ROD AND WIRE MILL GROUNDWATER CORRECTIVE MEASURES STUDY WORK PLAN

TRADEPOINT ATLANTIC
SPARROWS POINT, MARYLAND

Prepared By:

ENVIROANALYTICS GROUP
1515 Des Peres Road, Suite 300
Saint Louis, Missouri 63131

and

ARM GROUP INC.
9175 Guilford Road
Suite 310
Columbia, Maryland 21046

ARM Project No. 190685M

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1.0 INTRODUCTION

The Rod & Wire Mill (RWM) Area (the Site) is located in the northwestern portion of the Tradepoint Atlantic (TPA) Property and has also been given the designation of Parcel A3, as the entire property has been divided into several separate parcels.

In an email received on November 28, 2018, the United States Environmental Protection Agency (EPA) provided comments on the "Rod and Wire Mill Interim Measures Progress Report – August 2018". The comments identified elevated zinc levels in some perimeter monitoring wells as a potential concern with respect to discharges to surface water. The most recent progress report, "Rod and Wire Mill Interim Measures Progress Report—December 2018" was submitted to the EPA and Maryland Department of the Environment (MDE) on February 15, 2019. In an email received on February 28, 2019, the MDE provided comments on this most recent report. The comments recommended additional well locations to address data gaps in the current monitoring network at the RWM.

The "Rod and Wire Mill Interim Measures Supplemental Investigation Report" (Revison 0 dated July 26, 2019) was completed to improve the understanding of groundwater conditions in the RWM, to address the concerns raised by MDE and EPA outlined in the comments mentioned above, and to support an evaluation of the most relevant and effective additional corrective actions for the groundwater conditions at the RWM. In addition to the supplemental onshore investigation activities, pore water and surface water samples were collected from locations in Bear Creek in the area just offshore (to the west) of the RWM to assess the current risk to offshore aquatic receptors.

Based on the results of the supplemental investigations, it was concluded that the remaining groundwater impacts would not exacerbate the existing offshore impacts and do not present an imminent endangerment to human health or the environment that would necessitate additional interim measures. It was recommended that a Corrective Measures Study (CMS) be initiated to determine an appropriate final remedy for the groundwater impacts at the Site.

2.0 CURRENT CONDITIONS

2.1 SITE SETTING AND USE

The TPA Property is located in Baltimore County, Maryland within the southeastern corner of the Baltimore metropolitan area, and approximately nine miles from downtown. The property encompasses approximately 3,100 acres of land located on a peninsula situated on the Patapsco River near its confluence with the Chesapeake Bay, and physically positioned in the mouth of the heavily industrialized and urbanized Baltimore Harbor / Patapsco River region. **Figure 1** shows the location and boundaries of the TPA Property.

From the late 1800s until 2012, the property was used for the production and manufacturing of steel. Iron and steel production operations and processes at the Site included raw material handling, coke production, sinter production, iron production, steel production, and semi-finished and finished product preparation. In 1970, Sparrows Point was the largest steel facility in the United States, producing hot and cold rolled sheets, coated materials, pipes, plates, and rod and wire. The steelmaking operations at the facility ceased in fall 2012 and the steel mill has been demolished. Current plans for the TPA Property include redevelopment over the next several years. Some portions of the TPA Property have already undergone remediation and/or redevelopment.

The RWM (the Site) is located in the northwestern portion of the TPA property, and is the location of the former mills that produced rods and wire products from the 1940's to the early 1980's. **Figure 2** shows the location and boundaries of the RWM.

A Response and Development Work Plan (RADWP) was approved for the remediation and development of Area A: Sub-Parcel A3-1 which includes the former Rod & Will Mill Special Study Area and encompasses essentially all the impacted groundwater plume. The Parcel is currently zoned Manufacturing Heavy-Industrial Major (MH-IM). The RADWP called for selective removal of contaminated soils followed by capping of impacted soils to prevent direct contact by future industrial workers and implementation of the following institutional controls:

- A restriction prohibiting the use of groundwater for any purpose at the Site and a requirement to characterize, containerize, and properly dispose of groundwater in the event of deep excavations encountering groundwater.
- Notice to MDE prior to any future soil disturbance activities at the Site below areas designated for engineering controls. This written notice will be required at least 15 days prior to any planned excavation activities at the Site that will penetrate through the cap.
- Requirement for a HASP in the event of any future excavations at the Site.

