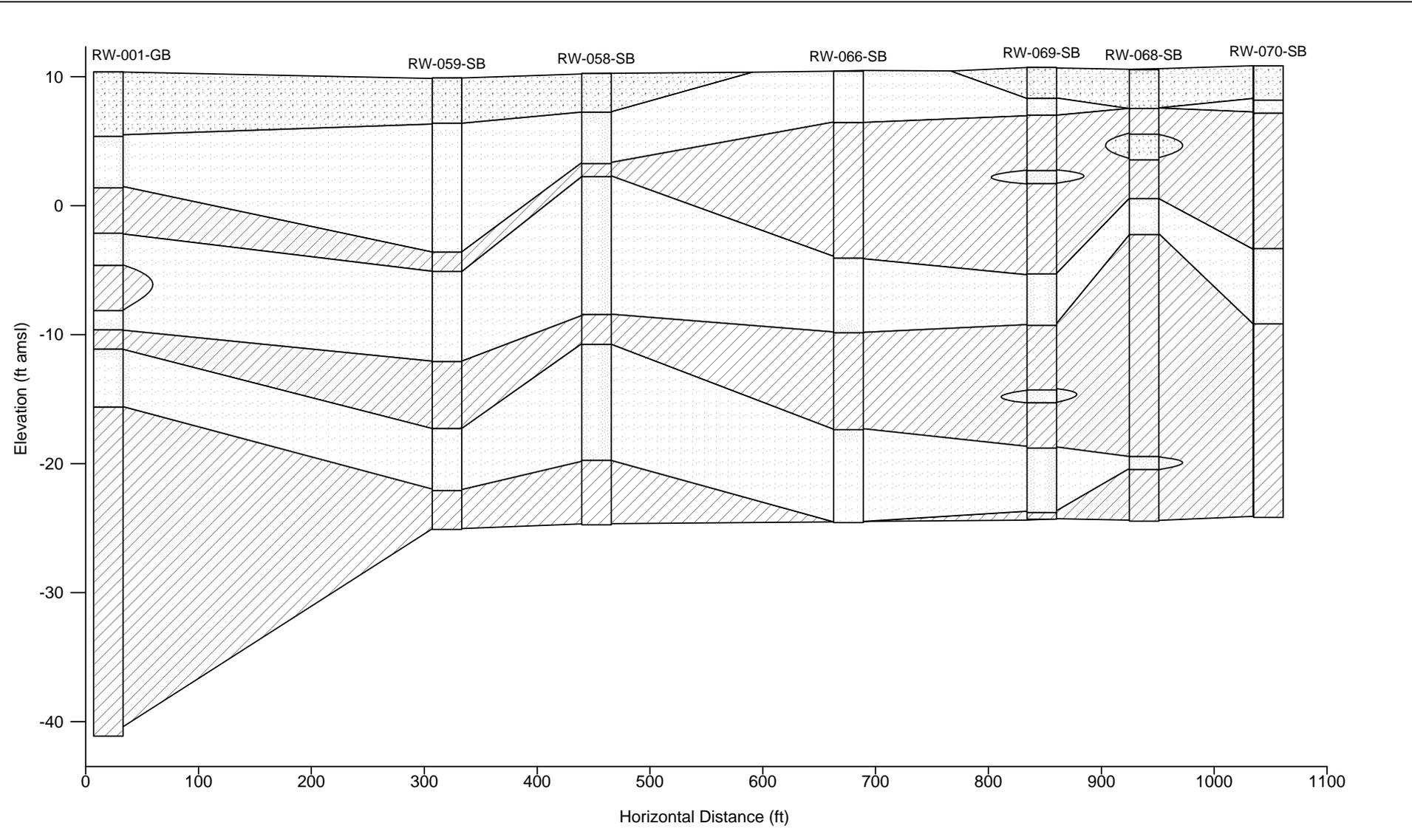
April 2016

150298

Figure
17

Northwest

Southeast



Parcel A3 (Rod & Wire Mill)
Cross Section

Tradepoint Atlantic
Baltimore County, MD



Cross Section B-B'

EnviroAnalytics Group
ARM Project 150298M
March 2016

LEGEND

-  Gravel/Slag
-  Sand
-  Clay

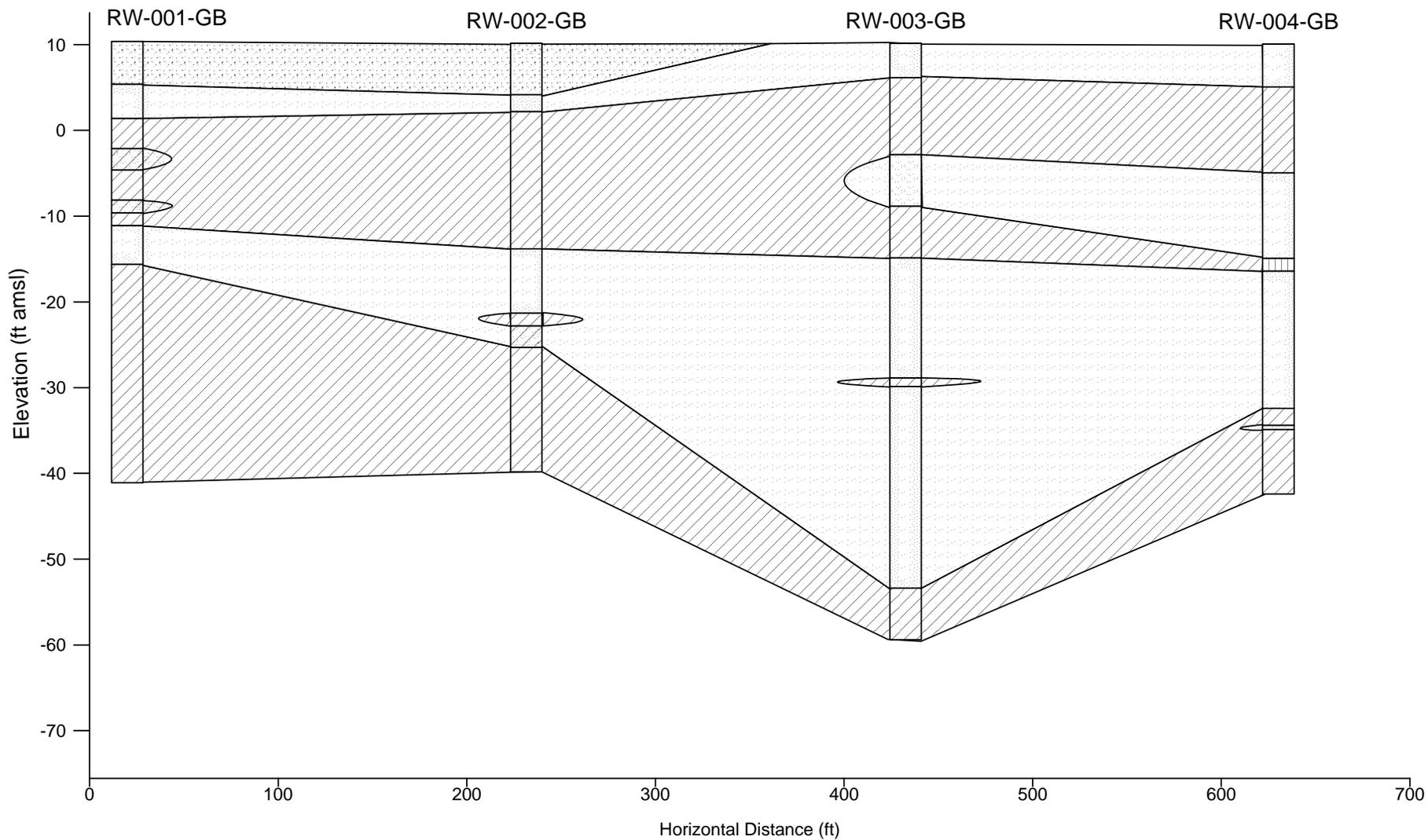
Note: amsl = above mean sea level
Cross-section is vertically exaggerated approximately 11:1

North

South

C

C'



Parcel A3 (Rod & Wire Mill)
Cross Section

Tradepoint Atlantic
Baltimore County, MD



ARM Group Inc.
Earth Resource Engineers
and Consultants

Cross Section C-C'

EnviroAnalytics Group
ARM Project 150298M
March 2016

LEGEND

-  Gravel/Slag
-  Sand
-  Clay

amsl = above mean sea level
Cross-section is vertically exaggerated



APPENDIX B

SAFETY DATA SHEET

Texas



1. Identification

Product identifier

Limestone

Other means of identification

Synonyms

Aggregate, Crushed Stone, Manufactured Sand, Agricultural Lime

Recommended use

Limestone is used in the manufacture of bricks, mortar, cement, concrete, plasters, paving materials, other construction materials, steel, consumer products, and other goods. Limestone aggregate may be distributed in bags, totes, and bulk shipments.

Recommended restrictions

None known.

Manufacturer/Importer/Supplier/Distributor information

Company

Bluegrass Materials Company, LLC

Address

200 W Forsyth Street, Jacksonville, FL 32202

Telephone

Corporate office: 904 (701) 6500

Website

<http://bluegrassmaterials.com/>

Contact person / E-mail /

Maryland: Gustaf Buttar, MSP, gbuttar@bluegrassmaterials.com, (443) 802 2769

Emergency Phone number

Georgia: Brian McNamara, CMSP, bmcnamara@bluegrassmaterials.com, (678) 618-2733

Kentucky: Eric Loggins, CMSP, eloggins@bluegrassmaterials.com, (270) 535-9762

2. Hazard(s) identification

Physical hazards

Not classified.

Health Hazards

Carcinogenicity

Category 1A

Specific Target Organ Toxicity,

Category 2

Repeated Exposure

OSHA defined hazards

Not classified.

Label elements



Signal word

Danger

Hazard statement

May cause cancer. May cause damage to organs (lung) through prolonged or repeated exposure.

Precautionary statement

Prevention

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves/protective clothing/eye protection/face protection.

Response

If exposed or concerned: Get medical advice/attention.

Storage

Restrict or control access to stockpile areas. Engulfment hazard: To prevent burial or suffocation, do not enter a confined space, such as a silo, bulk truck or other storage container or vessel that stores or contains aggregates without an effective procedure for assuring safety.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC)

None known.

Supplemental information

Respirable Crystalline Silica (RCS) may cause cancer. Limestone is a naturally occurring mineral complex that contains varying quantities of quartz (crystalline silica). In its natural bulk state, limestone is not a known health hazard. Limestone may be subjected to various natural or mechanical forces that produce small particles (dust) which may contain respirable crystalline silica (particles less than 10 micrometers in aerodynamic diameter). Repeated inhalation of respirable crystalline silica (quartz) may cause lung cancer according to IARC and NTP; ACGIH states that it is a suspected cause of cancer. Other forms of RCS (e.g., tridymite and cristobalite) may also be present or formed under certain industrial processes.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Calcium Carbonate	1317-65-3	> 50
Crystalline Silica (Quartz)	14808-60-7	> 0.1

4. First-aid measures

Inhalation

Limestone dust: Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact

Limestone dust: Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact

Limestone dust: Immediately flush with plenty of water for at least 15 minutes. Hold eyelids apart. Occasionally lift the eyelid(s) to ensure thorough rinsing. Beyond flushing, do not attempt to remove material from the eye(s). Get medical attention if irritation develops or persists.

Ingestion

Limestone dust: Rinse mouth and drink plenty of water. Never give anything by mouth to an unconscious person. Get medical attention.

Most important symptoms/effects, acute and delayed

Inhaling dust may cause discomfort in the chest, shortness of breath, and coughing.

Prolonged inhalation may cause chronic health effects. This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica liberated from this product can cause silicosis, and may cause cancer.

Indication of immediate medical attention and special treatment needed

Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.

General information

Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Pre-existing medical conditions that may be aggravated by exposure include disorders of the eye, skin and lung (including asthma and other breathing disorders). If addicted to tobacco, smoking will impair the ability of the lungs to clear themselves of dust.

5. Fire-fighting measures

Suitable extinguishing media

Limestone is not flammable. Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media

None known.

Specific hazards arising from the chemical

No unusual fire or explosion hazards noted. Not a combustible dust.

Special protective equipment and precautions for firefighters

Use protective equipment appropriate for surrounding materials.

Fire fighting equipment/instructions

No specific precautions.

Specific methods

Contact with powerful oxidizing agents may cause fire and/or explosions (see section 10 of SDS).

General fire hazards

No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, and emergency procedures Methods and materials for containment and cleaning up

Wear appropriate protective equipment and clothing during clean-up of materials that contain or may liberate limestone dust.

Spilled material, where dust is generated, may overexpose cleanup personnel to respirable crystalline silica-containing dust. Do not dry sweep or use compressed air for clean-up. Wetting of spilled material and/or use of respiratory protective equipment may be necessary.

Environmental precautions

Avoid discharge of fine particulate matter into drains or water courses.

7. Handling and storage

Precautions for safe handling

Do not handle until all safety precautions have been read and understood. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Do not breathe dust. Avoid prolonged exposure.

Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Avoid dust formation or accumulation.