- Complete appropriate characterization and disposal of any future material excavated from beneath the cap in accordance with applicable local, state and federal requirements.
- Implementation of inspection procedures and maintenance of the containment remedies.

Subsequent to the approval of the RADWP, the Site was developed with the construction of a large industrial warehouse, which is the intended permanent site use.

2.2 INTERIM MEASURES

In 1986, a soil and groundwater remediation program was initiated to address groundwater that exhibited elevated concentrations of cadmium and residual soil contamination within the Sludge Bin Storage Area. Remediation initially consisted of a soil flushing program with associated pumping and treatment of groundwater from shallow and intermediate wells.

This pump and treat system was reconfigured in 2001 to provide groundwater recovery from two intermediate zone recovery wells (RW10-PZM020 and RW15-PZM020) that operated at a rate of between 5 and 12 gallons per minute (gpm). Recovered groundwater was transported via a pipeline to the HCWWTP for subsequent treatment and discharge in accordance with the National Pollutant Discharge Elimination System (NPDES) permit requirements for the Facility. The pump and treat system remained active until September 2016.

The "Interim Measure Work Plan – In-Situ Groundwater Treatment" (Advanced GeoServices Corp., August 2016) presented a Conceptual Site Model (CSM) that focused on a source of acidity to the local groundwater that lowered pH and increased the solubility of cadmium and zinc and mobilized these metals creating the groundwater plume containing these metals. The acidity is neutralized by alkaline slag in the shallow groundwater zone; however, slag is not present and neutralization does not occur in the intermediate zone aquifer where the elevated zinc and cadmium is observed in the groundwater plume.

The current remedial approach utilizes in-situ treatment trenches designed to reduce dissolved metal concentrations in the intermediate zone within the identified source areas. Specifically, alkaline reagents (TerrabondMG – 40% by weight in conjunction with limestone aggregate – 60% by weight) were added into the intermediate groundwater zone as permeable reactive barrier trenches designed to introduce alkalinity and raise pH in groundwater flowing to the west from select high concentration areas. The trenches were backfilled with reagent mix from a depth of 35 feet below ground surface (bgs) up to a depth approximately 12 feet bgs. The design and oversight of this remedial technique was completed by Advanced GeoServices (AGS) and is discussed in greater detail in the AGS Work Plan, Interim Measure Work Plan In-Situ Groundwater Treatment dated August 22, 2016. The construction of the trenches was completed in January 2017.

The soils and groundwater beneath the Former Sludge Bin Storage area contained the highest concentrations of cadmium in the RWM. A 130-foot by 130-foot section of this area was designated as the cadmium hot spot. To reduce the source of continuing cadmium contamination to groundwater in this area, approximately 1,252 cubic yards of soils were excavated from the top 2 feet of the cadmium hot spot and disposed of off-site. TerrabondMG powder was then mixed into the hot spot soils from a depth of 2 feet to 7 feet bgs. After the soils were mixed with the TerrabondMG, the cadmium hot spot was capped with a 12-inch layer of the smaller gradation of steel mill slag.

The interim groundwater treatment goals are to increase the pH in order to precipitate the dissolved metals and achieve a reduction in dissolved concentrations of cadmium and zinc within the source areas when compared to pretreatment conditions.

Since the completion of the trench installation, groundwater monitoring (monthly through 2017 and quarterly since that time) has been performed at upgradient, performance and perimeter wells to assess the performance of the installed interim measures. Interim Measures Progress Reports – have been submitted to the EPA as well as the MDE on a semi-annual basis. These progress reports summarize the results of the quarterly monitoring events.

2.3 Nature and Extent of Contamination

The nature and extent of contamination is defined by overlapping plumes of two dissolved metal constituents of concern (COCs) – cadmium and zinc – in the shallow and intermediate groundwater zone. The source of the cadmium plume is the former Sludge Bin Storage Area. The zinc plume originates in the former East Pond. The limits of these source areas have been defined through historical plant documents and aerial photographs.