8. Exposure controls/personal protection

- Occupational exposure limits**
- 1 – Value equivalent to OSHA formulas (29 CFR 1910.1000; 29 CFR 1917; 29 CFR 1918)
 - 2 – Value also applies to MSHA Metal / Non-Metal (1973 TLVs at 30 CFR 56/57.5001).
 - 3 – OSHA enforces 0.250 mg/m³ in construction and shipyards (CPL-03-00-007).
 - 4 – Value also applies to OSHA construction (29 CFR 1926.55 Appendix A) and shipyards (29 CFR 1915.1000, Table Z).
 - 5 – MSHA limit = 10 mg/m³.

U.S. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Particulates not otherwise classified (CAS SEQ250).	PEL	5 mg/m ³	Respirable fraction
		15 mg/m ³	Total dust (4)
Calcium Carbonate (CAS 1317-65-3)	TWA	5 mg/m ³	Respirable fraction (4)
		15 mg/m ³	Total dust (5)

U.S. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Crystalline Silica (Quartz) (CAS 14808-60-7)	TWA	0.3 mg/m ³	Total dust (1,2)
		0.1 mg/m ³	Respirable (1,2,3)
Tridymite and Cristobalite (other forms of crystalline silica) (CAS Mixture)	TWA	0.15 mg/m ³	Total dust (1)
		0.05 mg/m ³	Respirable (1,2)
Particulates not otherwise classified (CAS SEQ250)	TWA	5 mg/m ³	Respirable fraction (1)
		15 mg/m ³	Total dust (1,4,5)

US. ACGIH Threshold Limit Values®

Components	Type	Value	Form
Crystalline Silica (all forms; CAS mixture)	TWA	0.025 mg/m ³	Respirable fraction
Particulates not otherwise classified silica (CAS Mixture)	TWA	3 mg/m ³	Respirable particles (2)
		10 mg/m ³	Inhalable particles (2)

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
Crystalline Silica (all forms; CAS mixture)	TWA	0.05 mg/m ³	Respirable dust
Calcium Carbonate (CAS 1317-65-3)	TWA	5 mg/m ³	Respirable fraction
		10 mg/m ³	Total dust

Biological limit values

No biological exposure limits noted for the ingredient(s).

Exposure guidelines

OSHA PELs, MSHA PELs, and ACGIH TLVs are 8-hr TWA values. NIOSH RELs are for TWA exposures up to 10-hr/day and 40-hr/wk. Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled. Terms including "Particulates Not Otherwise Classified," "Particulates Not Otherwise Regulated," "Particulates Not Otherwise Specified," and "Inert or Nuisance Dust" are often used interchangeably; however, the user should review each agency's terminology for differences in meanings.

Appropriate engineering controls

Good general ventilation (typically 10 air changes per hour indoors) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection

Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection

Use personal protective equipment as required.

Other

Use personal protective equipment as required.

Respiratory protection

When handling or performing work with limestone that produces dust or respirable crystalline silica in excess of applicable exposure limits, wear a NIOSH-approved respirator

that is properly fitted and is in good condition. Respirators must be used in accordance with all applicable workplace regulations.

Thermal hazards

Not anticipated. Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations

Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state

Solid.

Form

Solid, particles.

Color

To be completed by company.

Odor

Not applicable.

Odor threshold

Not applicable.

pH

To be completed by company.

Melting point/freezing point

Not applicable.

Initial boiling point and boiling range

Not applicable.

Flash point

Non-combustible

Evaporation rate

Not applicable.

Flammability (solid, gas)

Not applicable.

Upper/lower flammability or explosive limits

Flammability limit – lower (%)

Not applicable.

Flammability limit – upper (%)

Not applicable.

Vapor pressure

Not applicable.

Vapor density

Not applicable.

Relative density

To be completed by company.

Solubility(ies)

Solubility (water)

Insoluble

Partition coefficient (n-octanol/water)

Not applicable.

Auto-ignition temperature

Not applicable.

Decomposition temperature

Not applicable.

Viscosity

Not applicable.

Other information

Explosive properties

Not applicable.

Flammability

Not applicable.

10. Stability and reactivity

Reactivity

The product is stable and non-reactive under normal conditions of use, storage and transport.

Chemical stability

Material is stable under normal conditions.

Possibility of hazardous reactions

No dangerous reaction known under conditions of normal use.

11. Toxicological information

Information on likely routes of exposure

Inhalation

Repeated inhalation of respirable crystalline silica (quartz) may cause silicosis, a fibrosis (scarring) of the lungs. Silicosis is irreversible and may be fatal. Silicosis increases the risk of contracting pulmonary tuberculosis. Some studies suggest that repeated inhalation of respirable crystalline silica may cause other adverse health effects including lung and kidney cancer.

Skin contact

Limestone dust: May cause irritation through mechanical abrasion.

Eye contact

Limestone dust: May cause irritation through mechanical abrasion.

Ingestion

Not likely, due to the form of the product. However, accidental ingestion of the content may cause discomfort.

Symptoms related to the

Limestone dust: Discomfort in the chest. Shortness of breath. Coughing.

physical, chemical and toxicological characteristics

Information on toxicological effects

Acute toxicity	Not expected to be acutely toxic.
Skin corrosion/irritation	This product is not expected to be a skin hazard.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Respiratory or skin sensitization	
Respiratory sensitization	No respiratory sensitizing effects known.
Skin sensitization	Not known to be a dermal irritant or sensitizer.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	Respirable crystalline silica has been classified by IARC and NTP as a known human carcinogen, and classified by ACGIH as a suspected human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Crystalline Silica (Quartz) (CAS 14808-60-7)	1 Carcinogenic to humans.
Respirable Tridymite and Cristobalite (other forms of Crystalline) (CAS Mixture)	1 Carcinogenic to humans.

NTP Report on Carcinogens

Crystalline Silica (Quartz) (CAS 14808-60-7)	Known To Be Human Carcinogen.
--	-------------------------------

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity	Not expected to be a reproductive hazard.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity – repeated exposure	Respirable crystalline silica: May cause damage to organs (lung) through prolonged or repeated exposure.
Aspiration hazard	Due to the physical form of the product it is not an aspiration hazard.
Chronic effects	Prolonged inhalation of respirable crystalline silica may be harmful. May cause damage to organs (lungs) through prolonged or repeated exposure. There are reports in the literature suggesting that excessive crystalline silica exposure may be associated with autoimmune disorders and other adverse health effects involving the kidney. In particular, the incidence of scleroderma (thickening of the skin caused by swelling and thickening of fibrous tissue) appears to be higher in silicotic individuals. To date, the evidence does not conclusively determine a causal relationship between silica exposure and these adverse health effects.