The lateral extent of the dissolved COC plumes in both the shallow and intermediate zones was defined in the Rod & Wire Mill Interim Measure Supplemental Investigation Report (Revision 0 dated 7/26/2019). To the west the plumes are limited by the Bear Creek shoreline. While zinc is detected in several of the shallow wells outside the interim measure area, the elevated zinc plume is delineated to the northern portion of the former rod and wire mill footprint. There were no elevated levels of cadmium detected in the shallow zone outside the interim measure area. The lateral extent of the zinc plume in the intermediate zone has been generally defined by the lack of detections in the Greys Landfill wells to the north and the relatively low concentration observed in well RWG-MWI to the south and SW-082-MWI upgradient to the east.

Concentrations of dissolved zinc in sediment pore water were above the ambient water quality criteria for chronic exposure to aquatic life at three of the 16 offshore sediment sample locations.

Surface water samples confirmed the absence of concentrations of concern in Bear Creek as a result of the discharge of groundwater within the impacted area.

3.0 PURPOSE

3.1 OVERALL PURPOSE OF THE CORRECTIVE MEASURES STUDY

The scope of the CMS is to address groundwater impacts associated with the former Rod & Wire Mill Special Study Area. Soil impacts have been, or are being, addressed through a separate RADWP. Assessment and remediation of historical offshore impacts are being undertaken by the U.S. EPA, and is not within the scope of this CMS.

3.2 APPROACH FOR CORRECTIVE MEASURES STUDY

The groundwater concern is dissolved phase zinc and cadmium in the shallow and intermediate zone groundwater. The approach to addressing groundwater during the CMS is to develop and evaluate alternatives for reducing the levels of COCs in groundwater and mitigating migration of contaminated groundwater across the shoreline/property boundary. As noted, ecological risk associated with existing offshore sediment will not be addressed. The CMS will also evaluate exposure control measures (e.g., institutional and engineering controls). These measures will be evaluated relative to their ability to control exposure in the short-term, while other measures work towards the reduction of contaminant levels and areal extent over the long-term.

4.0 CORRECTIVE MEASURES OBJECTIVES

4.1 CORRECTIVE ACTION OBJECTIVES (CAOS)

EPA expects final remedies to return usable groundwater to its maximum beneficial use, where practicable, within a timeframe that is reasonable. Where returning contaminated groundwater to its maximum beneficial use is not technically practicable, EPA generally expects facilities to prevent or minimize the further migration of a plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction. Technical impracticability (TI) for contaminated groundwater refers to a situation where achieving groundwater cleanup standards associated with final cleanup standards is not practicable from an engineering perspective. The term "engineering perspective" refers to factors such as feasibility, reliability, scale or magnitude of a project, and safety.

CAOs for the RWM Site are defined as follows:

(1) control further releases of COCs to the groundwater to the extent practicable,

(2) control human exposure to the hazardous constituents remaining in the groundwater, and

(3) ensure that groundwater containing elevated concentrations of COCs will not adversely impact ecological receptors nor adjacent surface water quality.

4.2 TARGET MEDIA CLEANUP LEVELS

Target Media Cleanup Levels and points of compliance will be developed during the CMS. The CMS will propose media cleanup levels appropriate for the proposed CAOs and prepare figures to identify the locations and extents of exceedances of the proposed media cleanup levels. Potentially applicable standards and relevant criteria, and preliminary target levels and points of compliance are discussed below.

EPA prepared a groundwater use determination memorandum dated April 13, 2018. EPA concluded that drinking water use of groundwater in the shallow and intermediate aquifers at Sparrows Point can be excluded from consideration when developing groundwater cleanup levels. The memorandum indicated that maximum beneficial use is industrial, commercial or dewatering and that groundwater cleanup levels should be developed based on State surface water quality discharge standards. The memorandum also indicated that more stringent groundwater cleanup levels may be appropriate in specific areas of the Sparrows Point Site, based on other potential exposures or pathways not associated with groundwater use (e.g., vapor intrusion or direct contact during construction excavation).