12. Ecological information

Ecotoxicity	Not expected to be harmful to aquatic organisms. Discharging limestone dust and fines into waters may increase total suspended particulate (TSP) levels that can be harmful to certain aquatic organisms.
Persistence and degradability	Not applicable.
Bioaccumulative potential	Not applicable.
Mobility in soil	Not applicable.
Other adverse effects	No other adverse environmental effects (e.g., ozone depletion, photochemical ozone creation potential, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Do not allow fine particulate matter to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with fine particulates. Dispose of contents in accordance with local/regional/national/international regulations.
Hazardous waste code	Not regulated.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty packaging materials should be recycled or disposed of in accordance with applicable regulations and practices.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Not applicable.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

15. Regulatory information**US federal regulations**

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)**Hazard categories**

Immediate Hazard - No
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical

Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations**Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List**

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)**US state regulations**

Not regulated.

US. Massachusetts RTK - Substance List

Crystalline Silica (Quartz) (CAS 14808-60-7)
Respirable Tridymite and Cristobalite (other forms of crystalline silica) (CAS Mixture)

US. New Jersey Worker and Community Right-to-Know Act

Crystalline Silica (Quartz) (CAS 14808-60-7)
Respirable Tridymite and Cristobalite (other forms of crystalline silica) (CAS Mixture)

US. Pennsylvania Worker and Community Right-to-Know Law

Crystalline Silica (Quartz) (CAS 14808-60-7)
Respirable Tridymite and Cristobalite (other forms of crystalline silica) (CAS Mixture)

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Crystalline Silica (Quartz) (CAS 14808-60-7)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	July 22, 2015
Revision Date	July 22, 2015
Revision Date	V001.2015

Disclaimer

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SAFETY DATA SHEET

Issue Date 16-April-2015

Revision Date 26-June-2015

Version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name AQUAMAG® NW

Other means of identification

Product Code AQUAMAG® NW

Synonyms Magnesium Hydroxide, Mag Hydroxide, Hydrated Magnesia, Mg(OH)₂

Recommended use of the chemical and restrictions on use

Recommended Use Waste water treatment.

Uses advised against No information available

Details of the supplier of the safety data sheet

Manufacturer Address

Premier Magnesia, LLC, 300 Barr Harbor Drive, Suite 250, West Conshohocken, PA 19428

Emergency telephone number

Company Phone Number 610-828-6929

24 Hour Emergency Phone Number Chemtrec 1-800-424-9300

Emergency Telephone Chemtrec 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

Not hazardous in normal industrial use. Dust from dried product slurry is classified as a "nuisance particulate, not otherwise regulated" as specified by ACGIH and OSHA.

Label elements

Emergency Overview

White to off-white aqueous slurry. Not a fire or spill hazard. Low toxicity. Dust is classified as a "nuisance particulate not otherwise regulated". Do not store in drums or tanks constructed of aluminum! See section 7.

Appearance Slurry

Physical state Liquid

Odor Odorless

Particulate may cause eye irritation

Low toxicity by skin contact

An unlikely route of exposure. If ingested in sufficient quantity may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

Hazards not otherwise classified (HNOC)

Other Information

3. COMPOSITION/INFORMATION ON INGREDIENTS

Common name Magnesium Hydroxide CAS# 1309-42-8.
Synonyms Magnesium Hydroxide, Mag Hydroxide, Hydrated Magnesia, Mg(OH)₂

Formula #1 Mg(OH)₂

Chemical Name	CAS No.	Weight-%	Trade Secret
Water	7732-18-5	39-47	
Magnesium Hydroxide	1309-42-8	53-61	

4. FIRST AID MEASURES

First aid measures

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If eye irritation persists: Get medical advice/attention.

Skin Contact Wash skin with soap and water.

Inhalation Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Ingestion Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

Unsuitable extinguishing media Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No information available.

Explosion data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Carefully clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves and goggles to prevent irritation from contact and/or inhalation.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Do not allow product to freeze. Do not store in drums or tanks constructed of aluminum!.

Incompatible materials Maleic anhydride; Aluminum metal in contact with product may produce hydrogen.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection The use of eye protection is recommended.

Skin and body protection The use of eye protection, gloves and long sleeve clothing is recommended.

Respiratory protection Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910. 134 for level of exposure incurred.

General Hygiene Considerations Avoid contact with eyes, skin and clothing. After handling this product, wash hands before eating or drinking.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid	Odor	Odorless
Appearance	Slurry	Odor threshold	No information available
Color	White		

<u>Property</u>	<u>Values</u>	<u>Remarks • Method</u>
pH	10-11	
Melting point	350 °C	
Freezing point	No Information available	
Boiling point / boiling range	Loses free water at 100 °C ;Chemically combined water at 350°C	
Flash point	No information available	
Evaporation rate	Same as water	
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific Gravity	1.45	
Water solubility	No information available	Aqueous Slurry
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Auto ignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available
Density	No information available
Bulk density	12.71-13.19 lb/gal

10. STABILITY AND REACTIVITY

Reactivity

No data available

Chemical stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

None under normal processing.

Hazardous polymerization	Hazardous polymerization does not occur.
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Conditions to avoid

Extremes of temperature and direct sunlight.

Incompatible materials

Maleic anhydride; Aluminum metal in contact with product may produce hydrogen.

Hazardous Decomposition Products

Heat and steam.

11. TOXICOLOGICAL INFORMATION**Information on likely routes of exposure**

Product Information	Product does not present an acute toxicity hazard based on known or supplied information
Inhalation	No data available.
Eye contact	No data available.
Skin Contact	No data available.
Ingestion	No data available.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Water 7732-18-5	> 90 mL/kg (Rat)	-	-
Magnesium Hydroxide 1309-42-8	= 8500 mg/kg (Rat)	-	-

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	May cause eye irritation.
Sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Numerical measures of toxicity - Product Information**12. ECOLOGICAL INFORMATION****Eco toxicity**

No data available on any adverse effects of this material on the environment

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes	This produce does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal once the free water component is evaporated or absorbed by a suitable absorbent (earth). Follow all applicable federal, state and local regulations for safe disposal.
Contaminated packaging	Do not reuse container.

14. TRANSPORT INFORMATION

Note:	WARNING! Premier Magnesia, LLC prohibits this product from transportation or storage in tanks constructed of aluminum! See section 10.
<u>DOT</u>	Not regulated by DOT as a hazardous material. No hazard class, label or placard required, no UN or NA number assigned.

15. REGULATORY INFORMATION

International Inventories

TSCA	All substances are listed in TSCA
DSL/NDSL	Complies
EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Complies
KECL	Complies
PICCS	Does not comply
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals This product does not contain chemicals known to the state of California to cause birth defects or other reproductive harm

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Water 7732-18-5	-	-	X

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

<u>NFPA</u>	Health hazards 1	Flammability 0	Instability 0	Physical and Chemical Properties -
<u>HMIS</u>	Health hazards 0	Flammability 0	Physical hazards 0	Personal protection X

Revision Date 26-June-2015

Revision Note

No information available

Disclaimer

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet



SAFETY DATA SHEET

Issue Date 16-April-2015

Revision Date 26-June-2015

Version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name AQUAMAG®

Other means of identification

Product Code AQUAMAG®

Synonyms Magnesium Hydroxide, Mag Hydroxide, Hydrated Magnesia, Mg(OH)₂

Recommended use of the chemical and restrictions on use

Recommended Use Waste water treatment.