There is currently no direct exposure to groundwater for human receptors. The offsite human exposures have been determined to be negligible, while onsite workers may have short-term exposure to shallow groundwater during intrusive work. Offsite ecological receptors may have long-term exposure to pore water impacted by groundwater migration.

Therefore, with respect to potential human exposure, groundwater cleanup levels will be derived for constituents that might present an unacceptable risk due to direct contact during construction excavation. The point of compliance for these cleanup levels would be Site-wide.

With respect to potential industrial use and discharge of groundwater to surface water, groundwater cleanup levels will be developed based on State surface water quality discharge standards. These levels would apply Site-wide. The CMS will evaluate a surface water mixing zone in deriving these cleanup levels.

To protect ecological receptors, groundwater cleanup levels based on State surface water quality discharge standards will be derived with a point of compliance at the shoreline/property boundary. The CMS will evaluate an attenuation factor for groundwater to shallow pore water to account for interaction of surface water and pore water as well as degradation in the bioactive benthic zone.

The CMS report will include figures presenting the distribution of contaminant concentrations exceeding these target media cleanup levels.

5.0 CORRECTIVE MEASURES TECHNOLOGIES

This section of the CMS Work Plan presents a description of the technologies planned for evaluation in the CMS. The technologies presented include those technologies considered applicable in addressing Facility contaminants, are likely to perform reliably and, will achieve the CAOs presented in Section 4.0 of this CMS Work Plan.

The potential groundwater remediation technologies to be evaluated include:

Institutional and Engineering Controls
- Restrictions on Groundwater Use
- Restrictions on Site Use
- Fencing/Warning Signs/Access Restrictions

Removal Technologies
- Excavation
- Groundwater Recovery (pump and treat)

Containment Technologies
- Hydraulic Containment
- Vertical Barrier Walls (sheet piling, soil-bentonite, etc.)

Treatment Technologies
- In-Situ Chemical Fixation (reagent injection, deep soil mixing)
- In-Situ Biological Treatment (sulfate reduction)
- Permeable Reactive Barriers

Disposal Technologies
- Off-Site Disposal/Landfilling
- On-Site Disposal (CAMU)
- Permitted Discharge

A screening of these technologies will be presented in a summary table describing each technology screened and the results of the screening to indicate which technologies are considered to be potentially applicable based on applicability to the target COCs and the implementability of the technology under the site conditions.

6.0 IDENTIFICATION AND EVALUATION OF ALTERNATIVES

This section of the CMS Work Plan presents a general description of the approach for identifying and evaluating potential corrective measure alternatives. Per applicable guidance, this section of the CMS will present a description of each alternative and a brief screening of the identified corrective measure alternatives against the Resource Conservation and Recovery Act (RCRA) threshold criteria.

6.1 IDENTIFICATION OF CORRECTIVE MEASURE ALTERNATIVES

Those technologies determined to be potentially applicable will be developed into Corrective Action Alternatives. Identified technologies may be used alone or in combination to form the overall corrective measure alternatives. The CMS may identify a current interim measure as, or as part of, a final corrective measure alternative.

The CMS will describe the components of each corrective measure alternative including an engineering description of each corrective measure alternative, a conceptual level design that will form the basis for the estimate of potential cost for that alternative, how the alternative may be expected to perform and, expectations regarding the time-frame for remediation.

These alternatives will be screened against RCRA's threshold criteria which are:

1. protection of human health and the environment;
2. attainment of media cleanup objectives; and
3. controlling the sources.

6.2 PILOT OR BENCH SCALE STUDIES

No pilot or bench scale studies are currently anticipated. If an in-situ treatment technology is identified for detailed evaluation, bench-scale treatability testing may be performed to assess the efficacy and dosing of potential reagents.

6.3 EVALUATION OF CORRECTIVE MEASURE ALTERNATIVE(S)

This section will present a detailed evaluation of those alternatives determined to meet the threshold criteria. Pursuant to applicable CMS guidance, the evaluation will address each of the following evaluation/balancing criteria: long-term effectiveness; implementability; short-term effectiveness; toxicity, mobility and volume reduction; community acceptance; state acceptance; and cost.

6.3.1 Long-Term Effectiveness

This criterion refers to the expected effectiveness, reliability and risk of failure of the alternatives, including the effectiveness under analogous site conditions, the potential impact resulting from a failure of the alternative, and the projected useful life of the alternative.

6.3.2 Reduction in Toxicity, Mobility, or Volume of Wastes

This criterion generally refers to how much the corrective measures alternatives will reduce the waste toxicity, mobility and/or volume, primarily through treatment.

6.3.3 Short-Term Effectiveness

This criterion generally refers to potential short-term risks to on-site workers and the community in association with implementation of the corrective measure alternatives, such as might be associated with the excavation, handling, treatment, containment, and transportation of contaminated materials.

6.3.4 Implementability

This criterion refers to the relative ease of alternative implementation (construction), including duration, administrative and technical feasibility, and availability of the required services and materials.

6.3.5 Community Acceptance

This criterion refers to the known or anticipated community acceptance associated with the corrective measure alternatives. This criterion will be further evaluated through the 30-day public comment period that will be provided following remedy selection and issuance of a Statement of Basis by the USEPA.

6.3.6 State Acceptance

This criterion refers to how the corrective measure alternatives will comply with applicable State regulations (e.g., permit requirements).

6.3.7 Cost

This criterion addresses the anticipated short- and long-term costs associated with implementation of the corrective measure alternatives.

7.0 REPORT OUTLINE

The outline for the report is expected to be generally as follows:

1.0 INTRODUCTION
2.0 DESCRIPTION OF CURRENT SITUATION
- 2.1 Summary of Previous Investigations
- 2.2 Source Areas
- 2.3 Nature and Extent of Groundwater Impacts
- 2.4 Interim Measures

3.0 CORRECTIVE ACTION OBJECTIVES
- 3.1 Corrective Action Goals
- 3.2 Media Cleanup Levels and Point(s) of Compliance

4.0 IDENTIFICATION AND DEVELOPMENT OF THE CORRECTIVE MEASURES ALTERNATIVES
- 4.1 Screening of Corrective Measures Technologies
- 4.2 Identification of the Corrective Measures Alternatives
- 4.3 Detailed Description of Each Alternative
  - 4.3.1 Protection of Human Health and the Environment
  - 4.3.2 Attainment of Media Cleanup Objectives
  - 4.3.3 Control of Sources of Releases
- 4.4 Initial Screening of Alternatives

5.0 EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES
- 5.1 Detailed Evaluation of Alternative 1
  - 5.1.1 Long-Term Effectiveness
  - 5.1.2 Reduction in Toxicity, Mobility, or Volume of Wastes
  - 5.1.3 Short-Term Effectiveness
  - 5.1.4 Implementability
  - 5.1.5 Community Acceptance
  - 5.1.6 State Acceptance
  - 5.1.7 Cost
- 5.2 Alternative 2
- 5.3 Alternative 3, …

6.0 COMPARATIVE ANALYSIS AND PREFERRED ALTERNATIVE
- 6.1 Comparison of Alternatives
- 6.2 Recommended Alternative
- 6.3 Preliminary Implementation Schedule

8.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

8.1 PROJECT PERSONNEL

The Work Plan will be implemented by ARM Group Inc. (ARM) under a contract with EnviroAnalytics Group (EAG).