Uses advised against No information available

Details of the supplier of the safety data sheet

Manufacturer Address

Premier Magnesia, LLC, 300 Barr Harbor Drive, Suite 250, West Conshohocken, PA 19428

Emergency telephone number

Company Phone Number 610-828-6929

24 Hour Emergency Phone Number Chemtrec 1-800-424-9300

Emergency Telephone Chemtrec 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

Not hazardous in normal industrial use. Dust from dried product slurry is classified as a "nuisance particulate, not otherwise regulated" as specified by ACGIH and OSHA.

Label elements

Emergency Overview

White to off-white aqueous slurry. Not a fire or spill hazard. Low toxicity. Dust is classified as a "nuisance particulate not otherwise regulated". Do not store in drums or tanks constructed of aluminum! See section 7.

Appearance Slurry

Physical state Liquid

Odor Odorless

Particulate may cause eye irritation

Low toxicity by skin contact

An unlikely route of exposure. If ingested in sufficient quantity may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

Hazards not otherwise classified (HNOC)

Other Information

3. COMPOSITION/INFORMATION ON INGREDIENTS

Common name Magnesium Hydroxide CAS# 1309-42-8.
Synonyms Magnesium Hydroxide, Mag Hydroxide, Hydrated Magnesia, Mg(OH)₂

Formula #1 Mg(OH)₂

Chemical Name	CAS No.	Weight-%	Trade Secret
Water	7732-18-5	39-47	
Magnesium Hydroxide	1309-42-8	53-61	

4. FIRST AID MEASURES

First aid measures

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If eye irritation persists: Get medical advice/attention.

Skin Contact Wash skin with soap and water.

Inhalation Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Ingestion Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

Unsuitable extinguishing media Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No information available.

Explosion data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Carefully clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves and goggles to prevent irritation from contact and/or inhalation.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Do not allow product to freeze. Do not store in drums or tanks constructed of aluminum!.

Incompatible materials Maleic anhydride; Aluminum metal in contact with product may produce hydrogen.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection The use of eye protection is recommended.

Skin and body protection The use of eye protection, gloves and long sleeve clothing is recommended.

Respiratory protection Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910. 134 for level of exposure incurred.

General Hygiene Considerations Avoid contact with eyes, skin and clothing. After handling this product, wash hands before eating or drinking.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid	Odor	Odorless
Appearance	Slurry	Odor threshold	No information available
Color	White		

<u>Property</u>	<u>Values</u>	<u>Remarks • Method</u>
pH	10-11	
Melting point	350 °C	
Freezing point	No information available	
Boiling point / boiling range	Loses free water at 100 °C ;Chemically combined water at 350°C	
Flash point	No information available	
Evaporation rate	Same as water	
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific Gravity	1.45	
Water solubility	No information available	Aqueous Slurry
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available
Density	No information available
Bulk density	12.71-13.00 lb/gal

10. STABILITY AND REACTIVITY

Reactivity

No data available

Chemical stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

None under normal processing.

Hazardous polymerization	Hazardous polymerization does not occur.
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Conditions to avoid

Extremes of temperature and direct sunlight.

Incompatible materials

Maleic anhydride; Aluminum metal in contact with product may produce hydrogen.

Hazardous Decomposition Products

Heat and steam.

11. TOXICOLOGICAL INFORMATION**Information on likely routes of exposure**

Product Information	Product does not present an acute toxicity hazard based on known or supplied information
Inhalation	No data available.
Eye contact	No data available.
Skin Contact	No data available.
Ingestion	No data available.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Water 7732-18-5	> 90 mL/kg (Rat)	-	-
Magnesium Hydroxide 1309-42-8	= 8500 mg/kg (Rat)	-	-

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	May cause eye irritation.
Sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Numerical measures of toxicity - Product Information**12. ECOLOGICAL INFORMATION****Ecotoxicity**

No data available on any adverse effects of this material on the environment

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes	This produce does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal once the free water component is evaporated or absorbed by a suitable absorbent (earth). Follow all applicable federal, state and local regulations for safe disposal.
Contaminated packaging	Do not reuse container.

14. TRANSPORT INFORMATION

Note:	WARNING! Premier Magnesia, LLC prohibits this product from transportation or storage in tanks constructed of aluminum! See section 10.
<u>DOT</u>	Not regulated by DOT as a hazardous material. No hazard class, label or placard required, no UN or NA number assigned.

15. REGULATORY INFORMATION

International Inventories

TSCA	All substances are listed in TSCA
DSL/NDSL	Complies
EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Complies
KECL	Complies
PICCS	Does not comply
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals This product does not contain chemicals known to the state of California to cause birth defects or other reproductive harm

U.S. State Right-to-Know Regulations

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

<u>NFPA</u>	Health hazards 1	Flammability 0	Instability 0	Physical and Chemical Properties -
<u>HMIS</u>	Health hazards 0	Flammability 0	Physical hazards 0	Personal protection X

Revision Date 26-June-2015

Revision Note
No information available

Disclaimer

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

3. COMPOSITION/INFORMATION ON INGREDIENTS

Common name Magnesium Hydroxide CAS# 1309-42-8.
Synonyms Brucite, Magnesium Hydroxide Mg(OH)₂

Formula #1 Mg(OH)₂

Chemical Name	CAS No.	Weight-%	Trade Secret
Magnesium Hydroxide	1309-42-8	100	

4. FIRST AID MEASURES**First aid measures**

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If eye irritation persists: Get medical advice/attention.

Skin Contact Wash skin with soap and water.

Inhalation Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Ingestion Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES**Suitable extinguishing media**

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

Unsuitable extinguishing media Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No information available.

Explosion data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Carefully clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves and goggles to prevent irritation from contact and/or inhalation.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Do not allow product to freeze. Minimize dust generation during material handling and transfer. If in solution, Do Not store in containers constructed of aluminum!

Incompatible materials Maleic anhydride; Aluminum metal in contact with product may produce hydrogen. Soluble in aqueous acids generating heat and steam.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection The use of eye protection is recommended.

Skin and body protection The use of eye protection, gloves and long sleeve clothing is recommended.

Respiratory protection Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910. 134 for level of exposure incurred.

General Hygiene Considerations Avoid contact with eyes, skin and clothing. After handling this product, wash hands before eating or drinking.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Solid	Odor	Odorless
Appearance	Fine Powder	Odor threshold	No information available
Color	White		

<u>Property</u>	<u>Values</u>	<u>Remarks • Method</u>
pH	No information available	
Melting point	350 °C decomposes	
Freezing point	No information available	
Boiling point / boiling range	Loses water at 350 °C	
Flash point	No information available	
Evaporation rate	No information available	
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific Gravity	3.04	
Water solubility	Insoluble in water	Aqueous Slurry
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available
Density	No information available
Bulk density	18-25 lb/ft3

10. STABILITY AND REACTIVITY

Reactivity

No data available

Chemical stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

None under normal processing.