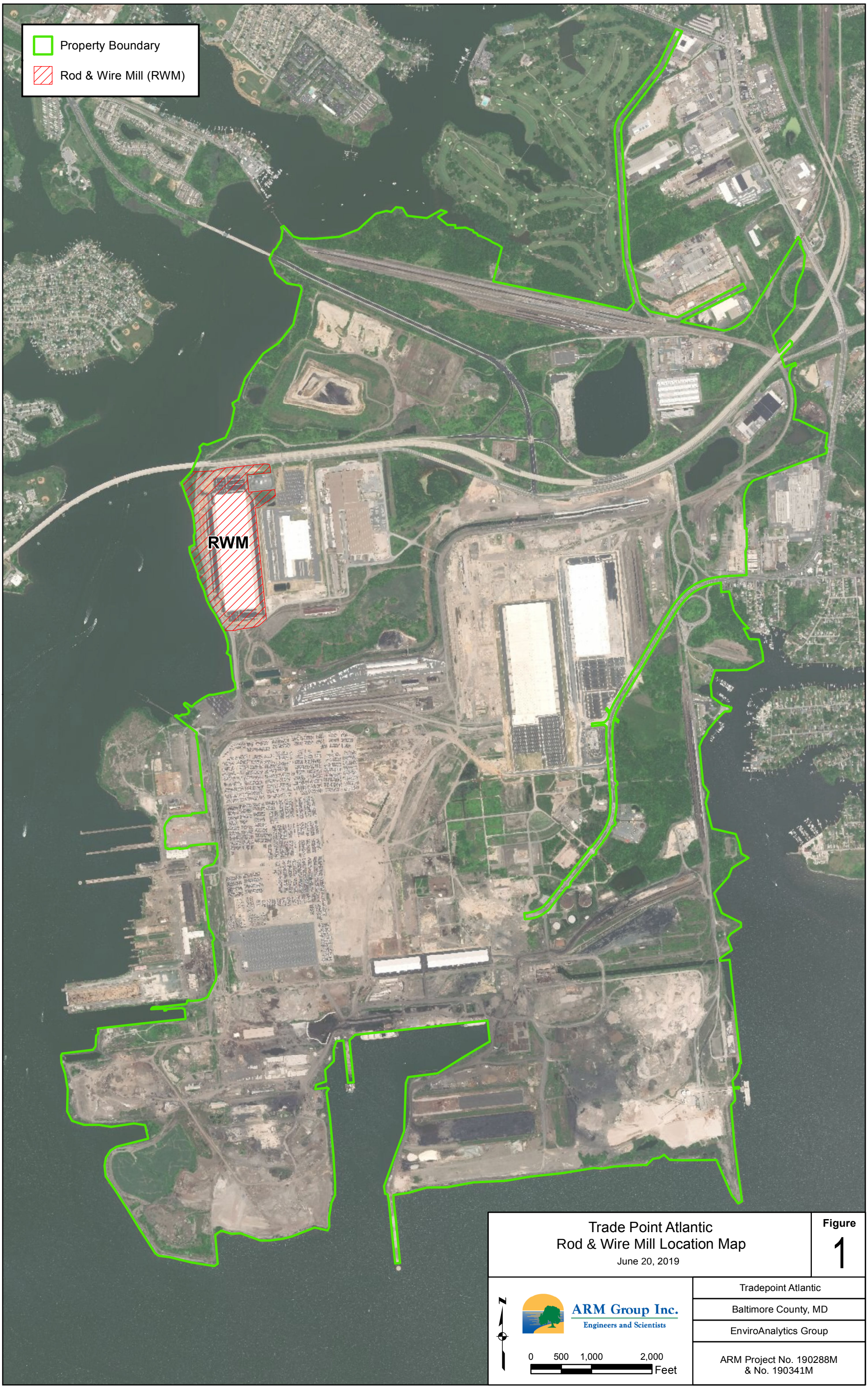
The EAG Project Manager is Mr. James Calenda. Mr. Calenda will be responsible for ensuring the availability of resources for the project and will be the primary point of contact with the regulatory agencies.

The ARM Project Manager, Mr. Neil Peters, P.E., is responsible for ensuring that all activities are conducted in accordance with this Work Plan and the contract requirements. Mr. Peters is a registered Professional Engineer in the State of Maryland and has served as Project Manager on numerous remediation projects. As Project Manager, Mr. Peters will be responsible for technical direction of ARM's team of engineers and geologists, directing daily project activities, tracking project schedule, and providing quality assurance. Mr. Peters will provide technical coordination with the MDE, EPA and EAG.

8.2 PROJECT SCHEDULE

The anticipated schedule for completion of the CMS report is 12 weeks from data of approval. If, after screening of technologies, it is determined that bench-scale or pilot-scale testing is necessary, additional time may be required and a proposed schedule will be submitted.