Hazardous polymerization	Hazardous polymerization does not occur.
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Conditions to avoid

Extremes of temperature and direct sunlight.

Incompatible materials

Maleic anhydride; Aluminum metal in contact with product may produce hydrogen. Soluble in aqueous acids generating heat and steam.

Hazardous Decomposition Products

Heat and steam.

11. TOXICOLOGICAL INFORMATION**Information on likely routes of exposure**

Product Information	Product does not present an acute toxicity hazard based on known or supplied information.
Inhalation	No data available.
Eye contact	No data available.
Skin Contact	No data available.
Ingestion	No data available.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Magnesium Hydroxide 1309-42-8	= 8500 mg/kg (Rat)	-	-

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	May cause eye irritation.
Sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Numerical measures of toxicity - Product Information**12. ECOLOGICAL INFORMATION****Ecotoxicity**

No data available on any adverse effects of this material on the environment

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes	This product does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal. Follow all applicable federal, state and local regulations for safe disposal.
Contaminated packaging	Do not reuse container.

14. TRANSPORT INFORMATION

Note:	If in solution, Do Not transport in containers constructed of aluminum!
DOT	Not regulated by DOT as a hazardous material. No hazard class, label or placard required, no UN or NA number assigned.

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL/NDSL	Complies
EINECS/ELINCS	Complies
ENCS	Complies
IECSC	Complies
KECL	Complies
PICCS	Complies
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations**California Proposition 65**

This product does not contain any Proposition 65 chemicals This product does not contain chemicals known to the state of California to cause birth defects or other reproductive harm.

U.S. State Right-to-Know Regulations**U.S. EPA Label Information**

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

<u>NFPA</u>	Health hazards 1	Flammability 0	Instability 0	Physical and Chemical Properties -
<u>HMIS</u>	Health hazards 0	Flammability 0	Physical hazards 0	Personal protection X

Revision Date 16-April-2015

Revision Note

No information available

Disclaimer

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End of Safety Data Sheet



SAFETY DATA SHEET

Issue Date 16-April-2015

Revision Date 16-April-2015

Version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name Magnesite 33 -200

Other means of identification

Product Code Magnesite 33 -200

Synonyms Ground Magnesite, Raw ground Magnesite, Magnesium Carbonate,

Recommended use of the chemical and restrictions on use

Recommended Use No information available.

Uses advised against No information available

Details of the supplier of the safety data sheet

Manufacturer Address

Premier Magnesia, LLC, 300 Barr Harbor Drive, Suite 250, West Conshohocken, PA 19428

Emergency telephone number

Company Phone Number 610-828-6929

24 Hour Emergency Phone Number Chemtrec 1-800-424-9300

Emergency Telephone Chemtrec 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

Product dust is classified as a "nuisance particulate, not otherwise regulated" as specified by ACGIH and OSHA. The excessive, long-term inhalation of mineral dusts may contribute to the development of industrial bronchitis, reduced breathing capacity, and may lead to the increased susceptibility to lung disease.

Label elements

Emergency Overview

Not a fire or spill hazard. Low toxicity. Dust is classified as a "nuisance particulate not otherwise regulated".

Appearance Fine Powder

Physical state Solid

Odor Odorless

Causes mild irritation to the eyes

Particulate may cause upper respiratory irritation.

Chronic overexposure may cause lung damage

An unlikely route of exposure. If ingested in sufficient quantity may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

Hazards not otherwise classified (HNOC)

Other Information

3. COMPOSITION/INFORMATION ON INGREDIENTS

Common name Magnesium Carbonate CAS# 546-93-0.
Synonyms Ground Magnesite, Raw ground Magnesite, Magnesium Carbonate,
Chemical Family Metallic Carbonate.

Formula #1 MgCO₃

Chemical Name	CAS No.	Weight-%	Trade Secret
Magnesium Carbonate	546-93-0	100	

4. FIRST AID MEASURES

First aid measures

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If eye irritation persists: Get medical advice/attention.

Skin Contact Wash skin with soap and water.

Inhalation Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Ingestion Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

Self-protection of the first aider Use personal protective equipment as required.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No information available.

Explosion data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Carefully, clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves and goggles to prevent irritation from contact and/or inhalation.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Avoid generation of dust. Do not allow contact with water.

Incompatible materials Formaldehyde. Soluble in aqueous acids generating heat and steam.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection Avoid contact with eyes. The use of eye protection is recommended.

Skin and body protection The use of eye protection, gloves and long sleeve clothing is recommended.

Respiratory protection Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910. 134 for level of exposure incurred. Ensure adequate ventilation, especially in confined areas.

General Hygiene Considerations Avoid contact with skin, eyes or clothing. Wash hands thoroughly after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state Appearance Color	Solid Fine Powder Gray to light brown	Odor Odor threshold	Odorless No information available
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Property	Values	Remarks • Method
pH	Insoluble	10% aqueous slurry
Melting point/freezing point	>2100 °C >3800 °F	
Boiling point / boiling range	Loses CO ₂ at 900 °C	
Flash point	No information available	
Evaporation rate	No information available	
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific Gravity	No information available	
Water solubility	Insoluble in water	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point Molecular weight VOC Content (%) Density Bulk density	No information available No information available No information available No information available 65-85 lb/ft ³
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10. STABILITY AND REACTIVITY

Reactivity

No data available

Chemical stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

None under normal processing.

Hazardous polymerization

Hazardous polymerization does not occur.

Conditions to avoid

Extremes of temperature and direct sunlight.

Incompatible materials

Formaldehyde. Soluble in aqueous acids generating heat and steam.

Hazardous Decomposition Products

Heat and steam.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information	Magnesium Carbonate	CAS# 546-93-0
Inhalation	No data available.	
Eye contact	No data available.	
Skin Contact	No data available.	
Ingestion	No data available.	

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	This product does not contain any carcinogens or potential carcinogens as listed by OSHA, IARC or NTP.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Numerical measures of toxicity - Product Information

12. ECOLOGICAL INFORMATION

Ecotoxicity

No data available on any adverse effects of this material on the environment

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes	This produce does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal once the free water component is evaporated or absorbed by a suitable absorbent (earth). Follow all applicable federal, state and local regulations for safe disposal. Disposal should be in accordance with applicable regional, national and local laws and regulations.
Contaminated packaging	Do not reuse container.

14. TRANSPORT INFORMATION

DOT Not regulated by DOT as a hazardous material. No hazard class, label or placard required, no UN or NA number assigned.

15. REGULATORY INFORMATION

International Inventories

TSCA	Does not comply
DSL/NDSL	Does not comply
EINECS/ELINCS	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

California Proposition 65

This product does not contain chemicals known to the state of California to cause birth defects or other reproductive harm

U.S. State Right-to-Know Regulations

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

<u>NFPA</u>	Health hazards 1	Flammability 0	Instability 0	Physical and Chemical Properties -
<u>HMIS</u>	Health hazards 0	Flammability 0	Physical hazards 0	Personal protection X

Revision Date 16-April-2015

Revision Note

No information available

Disclaimer

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet



SAFETY DATA SHEET

Issue Date 16-April-2015

Revision Date 16-April-2015

Version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name MAGOX® AG GRADE

Other means of identification

Product Code MAGOX® AG GRADE

Synonyms Light Burned Magnesium Oxide, Caustic Calcined Magnesia, MgO, Magnesium Oxide

Recommended use of the chemical and restrictions on use

Recommended Use Soil amendments.

Uses advised against No information available

Details of the supplier of the safety data sheet

Manufacturer Address

Premier Magnesia, LLC, 300 Barr Harbor Drive, Suite 250, West Conshohocken, PA 19428

Emergency telephone number

Company Phone Number 610-828-6929

24 Hour Emergency Phone Number Chemtrec 1-800-424-9300

Emergency Telephone Chemtrec 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

Product dust is classified as a "nuisance particulate, not otherwise regulated" as specified by ACGHI and OSHA. The excessive, long-term inhalation of mineral dusts may contribute to the development of industrial bronchitis, reduced breathing capacity, and may lead to the increased susceptibility to lung disease. This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.122)

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

Label elements

Emergency Overview

The product contains no substances which at their given concentration, are considered to be hazardous to health

Appearance Fine granular

Physical state Solid

Odor Odorless

Hazards not otherwise classified (HNOC)

Other Information

Unknown Acute Toxicity

100% of the mixture consists of ingredient(s) of unknown toxicity

3. COMPOSITION/INFORMATION ON INGREDIENTS

Common name Magnesium Oxide CAS# 1309-48-4.
Synonyms Light Burned Magnesium Oxide, Caustic Calcined Magnesia, MgO, Magnesium Oxide

Chemical Name	CAS No.	Weight-%	Trade Secret
Magnesium Oxide	1309-48-4	100	

4. FIRST AID MEASURES

First aid measures

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. (Get medical attention immediately if irritation persists.)

Skin Contact Wash skin with soap and water.

Inhalation Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Ingestion Not an expected route of exposure. Drink 1 or 2 glasses of water. Never give anything by mouth to an unconscious person. Do not induce vomiting without medical advice. Immediate medical attention is required.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media Water reacts with magnesium oxide producing magnesium hydroxide and heat. Do not allow water to get inside containers: reaction with water will cause product to swell, generate heat, and burst its container. If contact is unavoidable, use sufficient water to safely absorb the heat that may be generated. Wetted product is not a health or environmental hazard.

Specific hazards arising from the chemical

No information available.

Explosion data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Carefully, clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves and goggles to prevent irritation from contact and/or inhalation.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Use personal protective equipment as required.

Conditions for safe storage, including any incompatibilities

Storage Conditions Store in dry, protected storage. Product is stable under normal conditions of dry storage. Do not allow water to get inside containers: reaction with water will cause product to swell, generate heat, and burst its container.

Incompatible materials Interhalogens, bromine pentafluoride, chlorine trifluoride. Contact with aluminum metal may release hydrogen gas. Incandescent reaction with phosphorus pentachloride. Water will react with magnesium oxide to form magnesium hydroxide and release heat and steam.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Magnesium Oxide 1309-48-4	TWA: 10 mg/m ³ inhalable fraction	TWA: 15 mg/m ³ fume, total particulate (vacated) TWA: 10 mg/m ³ fume and total particulate	IDLH: 750 mg/m ³ fume

NIOSH IDLH Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910. 134 for level of exposure incurred.

Appropriate engineering controls

Engineering Controls Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection Avoid contact with eyes. The use of eye protection is recommended.

Skin and body protection The use of eye protection, gloves and long sleeve clothing is recommended.

Respiratory protection Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910. 134 for level of exposure incurred.

General Hygiene Considerations Wash hands thoroughly after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Solid	Odor	Odorless
Appearance	Fine granular	Odor threshold	No information available
Color	Brownish		

Property	Values	Remarks • Method
pH	10-11	
Melting point/freezing point	>2100 °C >3800 °F	
Boiling point / boiling range	No information available	
Flash point	No information available	
Evaporation rate	Not Applicable	
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific Gravity	3.58	
Water solubility	Slight <1%	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available
Density	No information available
Bulk density	50-70 lb/ft ³

10. STABILITY AND REACTIVITY

Reactivity

No data available

Chemical stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

None under normal processing.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid

Extremes of temperature and direct sunlight.

Incompatible materials

Interhalogens, bromine pentafluoride, chlorine trifluoride. Contact with aluminum metal may release hydrogen gas. Incandescent reaction with phosphorus pentachloride. Water will react with magnesium oxide to form magnesium hydroxide and release heat and steam.

Hazardous Decomposition Products

Heat and steam.

11. TOXICOLOGICAL INFORMATION**Information on likely routes of exposure**

Product Information	Magnesium Oxide CAS# 1309-48-4
Inhalation	Inhalation of fume (not MgO dust particulate) produced upon decomposition of magnesium compounds can produce a febrile reaction and leukocytosis in humans.
Eye contact	No data available.
Skin Contact	No data available.
Ingestion	No data available.

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Numerical measures of toxicity - Product Information

Unknown Acute Toxicity 100% of the mixture consists of ingredient(s) of unknown toxicity

12. ECOLOGICAL INFORMATION**Ecotoxicity**

No data available on any adverse effects of this material on the environment

100% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes	This produce does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal once the free water component is evaporated or absorbed by a suitable absorbent (earth). Follow all applicable federal, state and local regulations for safe disposal.
Contaminated packaging	Do not reuse container.

14. TRANSPORT INFORMATION

<u>DOT</u>	Not regulated Not regulated by DOT as a hazardous material. No hazard class, label or placard required, no UN or NA number assigned.
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15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL/NDSL	Complies
EINECS/ELINCS	Complies
ENCS	Complies
IECSC	Complies
KECL	Complies
PICCS	Complies
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

This product does not contain any substances reportable under Sections 302, 304 or 313. Sections 311 and 312 do apply. (Routine Reporting and Chemical Inventories)

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations**California Proposition 65**

This product does not contain chemicals known to the State of California to cause cancer, birth defects or other reproductive toxins.