FIGURES



Trade Point Atlantic
Rod & Wire Mill Location Map
June 20, 2019

Figure
1

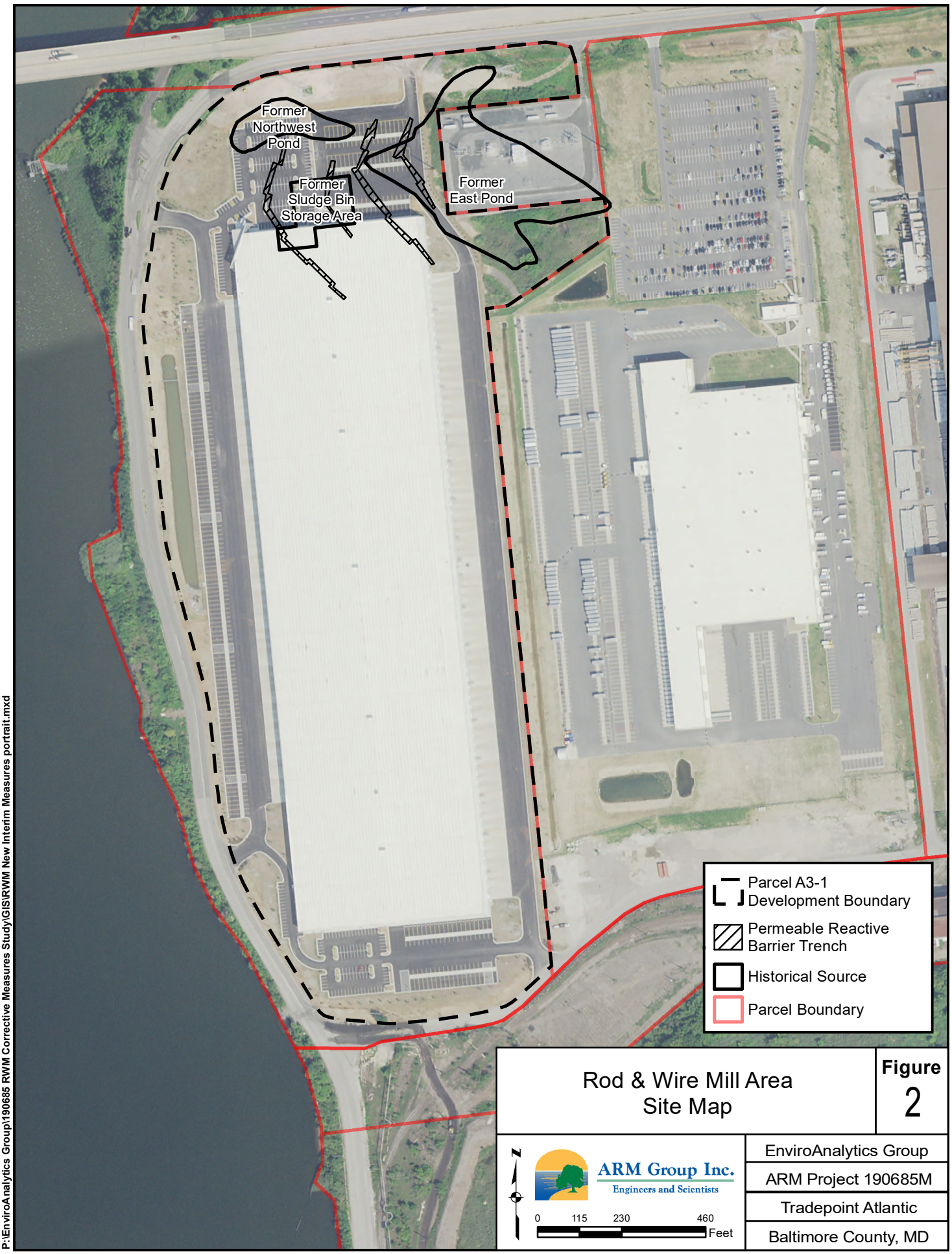
ARM Group Inc.
Engineers and Scientists

Tradepoint Atlantic

Baltimore County, MD

EnviroAnalytics Group

ARM Project No. 190288M
& No. 190341M



Rod & Wire Mill Area Site Map

Figure 2

ARM Group Inc.
Engineers and Scientists

0 115 230 460 Feet

EnviroAnalytics Group
ARM Project 190685M
Tradepoint Atlantic
Baltimore County, MD

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