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Magnesium Oxide 1309-48-4	X	X	X

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

<u>NFPA</u>	Health hazards 1	Flammability 0	Instability 0	Physical and Chemical Properties -
<u>HMIS</u>	Health hazards 0	Flammability 0	Physical hazards 0	Personal protection X

Revision Date 16-April-2015

Revision Note

No information available

Disclaimer

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet



SAFETY DATA SHEET

Issue Date 22-Aug-2014

Revision Date 25-Sept-2015

Version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name OXYMAG®

Other means of identification

Product Code OXYMAG®

Synonyms None

Recommended use of the chemical and restrictions on use

Recommended Use A finely ground magnesium oxide powder which has been specially calcined for use in magnesium oxychloride and magnesium oxysulfate cement.

Uses advised against No information available

Details of the supplier of the safety data sheet

Manufacturer Address

Premier Magnesia, LLC, 300 Barr Harbor Drive, Suite 250, West Conshohocken, PA 19428

Emergency telephone number

Company Phone Number 610-828-6929

24 Hour Emergency Phone Number Chemtrec 1-800-424-9300

Emergency Telephone Chemtrec 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

A brownish, free flowing powder. Not a fire or spill hazard. Low toxicity. Dust is classified as a "nuisance particulate not otherwise regulated".

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

Acute toxicity - Inhalation (Dusts/Mists)

Not toxic in normal industrial use.

Label elements

Emergency Overview

Not toxic in normal industrial use. Dust is classified as a "nuisance particulate not otherwise regulated" as specified by ACGIH and OSHA. The excessive, long-term inhalation of mineral dusts may contribute to the development of industrial bronchitis, reduced breathing capacity, and may lead to the increased susceptibility to lung disease.

Appearance Fine Powder

Physical state Solid

Odor Odorless

Particulate may cause eye irritation

Low toxicity by skin contact

Chronic overexposure by inhalation of airborne particulate may irritate upper respiratory system as well as the throat

Ingestion is an unlikely route of exposure. If ingested in sufficient quantity may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

Hazards not otherwise classified (HNOC)

Other Information

3. COMPOSITION/INFORMATION ON INGREDIENTS

Common name Calcined Magnesite, Magnesium Oxide.
Common name Magnesium Sulfate.

Chemical Name	CAS No.	Weight-%	Trade Secret
Magnesium Sulfate	7487-88-9	10-15	
Magnesium Oxide	1309-48-4	85-90	

4. FIRST AID MEASURES**First aid measures**

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If eye irritation persists: Get medical advice/attention.

Skin Contact Wash skin with soap and water.

Inhalation Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Ingestion Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES**Suitable extinguishing media**

Product on initial contact with water will generate some heat. Excess water will dissipate any heat.

Unsuitable extinguishing media Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No information available.

Explosion data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters

Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Carefully clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves and goggles to prevent irritation from contact and/or inhalation.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Store in dry, protected storage. Product is stable under normal conditions of storage. Minimize dust generation during material handling and transfer.

Incompatible materials Magnesium Oxide component is soluble in aqueous acids generating heat and steam; violent reaction or ignition with interhalogens (e.g., bromine pentafluoride; chlorine trifluoride). Incandescent reaction with phosphorus pentachloride. Water will react with magnesium oxide producing magnesium hydroxide and heat. The magnesium sulfate is potentially explosive when reacted with ethoxyethynyl alcohols (i.e., 1-ethoxy-3methyl-1butyn-3-ol).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Magnesium Oxide 1309-48-4	TWA: 10 mg/m ³ inhalable fraction	TWA: 15 mg/m ³ fume, total particulate (vacated) TWA: 10 mg/m ³ fume and total particulate	IDLH: 750 mg/m ³ fume

Appropriate engineering controls

Engineering Controls Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection The use of eye protection is recommended.

Skin and body protection The use of eye protection, gloves and long sleeve clothing is recommended.

Respiratory protection Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910. 134 for level of exposure incurred.

General Hygiene Considerations Avoid contact with skin, eyes or clothing. After handling this product, wash hands before eating or drinking.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Solid	Odor	Odorless
Appearance	Fine Powder	Odor threshold	No information available
Color	Brownish		

<u>Property</u>	<u>Values</u>	<u>Remarks • Method</u>
pH	10-11	
Melting point/freezing point	melting pt >2100 °C melting pt >3800 °F	
Boiling point / boiling range	Not applicable	
Flash point	No information available	
Evaporation rate	Not applicable	
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific Gravity	No information available	
Water solubility	Slight <1%	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available
Density	No information available
Bulk density	65-75 lb/ft3

10. STABILITY AND REACTIVITY

Reactivity
No data available

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid
Extremes of temperature and direct sunlight.

Incompatible materials

Magnesium Oxide component is soluble in aqueous acids generating heat and steam; violent reaction or ignition with interhalogens (e.g., bromine pentafluoride; chlorine trifluoride). Incandescent reaction with phosphorus pentachloride. Water will react with magnesium oxide producing magnesium hydroxide and heat. The magnesium sulfate is potentially explosive when reacted with ethoxyethynyl alcohols (i.e., 1-ethoxy-3methyl-1butyn-3-ol).

Hazardous Decomposition Products

Heat and steam above 1100°C SO_x.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information	Magnesium Oxide CAS# 1309-48-4 Product does not present an acute toxicity hazard based on known or supplied information. Magnesium Sulfate CAS #7487-88-9 Product does not present an acute toxicity hazard based on known or supplied information.
Inhalation	Inhalation of fume (not MgO dust particulate) produced upon decomposition of magnesium compounds can produce a febrile reaction and leukocytosis in humans.
Eye contact	Irritating to eyes.
Skin Contact	Low toxicity by skin contact.
Ingestion	Ingestion is an unlikely route of exposure. If ingested in sufficient quantity may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Serious eye damage/eye irritation	Irritating to eyes.
Irritation	Irritating to eyes and respiratory system.
Sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Numerical measures of toxicity - Product Information

12. ECOLOGICAL INFORMATION

Ecotoxicity

No data available on any adverse effects of this material on the environment

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS**Waste treatment methods****Disposal of wastes**

This product does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal. Follow all applicable federal, state and local regulations for safe disposal.

Contaminated packaging

Do not reuse container.

14. TRANSPORT INFORMATION**DOT**

Not regulated by DOT as a hazardous material. No hazard class, label or placard required, no UN or NA number assigned.

15. REGULATORY INFORMATION**International Inventories**

TSCA	Does not comply
DSL/NDSL	Does not comply
EINECS/ELINCS	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

US Federal Regulations**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Magnesium Oxide 1309-48-4	X	X	X

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

<u>NFPA</u>	Health hazards 1	Flammability 0	Instability 0	Physical and Chemical Properties -
<u>HMIS</u>	Health hazards 0	Flammability 0	Physical hazards 0	Personal protection X

Revision Date 25-Sept-2015

Revision Note

No information available

Disclaimer

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet