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DOCUMENT #7

Interim Site Management Plan

INTERIM SITE MANAGEMENT PLAN

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, ORANGE COUNTY, NEW YORK
[EPA ID NO. NYD030485288]

OCTOBER 2015

Revised May 2019

REVERE SMELTING & REFINING CORPORATION
NYSDEC PERMIT #3-3352-00145-00001-0
USEPA ID # NYD030485288

INTERIM SITE MANAGEMENT PLAN
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Revisions to Final Approved RCRA Interim Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
0	*October 2015*	*Creation of Original Publication - Integrated Contingency Plan for RCRA Permit Renewal*	
1	*February 2016*	*Revisions as requested by NYSDEC including addition of table identifying SWMUs/AOCs.*	
2	*December 2016*	*Additional SWMUs added.*	
3	*March 2018*	*Updated SWMU List - Sump, Smelter Main Entrance*	
4	*May 2019*	*Updated Groundwater Monitoring Plan*	

October 2015 / Revised May 2019

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1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 Introduction

In accordance with the Resource Conservation and Recovery Act ("RCRA"), this Interim Site Management Plan ("ISMP") is a required element of the Part 373 Permit for Revere Smelting & Refining Corporation ("Revere") located in Middletown, New York (hereinafter referred to as the "Site" or "Facility"). The RCRA program in New York State is administered by New York State Department of Environmental Conservation ("NYSDEC").

1.1.1 General

Revere operates a facility located in the Town of Wallkill, Orange County, New York to manage hazardous waste. Since remaining contamination and/or disposed waste are present at the Site, the NYSDEC has required preparation of this ISMP to present the monitoring activities and/or operations and maintenance ("O&M") procedures implemented at the Facility to prevent the migration of contamination and determine the continued effectiveness and protectiveness of any implemented remedy. A figure showing the site location and the boundaries of operable units ("OUs") at the Facility is provided as Figure 1.

For the purpose of this ISMP, the term "remaining contamination" is being used to refer to any contamination present at the Facility for which a remedy has been implemented or has been selected but not yet implemented. It is understood that an environmental easement will be required on portions of the Revere Smelting & Refining Corporation property consistent with the Order on Consent between NYSDEC and Revere dated February 1, 2011. This permit will be modified upon establishment of the easement. All reports associated with the Site can be reviewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State, as applicable.

This ISMP was prepared by Revere in accordance with the requirements of the NYSDEC's DER-10, Technical Guidance for Site Investigation and Remediation, dated May 3, 2010, the Part 373 regulations, codified at 6 NYCRR 373, and the guidelines provided by the NYSDEC.

The following is a listing of the solid waste management units (SWMUs) and areas of concern (AOCs) at the Facility:

Revere Smelting and Refining Corporation
List and Status of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at the Revere Smelting and Refining (RSR) Site

(SWMU/AOC LIST)

Unit #	NAME	SWMU / AOC	STATUS	COMMENTS
1	Waste Piles	SWMU	No Further Action (NFA)	Wrecker Material now in Containment Bldg.
2	Untreated Wastewater Tanks	SWMU	Active	
3	Treated Wastewater Tanks	SWMU	Active	
4	Neutralization Tank	SWMU	Active	
5	Filtration Tank	SWMU	Active	
6	Main Storm Water Sump (formerly named "Collection Sump" and "Stormwater Sump")	SWMU	Active	
7	Battery Storage Area (formerly named "Container Storage Areas in Storage Yard")	SWMU	Active	
8	Contaminated Soil Under Containment Building (formerly named "Contaminated Soil Under Old Storage Yard Area")	SWMU	Active	
9	Impacted Soils Within OU-4 (formerly named "On-Site Soil Contaminated With Lead")	SWMU	Active	
10	Off-Site Soil Contaminated With Lead	AOC	Active	
11	On-Site Contaminated Surface Water Sediments Located in Wetlands, Ponds, and Streams (formerly named "Surface Water Sediment")	AOC	NFA	Remediated
12	Off-Site Contaminated Surface Water Sediments Located in Wetlands, Ponds, and Streams	AOC	Active	
13	Containment Building	SWMU	Active	
14	On-Site Soils Beyond OU-4	SWMU	NFA – 3/31/16[1]	Remediated

Unit #	NAME	SWMU / AOC	STATUS	COMMENTS
15	Corrective Action Management Units 1-6	SWMU	NFA – 3/31/16[1]	Remediated
16	Soil Piles SP-2 and SP-3	SWMU	NFA – 3/31/16[1]	Remediated
17	Battery Storage Area Sump	SWMU	Active	
18	Shipping Dock Sump	SWMU	Active	
19	North Railroad Sump	SWMU	Active	
20	Railroad Berm Sump	SWMU	Active	
21	South Railroad Sump (formerly named "Railroad Area Sump")	SWMU	Active	
22	Trailer Parking Bldg. Sump	SWMU	Active	
23	Lower Yard Sump (formerly named "Southeast Corner Yard Sump")	SWMU	Active	
24	Storm Water Tankfarm Containment Sump (formerly named "Stormwater Containment Sump")	SWMU	Active	
25	Hill Tankfarm Containment Sump	SWMU	Active	
26	Crystallizer Tankfarm Containment Sump	SWMU	Active	
27	Crystallizer Pit Sump	SWMU	Active	
28	Main Plant Trench Sump	SWMU	Active	
29	Slag Caster Sump	SWMU	Active	
30	Plastic System Sump	SWMU	Active	
31	North Yard Sump (formerly named "Baghouse Ramp Sump")	SWMU	Active	
33	BW Dock Sump (formerly named "Battery Wrecker Puncher Sump")	SWMU	Active	
34	SRF Scrubber Room Sump	SWMU	Active	
35	Mobile Equipment Wash Station Sump	SWMU	Active	
36	ETP Acid Neutralization Room Sump (formerly named "Gypsum Bldg. Sump")	SWMU	Active	
37	ETP Clarifier Containment Sump	SWMU	Active	

Unit #	NAME	SWMU / AOC	STATUS	COMMENTS
38	ETP Lancy Room Sump (formerly named "Lancy Bldg. Sump")	SWMU	Active	
39	Scrubber Clarifier Room Sump (formerly named "Clarifier Bldg. Sump")	SWMU	Active	
40	Scrubber Building Sump	SWMU	Active	
41	Lab Emergency Shower Sump	SWMU	Active	
42	Laundry Discharge Pit	SWMU	Active	
43	Office Grey Water Ejection Pit Sump	SWMU	Active	
44	Truck Scale Sump	SWMU	Active	
43	Office Restrooms/Grey Water Sump (from original permit)	SWMU	NFA	Filled with concrete
44	Washroom Sump (from original permit)	SWMU	NFA	Filled with concrete
45	Vacuum System Area Sump (from original permit)	SWMU	NFA	Filled with concrete
46	Containment Cell	SWMU	Active	
47	Contaminated Groundwater	AOC	Active	
48	Sump, Regenerative Thermal Oxidizer (RTO) to Blow Down Tank	SWMU	Active	
49	Sump, Wet Electro-Static Precipitator (WESP) Cooling Tower to Blow Down Tank	SWMU	Active	
50	Sump, WESP West Floor to Blow Down Tank	SWMU	Active	
51	Sump, WESP East Floor to Blow Down Tank	SWMU	Active	
52	Sump, WESP Fire Sprinkler Room to Blow Down Tank	SWMU	Active	
53	Sump, WESP Storm Water Storage Tank	SWMU	Active	
54	WESP Blow Down Storage Tank	SWMU	Active	
55	WESP Storm Water Storage Tank	SWMU	Active	
56	Sump, Smelter Main Entrance	SWMU	NFA	Filled with concrete

1.1.2 Purpose

Remaining contamination, as previously defined, is present at the Facility. Engineering controls have been implemented at the Facility to control exposure to remaining contamination and to ensure the protection of public health and the environment. This plan has been approved by the NYSDEC, and compliance with this plan is required by the Facility's Part 373 Permit. This ISMP may only be revised with the approval of the NYSDEC and may require a permit modification.

This ISMP provides a detailed description of all procedures required to manage remaining contamination present at the Site. To address these needs, this ISMP includes three plans: (1) a Material and Groundwater Management Plan; (2) a Groundwater Monitoring Plan; and (3) a Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4.

1.1.3 Revisions

This ISMP is incorporated by reference into the Part 373 Permit for the Revere Facility. In the event that changes are made to the Facility that affects any of the contents of this ISMP, the plan will be updated in accordance with the requirements of Condition D of Module I of the facility's Part 373 Permit. Revisions to this plan will be proposed by the Permittee in writing to the NYSDEC's permit writer. Once complete, the NYSDEC will initiate a permit modification in accordance with 6 NYCRR 621.13 to incorporate the revised plan into the Facility's Part 373 Permit.

1.2 Site Background, Site Location and Description and Site History

Revere operates a secondary lead smelting facility located at 65 Ballard Road, approximately 7 miles east of Middletown, in the Town of Wallkill, Orange County, New York (Figure 1). The Revere facility was constructed in 1970 and acquired by Revere in 1973. Revere manufactures lead and lead alloys. The major raw material is used lead acid batteries, such as the typical automotive battery. Other raw materials used in production include battery-manufacturing by-products, lead-bearing baghouse dust from battery manufacturers and smelters, scrap metal from metal salvage yards, and virgin metal from metal brokers. In addition, Revere reclaims polypropylene from battery cases, and in the process, produces sodium sulfate.

The facility consists of several buildings, including the main smelter building, a crystallizer building, a containment building, a wastewater treatment building, six large storm water tanks, and employee and truck parking areas (Sheet 2). In addition, a rail spur from the adjacent Norfolk and Southern Railroad right-of-way services the facility. The operational portion of the site (OU4) encompasses approximately 14 acres. Eco-Bat New York LLC owns the operational property and contiguous undeveloped property to the north and east of the facility and undeveloped property south of the railroad right-of-way. The Eco-Bat properties consist of the eight tax parcels listed in the definition of OU1, which together comprise 154.9 acres. The undeveloped areas are in varying degrees of past disturbance that range from second growth forest, reverting farmlands, maintained lawns, and wetlands.

The facility is located in a combined rural and industrial area of south-central New York, approximately 6,000 feet northwest of the Wallkill River. North of the facility are open, overgrown fields, wetlands, and mature woodlands. North of the woodlands is a Lukoil service station. East of the facility is a combination of open, overgrown fields, wetlands, and mature woodlands. President Container, Inc. operates in a facility located approximately 0.25 mile southeast of the site. Interstate Highway 84 is located approximately 0.6 mile south of the site. A Ball Aluminum can manufacturing facility is located west of the site across Ballard Road, and additional industrial development is located further west and south.

Revere is in the process of design, permitting, and constructing a Wet Electrostatic Precipitator (WESP) emissions control unit that will be located in OU1 in the former Eastern Fill Area (EFA) (Sheet 2). The EFA was recently remediated by Revere, and an onsite containment cell was constructed in OU1 to dispose of lead and arsenic contaminated soils and sediments as part of the Phase I Remedial Design/Remedial Action (RD/RA) for OU1.

2.0 MATERIAL AND GROUNDWATER MANAGEMENT PLAN

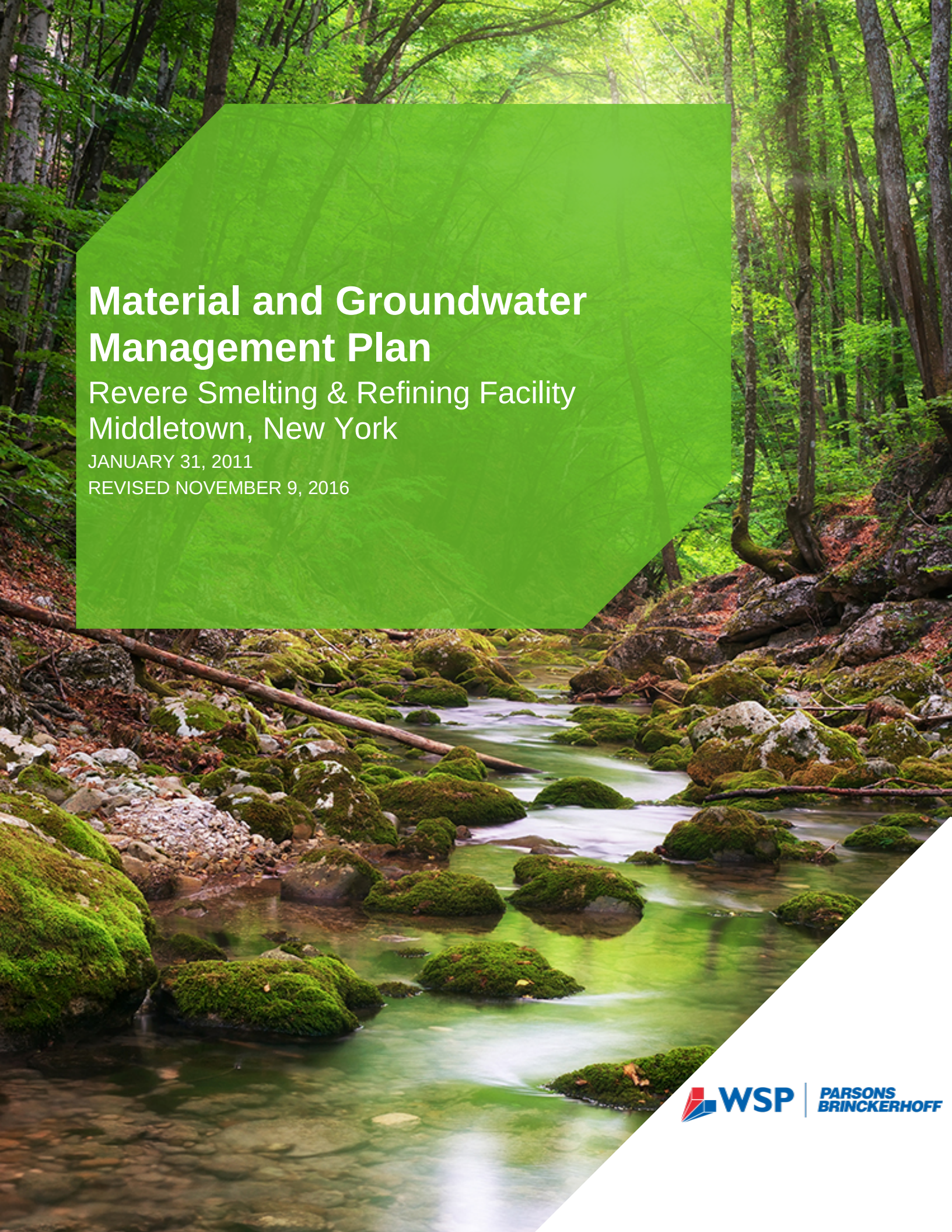
Revere Smelting & Refining Corporation Facility Material and Groundwater Management Plan, revised January 21, 2016 (Revision Date), prepared by WSP USA Corp. and approved by the NYSDEC is attached as Appendix 6-A.

3.0 GROUNDWATER MONITORING PLAN

Revere Smelting & Refining Corporation Facility Groundwater Monitoring Plan, dated November 30, 2018 (Revision Date) and approved by NYSDEC is attached as Appendix 6-B.

4.0 GROUNDWATER EXTRACTION SYSTEM MONITORING AND CONTINGENT EXPANSION WORK PLAN FOR OPERABLE UNIT 4

Revere Smelting & Refining Corporation Facility Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4, dated January 21, 2016 (Revision Date), prepared by WSP USA Corp. and approved by NYSDEC, are attached as Appendix 6-C.



Material and Groundwater Management Plan

Revere Smelting & Refining Facility
Middletown, New York

JANUARY 31, 2011

REVISED NOVEMBER 9, 2016

WSP | PARSONS BRINCKERHOFF

MATERIAL AND GROUNDWATER MANAGEMENT PLAN

Revere Smelting & Refining Facility
Middletown, New York

January 31, 2011
Revised November 9, 2016

Client

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1 Introduction

On behalf of Revere Smelting & Refining Corporation (Revere), WSP USA Corp. has prepared this Material and Groundwater Management Plan (MGMP) for the Revere facility located at 65 Ballard Road, in Middletown, New York (Figure 1). This MGMP was revised to correct information presented in the previous version that is no longer accurate, particularly the limits of the Operable Units (OUs) and the nomenclature for groundwater extraction wells located at the site. This MGMP supersedes previous versions.

The Revere facility is a secondary lead smelter located approximately 7 miles east of Middletown, in the Town of Wallkill, Orange County, New York. Historical environmental investigations have identified impacts to environmental media as a result of operations at the site and the site has been listed in the *Registry of Inactive Hazardous Waste Disposal Sites in New York State* as Site # 3-36-053. Revere entered into a Consent Order (Order; Index # 3-20100528-80) with the New York State Department of Environmental Conservation (NYSDEC) on February 1, 2011 to investigate impacts within each of the following OUs, which were defined to prioritize corrective action and remediation activities on the site (Sheet 1):

- OU1 – all environmental media, other than groundwater (OU2), on property currently owned by Eco-Bat to the east of Ballard Road in the Town of Wallkill, Orange County, New York (Tax Parcels 41-1-70.21, 41-1-70.22, 41-1-70.23, 41-1-71.22, 41-1-73.1, 41-1-73.22, 41-1-74.82, and 41-1-76), except for the Facility (OU4), and all environmental media, other than groundwater, not owned by Eco-Bat in the Town of Wallkill, Orange County, New York within Tax Parcels 60-1-120 and 41-1-72.2.
- OU2 – all onsite groundwater.
- OU3 – all offsite media impacted by Revere's activities, except environmental media other than groundwater on property not owned by Eco-Bat that is included in OU1.
- OU4 – the Facility.

Revere is in varying stages of the Remedial Investigation/Feasibility Study (RI/FS) and Remedial Design/Remedial Action (RD/RA) process for OU1, OU2, and OU3 and the RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) process for OU4. Revere's operations within OU4 periodically require intrusive activities to address the day-to-day and long term needs of the facility.

This MGMP is intended to address the handling and management of impacted material temporarily stored onsite in locations outside of the storm water containment area in OU4 (Sheet 1). For purposes of this MGMP, materials are defined as:

- *Any potentially contaminated material including soil, sediment, concrete, rocks, and other building or utility construction materials from OU4 generated as part of facility-related construction projects.*

2 Background

2.1 Property Location and Description

Revere operates a secondary lead smelting facility located at 65 Ballard Road, approximately 7 miles east of Middletown, in the Town of Wallkill, Orange County, New York (Figure 1). The Revere facility was constructed in 1970 and acquired by Revere in 1973. Revere manufactures lead and lead alloys. The major raw material is used lead acid batteries, such as the typical automotive battery. Other raw materials used in production include battery-manufacturing by-products, lead-bearing baghouse dust from battery manufacturers and smelters, scrap metal from metal salvage yards, and virgin metal from metal brokers. In addition, Revere reclaims polypropylene from battery cases, and in the process, produces sodium sulfate.

The facility consists of several buildings, including the main smelter building, a crystallizer building, a containment building, a wastewater treatment building, six large storm water tanks, and employee and truck parking areas (Sheet 1). In addition, a rail spur from the adjacent Norfolk and Southern Railroad right-of-way services the facility. The operational portion of the site (OU4) encompasses approximately 14 acres. Eco-Bat New York LLC owns the operational property and contiguous undeveloped property to the north and east of the facility and undeveloped property south of the railroad right-of-way. The Eco-Bat properties consist of the eight tax parcels listed in the definition of OU1, which together comprise 154.9 acres. The undeveloped areas are in varying degrees of past disturbance that range from second growth forest, reverting farmlands, maintained lawns, and wetlands.

The facility is located in a combined rural and industrial area of south-central New York, approximately 6,000 feet northwest of the Wallkill River. North of the facility are open, overgrown fields, wetlands, and mature woodlands. North of the woodlands is a Lukoil service station. East of the facility is a combination of open, overgrown fields, wetlands, and mature woodlands. President Container, Inc., operates in a facility located approximately 0.25 mile southeast of the site. Interstate Highway 84 is located approximately 0.6 mile south of the site. A Ball Aluminum can manufacturing facility is located west of the site across Ballard Road, and additional industrial development is located further west and south.

Revere is in the process of designing, permitting, and constructing a Wet Electrostatic Precipitator (WESP) emissions control unit that will be located in OU1 in the former Eastern Fill Area (EFA) (Sheet 1). The EFA was recently remediated by Revere, and an onsite containment cell was constructed in OU1 to dispose of lead and arsenic contaminated soils and sediments as part of the Phase I RD/RA for OU1.

2.2 Environmental Concerns Identified at the Site

Historical environmental investigations have identified impacts to environmental media (soil, sediment, and groundwater) as a result of operations at the site. Lead and arsenic are the primary contaminants of concern associated with the site.

A CMS for OU4 was prepared by ENTACT LLC (ENTACT), on behalf of Revere, and submitted to the NYSDEC on February 7, 2014[1] (ENTACT 2014). The purpose of the CMS was to develop and evaluate corrective measures alternatives that address risks to human health and the environment from exposures to impacted soils and source materials within OU4. Due to the current and expected future operations of the facility, Revere has determined that the implementation of final corrective measures is not practical or feasible and that a phased approach is warranted:

- Phase 1 – Interim Corrective Measures (ICMs) that will be implemented to address risks based on current land use and are consistent with the continued operations of the facility.
- Phase 2 – Final Corrective Measures that are implemented upon cessation of operations at the facility.

[1] The February 7, 2014 CMS was Revision 2.0.

The final corrective measure alternatives are discussed in detail in the February 7, 2014, CMS. Each of the four alternatives involve the use of existing OU4 surface cover (i.e. asphalt surface, concrete surface, building foundation, vegetated soil covers, gravel) and completion of the barrier wall system around the facility as the ICM to address risks based on current land use. On February 19, 2015, WSP submitted the *Interim Corrective Measure Completion Report – Phase III Barrier Wall Installation and Phase I and II Barrier Wall Extensions - Operable Unit 4* (WSP 2015), which presents the complete barrier wall system that encircles OU4 (WSP 2015). Sheet 1 shows the barrier wall system location and the location of groundwater extraction wells located inside the barrier wall that provide hydraulic groundwater containment.

Historical groundwater monitoring data indicate that onsite groundwater (OU2) is impacted by lead, pH, and sulfate in some areas (GWI 2009). The depth to groundwater in monitoring wells and piezometers installed in OU4 generally ranges from 5 feet to 10 feet below ground surface (bgs). Although not anticipated, shallow excavations in OU4 may require some amount of dewatering and groundwater management.

3 Purpose, Scope, and Applicability

The purpose of this MGMP is to ensure that lead impacted material removed from OU4 as part of routine facility operations is managed in accordance with applicable federal, state, and municipal laws and regulations. The plan presents procedures that will be followed during construction activities to ensure that impacted materials and groundwater are managed properly. The plan does not apply to:

- De minimis excavations that would not require any material management, transport, storage, or disposal, such as digging small holes for traffic signs or fence posts.
- Excavation/demolition projects within OU4 where the materials are temporarily stored wholly within the plant or the facility's storm water containment area (Sheet 1). For excavations in this category, only the post-excavation sampling described in Section 4.2 will be applicable. Data from the post excavation sampling will be shared with the NYSDEC to document the nature of materials left in place.

Because existing data for OU4 are insufficient to predetermine whether a generated material would be hazardous, this MGMP was conservatively prepared on the basis that soils from OU4 must first be tested before such soils are handled as not impacted by lead. As such, the provisions of this MGMP will apply to all future construction activities by Revere and its subcontractors in all areas of OU4, and are not specific to a single location or facility project.

4 Material Management

The MGMP includes a program for providing notice to the NYSDEC of proposed construction activities, general procedures for pre-excavation and post-excavation sampling, criteria for temporary storage of lead-impacted materials, and reporting requirements.

4.1 Notice of Excavation/Demolition Activities

Revere will provide a minimum of 24-hour's notice to the NYSDEC for proposed construction activities requiring excavation and/or demolition of up to 10 cubic yards (CY) of material and 5 business days' notice for all construction activities requiring removal of more than 10 CY of material, except where exigent circumstances require shorter notice. For a 24-hour notice project, the maximum amount of material that will be moved within that 24 hour period is 10 CY. Revere will provide prompt notice to the NYSDEC in the event that a project initially planned for 10 CY or less will necessarily expand to greater than 10 CY due to unforeseeable conditions realized during construction. The 10 CY threshold is based on the typical size of a standard roll-off container and will allow Revere to move forward quickly with routine construction activities that may require small volumes of material removal.

The notice will include a summary of the work to be conducted and a schematic showing the proposed excavation/demolition area, anticipated material volumes to be removed, and number and location of proposed samples (if necessary) in accordance with Section 4.2 below. If applicable, the notice will also include a schematic showing the location of any temporary storage areas in OU1 or in portions of OU4 outside the storm water containment area. The notice will be distributed electronically to the Department.

4.2 Material Characterization and Post-Excavation Sampling

For materials being disposed of offsite, the requirements of 6 NYCRR Parts 370 to 372 concerning generation, characterization, handling, storage, and disposal of waste shall be followed.

Pre-excavation/demolition sampling will not be required for projects generating less than 10 CY. One composite sample will be collected from the excavated/demolished material and analyzed for Target Analyte List (TAL) Metals using Environmental Protection Agency (EPA) Method 6010B and for lead using the Toxicity Characteristic Leaching Procedure (TCLP).

For materials temporarily stored onsite in locations outside of the storm water containment area in OU4, Revere will submit a sampling plan concurrent with the notice of excavation/demolition activities for projects requiring removal of more than 10 CY of material. Pre-excavation/demolition sampling may be proposed to confirm characterization and develop/modify appropriate health and safety procedures based on specific sampling data. At a minimum, one composite sample will be collected per 10 CY of removed material and analyzed for TAL Metals and TCLP-Lead.

Post-excavation sampling will also be conducted for all excavations (both greater and less than 10 CY) to document materials left in place. For excavations greater than 10 CY, an estimate of the number of post-excavation samples will be provided with the sampling plan submitted to the NYSDEC concurrent with the notice of excavation activities. At a minimum, one sample from the excavation floor per 900 square feet of surface area and one sample per 30 linear feet of sidewall will be collected and analyzed for TAL Metals and TCLP-Lead.

4.3 Material Stockpiling and Temporary Storage Outside of the OU4 Storm Water Containment Area

4.3.1 Non-Hazardous Material and Uncontaminated Material Suitable for Reuse

Excavated material, which has been confirmed to be non-hazardous under the Resource Conservation and Recovery Act (RCRA) based on pre-excavation TCLP analysis and determined (in consultation with the NYSDEC

on a project-specific basis) to be uncontaminated and suitable for reuse based on total metals analysis, may be temporarily staged within and/or adjacent to the excavation area prior to reuse as backfill. A material reuse determination will be made by the NYSDEC on a project-specific basis based on the analytical data provided by Revere in its notice of excavation activities and/or weekly project status reports. All backfill must meet the protection of groundwater soil cleanup objective for lead of 450 mg/kg.

4.3.2 Uncharacterized Material, Hazardous Material, and Contaminated Material Unsuitable for Reuse

Temporary stockpile and storage locations will be selected based on field conditions, project sequencing, and site logistics for uncharacterized material, material confirmed to be RCRA hazardous by pre-excavation/demolition TCLP analysis, and non-hazardous but contaminated material deemed unsuitable for reuse by the NYSDEC. These materials will be retained in OU4 or within select areas of OU1. In order of preference, such materials will be:

1. Placed directly into covered and lined leak-proof roll-off containers and temporarily stored adjacent to the area of excavation.
2. Transported to a pre-selected and pre-approved area within OU1 or OU4 and placed into covered leak-proof roll-off containers.
3. Temporarily stockpiled adjacent to the area of excavation.
4. Transported to a pre-selected and pre-approved area within OU1 or OU4 and temporarily stockpiled.

All material from projects generating less than 10 CY will be managed following option 1 above. If the materials cannot be managed in a lined roll-off near the area of excavation/demolition (due to access constraints or other project-specific constraints), then Revere will provide the NYSDEC a detailed notification of the storage plan as described in Section 4.1. The notice shall be submitted to the NYSDEC at least 5 business days before commencing excavation activities, unless exigent circumstances require a shorter notification period.

Containers used for excavated/demolished material characterized as hazardous will be suitable for over-the-road transport of hazardous materials in accordance with federal and state transportation regulations.

Material stockpiled prior to disposal will be placed within an engineered berm lined with polyethylene sheeting as containment, and covered to prevent infiltration of storm water. Engineered berms will be designed by appropriate personnel and may consist of straw bale barriers, gravel bag barriers, sand bag barriers, and fiber rolls as appropriate based on the existing grade material (pavement, asphalt, or soil) and slope of the temporary storage area. Natural soil berms constructed of native materials will not be used based on an assumption that most surface soils in OU1 and OU4 contain some detectable concentration of lead. Stockpiles will be actively managed by Revere or its subcontractor to prevent run-off.

Material characterized as RCRA hazardous may be temporarily stored for up to 90 days before being transported offsite for appropriate disposal or treatment. Material to be disposed offsite may require additional sampling and analysis to meet disposal facility requirements, and Revere will conduct the necessary sampling and analysis.

Appropriate signage and other barriers (temporary fencing) to restrict access to material will be installed and maintained by Revere and/or its subcontractor.

4.4 Material Reuse and Disposal

Only material confirmed to be non-hazardous under RCRA by TCLP analysis of either pre- or post-excavation samples and determined to be uncontaminated by the NYSDEC based on total metals analysis may be reused as backfill within the same excavation or another excavation in OU4 containing similar contaminants under the predetermined beneficial use determination (BUD) in 6 NYCRR 360.1.15(b)(8). All backfill must meet the protection of groundwater soil cleanup objective for lead of 450 mg/kg. Any excess non-hazardous material will be transported offsite to a facility permitted to accept and treat or landfill the material.

Material found to be characteristically RCRA hazardous by TCLP analysis will be disposed of at a licensed hazardous waste treatment or disposal facility within 90 days of excavation. Hazardous material will be transported to a permitted facility under appropriate manifests, applicable permits, and applicable state and federal laws and regulations.

4.5 Reporting Requirements

At the conclusion of each project that requires post-excavation sampling, a brief report will be submitted electronically to the Department. The report will include all sampling results generated during the project.

For projects that exceed a week of construction activity, a weekly status report will also be distributed electronically to the Department. At a minimum, the report will include all available analytical data from the project for the previous week's work and an anticipated schedule of completion.

5 Groundwater Management

The depth to groundwater from monitoring wells and piezometers installed in OU4 (Sheet 1) generally range from 5-feet to 10-feet bgs. Although not anticipated, shallow excavations in OU4 may require some amount of localized dewatering to control groundwater infiltration into the open excavation. The MGMP includes a program for providing notice to the NYSDEC of potential dewatering and general procedures for discharge of groundwater into Revere's existing recycled process water system.

5.1 Notice of Dewatering Activities

Revere will provide notice to the NYSDEC of the potential for dewatering activities associated with any excavation conducted under the provisions of this MGMP. The notice will include an estimate of the anticipated dewatering volume, method of conveyance to discharge location, and duration of proposed activities.

5.2 Groundwater Discharge

Extracted water will be discharged into Revere's storm water sump located south of the scrubber building on the southern portion of the facility. The sump receives storm water runoff from the roofs and paved areas of the facility as well as extracted groundwater from the groundwater extraction system (Sheet 1) installed around the perimeter of the containment building.

Water is pumped from the sump to a recycle water storage tank. Water from the recycle tank is then pumped through sand filters, utilized in facility operations, treated by the facility's wastewater treatment system, and discharged under permit to the Town of Wallkill sanitary sewer.

5.3 Groundwater Conveyance

Groundwater may be pumped directly from the open excavation to the storm water sump. Alternatively, Revere may utilize temporary fractionation (frac) tanks if high volumes of water are anticipated and/or the location of the excavation is not conducive to direct pumping. Pre-treatment of discharged water will not be required; however, Revere may elect to filter the water to remove solids if necessary.

6 References

2014. ENTACT LLC. Corrective Measures Study, Operable Unit 4, Revision 2, Revere Smelting & Refining Site, Middletown, New York. NYSDEC Site No. 3-36-053. February 7.

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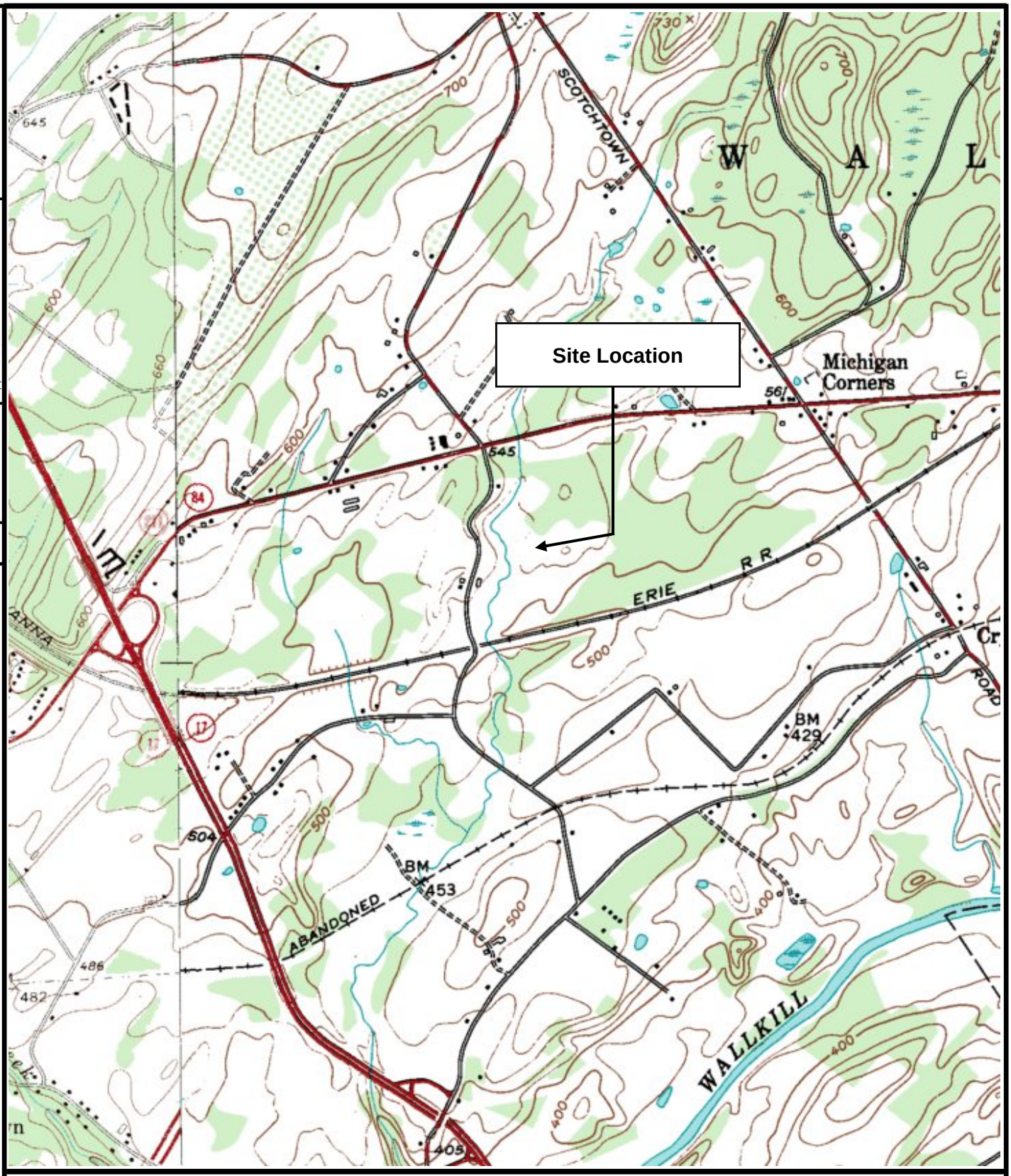
Figure



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7.5 MINUTE SERIES TOPOGRAPHIC QUADRANGLE
ORANGE COUNTY, NEW YORK
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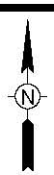

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SCALE, FEET

WSP | PARSONS BRINCKERHOFF

WSP USA Corp.
75 Arlington Street, Fourth Floor
Boston, Massachusetts 02116
(617) 426-7330

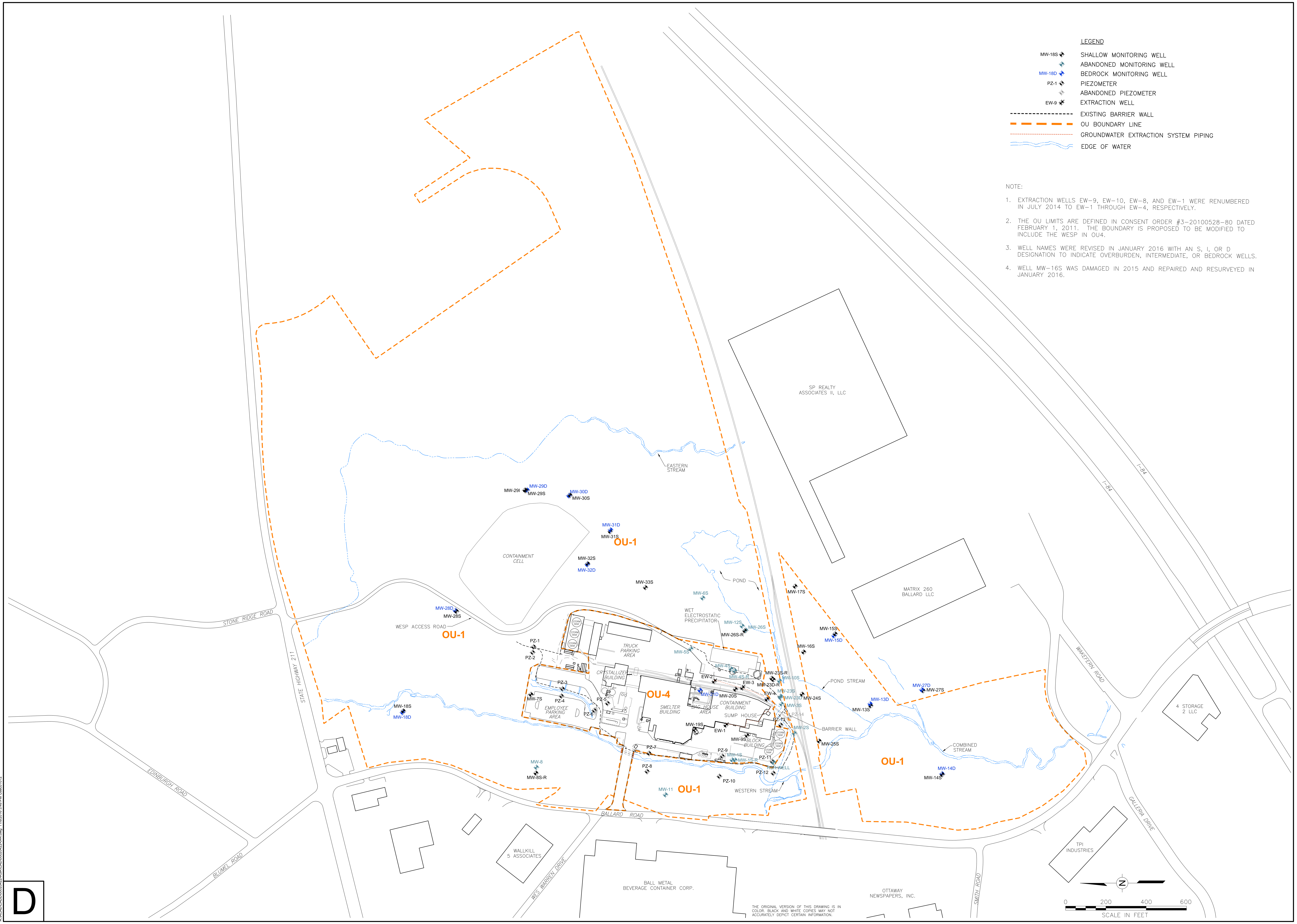
FIGURE 1

SITE LOCATION MAP

REVERE SMELTING & REFINING FACILITY
MIDDLETOWN, NEW YORK

PREPARED FOR
RSR CORPORATION
DALLAS, TEXAS

Sheet



LEGEND

Symbol	Description
MW-18S	SHALLOW MONITORING WELL
	ABANDONED MONITORING WELL
MW-18D	BEDROCK MONITORING WELL
PZ-1	PIEZOMETER
	ABANDONED PIEZOMETER
EW-9	EXTRACTION WELL
	EXISTING BARRIER WALL
	OU BOUNDARY LINE
	GROUNDWATER EXTRACTION SYSTEM PIPING
	EDGE OF WATER

NOTE:

1. EXTRACTION WELLS EW–9, EW–10, EW–8, AND EW–1 WERE RENUMBERED IN JULY 2014 TO EW–1 THROUGH EW–4, RESPECTIVELY.
2. THE OU LIMITS ARE DEFINED IN CONSENT ORDER #3–20100528–80 DATED FEBRUARY 1, 2011. THE BOUNDARY IS PROPOSED TO BE MODIFIED TO INCLUDE THE WESP IN OU4.
3. WELL NAMES WERE REVISED IN JANUARY 2016 WITH AN S, I, OR D DESIGNATION TO INDICATE OVERBURDEN, INTERMEDIATE, OR BEDROCK WELLS.
4. WELL MW–16S WAS DAMAGED IN 2015 AND REPAIRED AND RESURVEYED IN JANUARY 2016.

REVISIONS

REV	DESCRIPTION

SEAL

DATE

DRAWN BY	EGC	
CHECKED	CDA	11/8/2016
APPROVED	[signature]	11/8/2016

OPERABLE UNIT BOUNDARIES

AS–BUILT AND CONTINGENT EXPANSION CONSTRUCTION DRAWING PACKAGE
REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

PREPARED FOR
RSR CORPORATION
DALLAS, TEXAS

WSP | PARSONS BRINCKERHOFF
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SHEET 1

Drawing Number
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D

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GROUNDWATER MONITORING PLAN

REVERE SMELTING & REFINING CORPORATION MIDDLETOWN, NEW YORK, EPA ID NO. NYD030485288

PROJECT NO.: 31401015
DATE: NOVEMBER 9, 2016
REVISION 1: NOVEMBER 30, 2018

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TABLES

APPENDICES

1 INTRODUCTION

Revere Smelting & Refining Corporation (Revere) operates a secondary lead smelter facility located at 65 Ballard Road in the Town of Wallkill, Orange County, New York. Revere conducts operations at the facility including the storage, treatment, and management of hazardous wastes as defined by New York State Department of Environmental Conservation (NYSDEC) rules and regulations. NYSDEC issued permit # 3-3352-00145/00001-0 to Revere for operation of a hazardous waste management facility.

Historical environmental investigations have identified impacts to environmental media (soil, sediment, and groundwater) as a result of operations at the site. Lead and arsenic are the primary contaminants of concern. The NYSDEC and Revere signed an Order of Consent (#C3-5288-11--98) in March 1999 that required Revere to update, modify, and develop a groundwater monitoring plan (GWMP) for the facility. Since 1999, the GWMP has been modified on several occasions with the approval of the NYSDEC. The November 2016 version of the GWMP superseded all previous versions and was produced to account for changes at the facility resulting from new construction and the implementation of various remediation projects. Revision No. 1 to the GWMP incorporates additional piezometers that were installed in September 2018 in accordance with the August 2017 addendum (WSP 2017) to the Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4 dated September 24, 2014, and revised November 9, 2016 (WSP 2016).

Revere entered into a Consent Order (Order; Index # 3-20100528-80) with the NYSDEC on February 1, 2011 to investigate impacts within each of the following OUs, which were defined to prioritize corrective action and remediation activities on the site (Sheet 1):

- OU1 – all environmental media, other than groundwater (OU2), on property currently owned by Eco-Bat to the east of Ballard Road in the Town of Wallkill, Orange County, New York (Tax Parcels 41-1-70.21, 41-1-70.22, 41-1-70.23, 41-1-71.22, 41-1-73.1, 41-1-73.22, 41-1-74.82, and 41-1-76), except for the Facility (OU4), and all environmental media, other than groundwater, not owned by Eco-Bat in the Town of Wallkill, Orange County, New York within Tax Parcels 60-1-120 and 41-1-72.2.
- OU2 – all onsite groundwater.
- OU3 – all offsite media impacted by Revere's activities, except environmental media other than groundwater on property not owned by Eco-Bat that is included in OU1.
- OU4 – the Facility.

Revere is in varying stages of the Remedial Investigation/Feasibility Study (RI/FS) and Remedial Design/Remedial Action (RD/RA) process for OU1, OU2, and OU3 and the RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) process for OU4.

A Corrective Measures Study (CMS) for OU4 was prepared by ENTACT LLC (ENTACT), on behalf of Revere, and submitted to the NYSDEC on February 7, 2014[1] (ENTACT 2014). The purpose of the CMS was to develop and evaluate corrective measures alternatives that address risks to human health and the environment from exposures to impacted soils and source materials within OU4. Due to the current and expected future operations of the facility, Revere has determined that the implementation of final corrective measures is not practical or feasible and that a phased approach is warranted:

- Phase 1 – Interim Corrective Measures (ICMs) that will be implemented to address risks based on current land use and are consistent with the continued operations of the facility.
- Phase 2 – Final Corrective Measures that are implemented upon cessation of operations at the facility.

The final corrective measure alternatives are discussed in detail in the February 7, 2014, CMS. Each of the four alternatives involve the use of existing OU4 surface cover (i.e. asphalt surface, concrete surface, building foundation, vegetated soil covers, gravel) and completion of the barrier wall system around the facility as the ICM to address risks based on current land use. On February 19, 2015, WSP submitted the Interim Corrective Measure Completion Report – Phase III Barrier Wall Installation and Phase I and II Barrier Wall Extensions - Operable Unit 4 (WSP 2015a), which presents the complete barrier

[1] The February 7, 2014 CMS was Revision 2.0.

wall system that encircles OU4. Sheet 1 shows the barrier wall system location and the location of groundwater extraction wells installed inside the barrier wall that provide hydraulic groundwater containment.

In September 2015, an OU1 Phase III Containment Cell Groundwater Monitoring Work Plan (WSP 2015b) was prepared and submitted to the NYSDEC. This work plan included details regarding the installation of four proposed well pairs located around the containment cell to monitoring groundwater conditions upgradient and downgradient of the cell in accordance with 6 NYCRR Part 360-2.11. The NYSDEC approved the work plan with modifications, including an additional well pair, in a letter dated October 23, 2015 (NYSDEC 2015). Wells were installed at three of the proposed locations (MW-28, MW-29, and MW-30) in 2015, while the remaining well pairs (MW-31 and MW-32) were installed in September 2016. In addition, monitoring well pair MW-23S/D and well MW-26, which were abandoned during construction activities associated with the Wet Electrostatic Precipitator (WESP), and an additional well (MW-33S) in the former Eastern Fill Area (EFA) were installed in September 2016.

The monitoring program specified in the Groundwater Extraction System Monitoring and Contingent Expansion Work Plan includes quarterly collection of water level data from monitoring wells and piezometers located on either side of the hydraulic containment system. Piezometer pairs were previously installed on the upgradient and downgradient sides of the Phase I and II barrier walls, but were not yet completed along the Phase III alignment due to construction of the WESP building. In addition, piezometer PZ-14 was abandoned in April 2014 as part of the Phase IIB Remedial Design/Remedial Action (RD/RA) and required replacement. The construction of the WESP building was completed in 2017, and the new and replacement piezometers were installed in September 2018.

During the May 2016 quarterly groundwater sampling event, it was discovered that monitoring well MW-25S was damaged. In a letter dated September 8, 2017, the NYSDEC approved removal of this monitoring well from the GWMP. This modification is reflected in Table 1.

Any additional wells damaged or destroyed by construction or other actions in the future shall be replaced (if warranted) in consultation with the NYSDEC and will also be incorporated into this GWMP.

2 GROUNDWATER MONITORING PLAN

Revere collects groundwater quality samples from monitoring wells installed in the unconsolidated and bedrock aquifer system at the Revere facility. With the additional wells installed in 2015 and 2016 and excluding monitoring well MW-25S, Revere currently has 34 active groundwater monitoring wells (21 overburden wells and 13 bedrock wells) located within the boundaries of OU1 and OU4 (Sheet 1). In addition, one barrier wall piezometer (PZ-13) is included in the groundwater sampling program. Monitoring well and piezometer construction details for all of the wells installed at the site are included in Table 1[2], while available boring logs and construction diagrams are included in Appendix A.

Revere performs "property line compliance" monitoring with respect to the unconsolidated and bedrock aquifer system. Property line compliance means that the unconsolidated and bedrock aquifer monitoring wells are or will be situated in the vicinity of Reveres' downgradient southern property boundary. Based upon historical groundwater elevation data collected from existing monitoring wells, groundwater flow in the unconsolidated aquifer is toward the south–southeast. Groundwater flow in the bedrock aquifer also appears to flow toward the south–southeast.

2.1 UNCONSOLIDATED AQUIFER

Revere collects groundwater quality samples from 21 monitoring wells and one piezometer installed in the unconsolidated material aquifer. The shallow monitoring wells and piezometers that are currently part of the facility's GWMP are shown on Table 1. The unconsolidated aquifer monitoring well locations are presented in Sheet 1. These monitoring wells are installed in and around the facility to monitor the unconsolidated aquifer. MW-18S is located upgradient of the Middletown facility and represents background groundwater quality. The existing unconsolidated monitoring wells are sufficient to monitor groundwater quality and to determine groundwater flow direction upgradient and downgradient of the Middletown facility.

Monitoring wells MW-31S and MW-32S were installed in September 2016 and added to the GWMP to complete the groundwater monitoring network in the unconsolidated aquifer upgradient and downgradient of the containment cell. The locations of these wells are also shown on Sheet 1. All of the containment cell wells are located within 50 feet of the cell, well MW-28S is located approximately 600 feet upgradient of MW-29S, and the downgradient wells are located approximately 200 feet on center.

2.1.1 SHALLOW MONITORING WELL INSTALLATION

The existing shallow monitoring wells at the site have been installed by various drilling contractors and consultants over the past three decades. WSP understands that the majority of the wells were installed using hollow-stem auger methods. While WSP does not have detailed well construction information for all of the shallow monitoring wells, the following section describes a typical hollow-stem auger installation methodology for shallow monitoring wells at the site. With the exception of the wells that were installed in September 2016 using rotosonic techniques, the shallow wells installed under WSP's oversight were constructed following this methodology.

The shallow borings would have been advanced through the overburden using either a truck-mounted or track-mounted drill rig equipped with minimum 4.25-inch inside-diameter (ID) hollow-stem augers. Continuous split-barrel or macro-core soil samples would have typically been collected until the final termination depth of the well. On retrieval, the soil would have been logged and classified according to the Unified Soil Classification System (refer to the available boring logs in Appendix A). The September 2016 wells were installed using a track-mounted drill rig equipped with a 4-inch core barrel and logged as described above.

The wells were typically constructed with 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing fitted with 0.010-inch slotted PVC screen. Screen lengths for each shallow monitoring well are included on Table 1. Once the casings were installed, a quartz sand filter pack (typically U.S. Silica #1, or equivalent) would have been placed in the annular space

[2] Well names were revised in January 2016 with an S, I, or D to indicate overburden, intermediate, or bedrock wells.

between the casing and the surrounding formation. The sand would have been installed to a level approximately 1-foot above the top of the screened interval and topped with approximately 3-feet of bentonite to form a seal. Once the seal had set, a bentonite-cement grout would have been installed to fill the remaining annular space. The wellheads were completed with either flush-mounted protective covers or above-grade stick-ups set in a concrete pad. The inner casings of the wells were fitted with watertight lockable caps.

All downhole drilling equipment and the split spoon samplers would have been decontaminated following NYSDEC-approved procedures. Soil cuttings generated during well installation would have been placed in appropriate containers and transported to an onsite temporary storage area for characterization before final disposal.

Future shallow groundwater monitoring wells will be installed in a similar manner, with the exception that other drilling methods, such as rotosonic techniques, may be implemented on a case by case basis with the approval of the NYSDEC.

2.2 BEDROCK AQUIFER

Bedrock monitoring wells located at the facility are also listed on Table 1. Monitoring well MW-29I (intermediate) was installed at the proposed location for monitoring well MW-29D; however, during construction this well could not be completed to the design depth and was installed to 12 feet bgs. Because this well is double-cased and screened within the weathered shale siltstone and not the overburden, this well is considered to be a bedrock monitoring well. Available groundwater elevation data for the bedrock wells indicate groundwater flow direction in the bedrock aquifer toward the south-southeast. Bedrock monitoring well MW-18D was installed upgradient of the Middletown facility to determine background water quality. The bedrock monitoring wells have allowed for evaluation of groundwater quality and groundwater migration in the bedrock aquifer.

Wells MW-31D and MW-32D were installed in September 2016 and added to the GWMP to complete the monitoring well network in the bedrock aquifer upgradient and downgradient of the containment cell. The locations of these wells are also shown on Sheet 1. All of the containment cell wells are located within 50 feet of the cell, well MW-28D is located approximately 600 feet upgradient of MW-29D, and the downgradient wells are located approximately 200 feet on center.

2.2.1 BEDROCK MONITORING WELL INSTALLATION

The existing bedrock monitoring wells were installed as double cased wells with an outer metal casing having a minimum six-inch (inner) diameter. The outer conductor casing was installed to seal off groundwater in the unconsolidated aquifer and the weathered, fractured bedrock horizon.

The initial soil boring for each existing well was advanced through the unconsolidated material using minimum 10.25-inch (inner) diameter hollow stem augers and split spoon samplers or rotosonic techniques. The hollow stem augers or core barrels were advanced into the top of the weather bedrock horizon to refusal. Bedrock coring techniques were used to advance the bore hole approximately five feet through the weathered bedrock until competent bedrock was encountered. After competent bedrock was encountered, the bedrock portion of the borehole was reamed with a minimum of 6.25-inch diameter roller bit. The reamed borehole was cleaned of drill cuttings. The conductor casing was set into the bedrock socket and grouted in place using a cement bentonite grout. Once the conductor casing was positioned, the grout was allowed to cure for a minimum of 24 hours before the borehole was advanced into the underlying bedrock. Casing centralizers were placed on the conductor casings when the conductor casings exceed 80 feet in total length to properly align the conductor case in the borehole. Centralizers were placed approximately every 15 to 20 feet of casing length.

The bedrock monitoring wells were installed using a two-inch Schedule 40 polyvinyl chloride (PVC) riser casing and 0.010-inch slotted well screen installed through the conductor casing. Ten feet of two-inch (inner) diameter well screen was placed in the bottom of the bore hole. The annular space between the well screen and the boring wall was fitted with filter pack material consisting of clean quartz and compatible with the screen slot size. The filter pack was extended to one foot from the top of the well screen. A one-foot thick fine sand layer was placed above the filter pack material. A bentonite pellet seal, a minimum of two-feet in thickness was placed above the fine sand layer. Depending on the depth at which the bedrock aquifer was encountered, the bentonite pellet seal was extended in the bottom of the conductor casing to eliminate cross communication between the unconsolidated material / weather bedrock horizon and the bedrock aquifer. The remaining

annular space was filled with a cement bentonite grout to within three feet of the original grade. The cement bentonite grout was pumped into the borehole starting at the top of the bentonite seal and proceeding upward using a tremie pipe.

The bedrock monitoring wells were completed above grade by installing a metal sono-tube protective surface casing to prevent well head damage due to frost heaving. The sono-tube was cemented into place and fitted with a lock cap. The PVC monitoring wells were fitted with a bottom and top end cap. One exception is for well MW-21D, which was completed as a flush mount well. Casing centralizers were placed on the monitoring wells casings as necessary, and any well that had a termination depth of greater than 30 feet. The first centralizer was placed approximately two feet above the top of the well screen and every 15 feet thereafter.

All downhole drilling equipment and the split spoon samplers were decontaminated following NYSDEC-approved procedures.

Soil and bedrock cuttings generated during bedrock well installation were placed in appropriate containers and transported to an onsite temporary storage area for characterization before final disposal.

Future bedrock groundwater monitoring wells will be installed in a similar manner, with the exception that other drilling methods, such as rotosonic techniques, may be implemented on a case by case basis with the approval of the NYSDEC.

2.3 BARRIER WALL PIEZOMETERS

Piezometer clusters were installed upgradient and downgradient of the barrier wall for measuring groundwater levels in the unconsolidated aquifer. The groundwater elevation data collected from the piezometers is used to evaluate the effectiveness of the barrier wall in retarding groundwater migration through the barrier structure.

Revere installed piezometer clusters (PZ-1 through PZ-25[3]) for measuring groundwater levels in the unconsolidated aquifer. PZ-14 was removed as part of on-going remediation efforts being completed at the facility; replacement piezometer PZ-14R was installed in September 2018 as shown on Sheet 1. The piezometer clusters are positioned on an approximate 300-foot spacing along the completed eastern sections of the barrier wall.

2.3.1 PIEZOMETER INSTALLATION

Soil borings for piezometer installation were advanced through the unconsolidated materials using either minimum 2.25-inch (inner) diameter hollow stem augers (PZ-1 through PZ-18[4]) or rotosonic techniques (PZ-14R and PZ-19 through PZ-25). Split spoon or 5-foot interval continuous core samples were retrieved from the borings and logged by an onsite hydrogeologist.

The piezometers were constructed of two-inch (inner) diameter schedule 40 PVC riser casing and well screen. The PVC well screen consists of 2-inch 0.010-inch machine slots. On reaching the bedrock surface, bentonite pellets were placed in the bottom two-foot sections of the boring and topped with six-inches of sand material. The well screen was placed into the boring from the top of the sand material to the depth at which the unconsolidated groundwater table was encountered.

The annular space between the well screen and the boring wall was fitted with filter pack material consisting of clean quartz and compatible with the screen slot size. The filter pack was extended to one foot from the top of the well screen top. A minimum two-foot thick bentonite pellet seal was placed above the filter pack material. The remaining annular space was filled with a cement bentonite grout within three feet of the original grade. Above grade protective metal casing sono-tube structures were installed on each piezometer, with the exception of piezometers PZ-5 and PZ-21 through PZ-25, which were

[3] Piezometer PZ-26 was also installed in September 2018. As described in the October 30, 2018, Completion Report for the August 2017 Addendum to the Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4 (WSP 2018), piezometer PZ-26 will be abandoned with the approval of the NYSDEC and is therefore not included in this GWMP.

[4] Piezometers PZ-15 though PZ-18 were installed in 2011 to determine depth to water for the design of the containment cell. These piezometers have since been removed.

installed in flush mount protective casings to prevent damage by vehicular traffic. Additionally, as the result of a grade change, access to piezometer PZ-7 is now through a protective manhole cover. The sono-tubes were fitted with locking caps.

Piezometers installed to a depth greater than 30 feet were fitted with casing centralizers to properly align the PVC casing and well screen to the borehole. Each piezometer was fitted with a bottom and top end cap. Piezometers installed in the facility operational areas were completed with appropriately sized, flushed mount curb boxes so that the piezometers will not restrict facility traffic.

All downhole drilling equipment and the split-spoon samplers were decontaminated following NYSDEC-approved procedures.

Soil and bedrock cuttings generated during piezometer installation were placed in appropriate containers and transported to an onsite temporary storage area for characterization prior to proper disposal.

Future piezometers will be installed in a similar manner, with the exception that other drilling methods, such as rotosonic techniques, may be implemented on a case by case basis with the approval of the NYSDEC.

2.4 MONITORING WELL AND PIEZOMETER DEVELOPMENT

The monitoring wells and piezometers were developed using submersible pumps, bailers, and mechanical surging equipment to remove formation fines from the filter pack. The installed monitoring wells and piezometers were developed until the discharged groundwater was free of sediment or suspend matter and in-situ parameters for pH, temperature, and specific conductance have stabilized. Based on historical well development activities performed at the Middletown facility, approximately 5-10 well volumes or a minimum of one-hour of mechanical development were required to complete the development of each monitoring well or piezometer.

Development and purge water generated during development, purging or sampling activities was collected in containers and transported to containment areas that drain to the onsite water treatment facility for treatment.

2.5 SURVEYING

Monitoring wells and piezometers were surveyed for horizontal location and vertical elevation by a registered licensed New York surveyor. Horizontal measurements were calculated to the nearest 0.1 foot. Vertical elevations were calculated to the nearest 0.01 foot and reported in feet above mean sea level (MSL). Orientation for the monitoring well and piezometer locations are on New York State Plane Coordinate System, east zone (Horizontal NAD-83; Vertical NAVD-88). The monitoring well and piezometer locations have been plotted on Sheet 1 for reference.

Vertical elevations on the north side top of the PVC casing, north top side of the metal protective casing or curb box, and the local ground surface were determined at each monitoring well and piezometer. Vertical elevations are reported relative to MSL. The top of the PVC casing elevation is used to determine groundwater elevations in the unconsolidated and bedrock aquifers.

2.6 SAMPLING AND FIELD MEASUREMENTS

To the extent allowed by existing physical conditions at the Middletown facility, the groundwater sampling protocols adhere to the specific methods present in this GWMP document. If alternative sampling procedures are implemented in response to facility specific constraints, each procedure will be selected on the basis of meeting data objectives. Such alternatives will be fully documented and reported to the proper regulatory agencies.

2.6.1 GROUNDWATER ELEVATION MEASUREMENTS

Total monitoring well/piezometer depth and the depth to groundwater is measured in each monitoring well/piezometer before evacuation, purging, or sampling activities are performed. An electronic water level indicator is used to measure the depth to

groundwater and total depth of each monitoring well/piezometer. The total depth and depth to groundwater measurements are used to determine the direction of potential groundwater flow and how water levels change with time and to calculate the necessary purge volumes for sampling. Groundwater elevation data are recorded for all of the piezometers to determine the effectiveness of the barrier wall structure. Water levels are measured from a marked measuring point established on the inner well casing. The water level probe and tape shall be decontaminated between measurements. Groundwater elevation monitoring activities are performed on a quarterly basis for piezometers and monitoring wells that are part of this GWMP.

2.6.2 GROUNDWATER SAMPLING PROCEDURES

Groundwater monitoring wells that are designated for sampling will be purged with the aid of a peristaltic-type pump and new or dedicated, disposable tubing as recommended in EPA's RCRA Groundwater Monitoring Draft Technical Guidance document (November 1992). Using a pump for purging monitoring wells and for collection of groundwater quality samples is an acceptable purging method according to EPA's Region II QAM. The NYSDEC approved the use of a peristaltic pump to purge groundwater monitoring wells in August 1994. Monitoring wells may also be purged and sampled using a new polyethylene bailer.

Groundwater sampling activities will be initiated after each well is properly developed and purged. Because drilling and well construction activities disturb the natural groundwater system for a new well, a minimum of 10 days will be allowed for the groundwater system to return to chemical and physical equilibrium before initial groundwater quality samples are collected from any new well for laboratory analysis. All equipment used during groundwater quality sampling activities will be decontaminated and thoroughly rinsed before use.

If any specific monitoring well cannot be purged using a peristaltic pump, then that monitoring well will be purged using a new polyethylene or PVC bailer and new sampling rope. Peristaltic pumps, in general, cannot recover groundwater from monitoring wells if the depth to groundwater is greater than 25 feet. Based upon historical groundwater drawdowns observed on wells MW-13D, MW-14D, MW-15D, MW-18D, PZ-13 and MW-27D, these bedrock monitoring wells require purging and sampling activities to be completed with a polyethylene or PVC bailer.

After measuring the depth to water, the depth to the bottom of the well shall be measured. The volume of water in the casing shall then be calculated, followed by the calculation of the minimum purge volume. The depths and calculations shall be recorded on a sample log for each well.

A minimum of three well volumes will be evacuated from each monitoring well before collection of the groundwater quality samples to ensure water from the formation has displaced the standing water in the well casing. In-situ indicator parameters of pH, temperature, oxidation/reduction potential and specific conductance will be recorded in a field book after each well volume. Turbidity and hardness values will be recorded from the final purge volume. All field measurements (purge volume, times, water level measurements and field parameters, etc.) will be recorded in the field notebook. If any groundwater monitoring well is of a low yielding nature or is purged to dryness before the removal of three well volumes, that monitoring well will be purged to near dryness once and then allowed to recover sufficiently before groundwater quality samples are collected. All wells will be sampled within 3 hours after the completion of the evacuation process as recommended in the EPA's 1992 draft guidance document. Two wells, MW-9S and PZ 13 are sampled after an overnight recovery. If any monitoring well is purged to dryness during the groundwater sampling process, that monitoring well will be allowed to recover before the sampling process is continued.

Portable pumps and vehicles shall be placed down-wind of the well to be sampled (specifically when sampling volatile organic compounds [VOCs]). Gasoline for portable pumps shall not be stored near empty sample containers, nor near the coolers with filled sample containers.

2.6.3 SAMPLING AND ANALYTICAL PARAMETERS

Nitrile gloves shall be worn whenever sampling or handling samples. To prevent cross-contamination by sample handling, new gloves shall be used at each well. Gloves shall be replaced with new gloves whenever contact is made with the ground or other surface that could be contaminated.

Samples shall be collected in clean, pre-preserved containers, where applicable. All groundwater quality samples will be collected in sampling containers supplied by the analytical laboratory. Containers shall be acquired already cleaned in

accordance with EPA contract laboratory protocols. Total metals will be collected in a laboratory supplied pre-preserved sample container. Containers should be labeled and provide the following information:

- Well Number or Sample ID
- Sample Matrix
- Facility Name
- Sample Collector's Name or Initials
- Date and Time of Sample Collection
- Analysis to be performed
- Preservative

Sampling shall be performed in a prescribed sequence. Duplicate samples shall be taken in the same manner and identified with a unique identification that does not indicate the nature of the sample. Equipment blank samples shall be taken in a manner that duplicates well sampling as much as practical. Samples shall be immediately placed in a pre-cooled cooler.

QUARTERLY SITE-WIDE MONITORING PROGRAM

Groundwater quality samples will be collected from the existing wells and analyzed for total lead, antimony, arsenic, cadmium, and chromium, sulfate, alkalinity and pH to evaluate both site-wide groundwater quality and specifically groundwater quality upgradient and downgradient of the containment cell. Total metals and inorganic groundwater quality samples will be collected from the monitoring wells using new or dedicated tubing and a peristaltic pump, or a bailer, after the purging process.

Groundwater quality samples collected from any monitoring well as part of the GWMP will be analyzed for the constituents listed in Table 2 on a quarterly basis. It should be noted that the elimination of dissolved lead from the groundwater monitoring program was approved by the NYSDEC in July 2003, and, as such, analysis for this parameter is no longer required.

Field blanks and/or trip blanks shall be collected and handled in as near to the same manner as groundwater samples. Duplicate samples shall be taken and handled exactly the same as other groundwater samples.

ANNUAL CONTAINMENT CELL MONITORING PROGRAM

Groundwater quality samples will be collected from the containment cell monitoring wells on a quarterly basis as described above. In addition, groundwater samples will be collected on an annual basis from the containment cell wells (MW-28S/D, MW-29S/D, MW-30S/D, MW-31S/D, and MW-32S/D) for analysis of the parameters shown in Table 3, which are listed in 6 NYCRR Part 360-2.11 as "routine" and "baseline" parameters.

The initial sampling event after the wells have been installed and developed will include all of the parameters listed in Table 3. The analysis of the annual program parameters will be rotated quarterly, such that the annual program is conducted during a different quarter each calendar year.

Groundwater quality samples collected from any monitoring well for VOC analysis will be collected using a new or dedicated Teflon or Polyethylene bailer before collection of any other samples. VOA vials shall be filled completely with no remaining headspace and no bubbles. Care should be taken to avoid over-filling vials and bottles to prevent spillage of preservatives.

Field blanks and/or trip blanks shall be collected and handled in as near to the same manner as groundwater samples. Duplicate samples shall be taken and handled exactly the same as other groundwater samples. All containment cell groundwater samples collected as part of either baseline or expanded sampling will be validated in accordance with the procedures outlined in 6 NYCRR Part 360-2.11(d).

CONTINGENCY MONITORING PROGRAM

Site-Wide Monitoring Wells

The quarterly reports will include an evaluation of the data for all monitoring wells and recommend changes to the program as appropriate. For monitoring wells not associated with the containment cell, if a significant increase over historical water

quality data is detected for one or more of the quarterly parameters, a contingent modification to the quarterly program will be developed and implemented in coordination with the NYSDEC.

Containment Cell Monitoring Wells

In accordance with 6 NYCRR Part 360-2.11(c), if a significant increase over existing water quality is detected for one or more of the parameters in the quarterly (Table 2) or annual (Table 3) program for the containment cell monitoring wells, the NYSDEC will be notified within 14 days. A significant increase over the existing water quality is defined as an exceedence of the existing groundwater quality by three standard deviations, or an exceedence of water quality standards for that parameter as defined in 6 NYCRR Part 703 for a class GA groundwater. If the exceedence was detected during quarterly sampling, samples collected from the containment cell monitoring wells during the next quarterly sampling event will be analyzed for all of the annual parameters listed in Table 3. If the exceedence was detected in an annual parameter, the data will be evaluated to determine an offsite source or explanation for the exceedence due to error in sampling, analysis, or natural variation, and a report will be submitted to the NYSDEC.

In accordance with 6 NYCRR Part 360-2.11(c), if a significant increase over existing water quality has been detected for one or more of the annual parameters listed above in the containment cell monitoring wells, and it cannot successfully be demonstrated to be due to an offsite source or an error in sampling, analysis, or natural variation in groundwater quality, a contingent groundwater monitoring program will be developed and implemented in coordination with the NYSDEC. Table 4 includes potential expanded parameters that may be included in the contingent program.

2.6.4 INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

All field instruments, including electro-conductivity meters, pH meters, dissolved oxygen meters and turbidity meters, shall be calibrated in accordance with the manufacturer's specifications before each daily use. All calibration fluids shall be kept in clearly marked containers with the fluid expiration dates on each container. Documentation that the meters were appropriately calibrated shall be recorded on a field log. Information to be recorded includes instrument type, model number, date and time.

2.6.5 ANALYTICAL PROCEDURES

Analyses shall be performed for the parameters and by the methods shown in Tables 2 and 3. Analytical procedures shall be specified and analyses conducted in accordance with the laboratory's quality assurance manual.

2.6.6 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

Measuring tapes, probes, sensors, field indicator parameter meters, purging and sampling devices shall be decontaminated with de-ionized water. Any equipment or device that will be placed in the well casing or could come into contact with groundwater to be sampled shall not be placed on the ground. All equipment and devices shall be placed on clean surfaces only. Any equipment or device that is to be placed in the well casing or could come into contact with groundwater to be sampled shall be decontaminated between sampling at different well locations and shall be rinsed with de-ionized water prior to placing the equipment or device in the well casing.

2.6.7 INTERNAL QUALITY CONTROL CHECKS

Quality control of sampling and sample handling is maintained by a systematic collection and analysis of "blank" and duplicate samples. Quality control samples include:

- Trip blanks that are placed in coolers by the supplying laboratory and analyzed for VOCs to assess the containers and the impacts on samples caused by the transport of the samples. These blank samples are made by the laboratory using reagent grade de-ionized water and the usual preservative. The caps are to remain sealed until removed in the laboratory. One trip blank per VOC sampling event shall be prepared and analyzed.

- Equipment blanks are checks of the decontamination procedure's effectiveness made after decontamination by pouring distilled water over, or passing the distilled water through, equipment and collecting it in sample bottles for analysis. One equipment blank per sampling event is collected and analyzed.
- Duplicate samples are made in the field by duplicating a sample or sample suite, as much as practical, as near to the same time as practical, using the same sampling techniques, preservatives, containers and container source to eliminate as many variables as possible. The samples shall be identified in a manner that the duplicate sample appears to be simply another sample from a different well, not labeled or coded unusually, and not analyzed in a different manner. Duplicate samples will be collected and analyzed at the rate of 1 per 20 primary samples per sampling event.

2.6.8 SAMPLE CHAIN-OF-CUSTODY

Chain-of-custody documents shall be maintained in a manner such that samples are in the custody and control of a known person at all times. The chain-of-custody procedures will allow the tracing of possession and handling of each sample from the time of field collection through laboratory analysis. The quality control procedure shall include completed purge and sample (field) logs, completed sample labels for each sample, completed chain-of-custody forms and transport of a properly sealed cooler. Transport of a properly sealed cooler by a common carrier does not require acknowledgement of the contents by the common carrier. The chain-of-custody form shall include provisions to record the sample identification, analyses required, personnel handling and receiving of the samples, and dates and times.

2.6.9 PREVENTATIVE MAINTENANCE

As part of the routine before sampling each well, a well inspection shall be conducted. The well inspection shall include observations concerning general appearance (free of debris, access is maintained), labeling/markings (well number and measurement point clearly marked), traffic protection, concrete pad, lock, cap and surroundings. A review of records will be conducted to assess evidence of silt build-up in the well or screen clogging. Any deficiencies shall be noted in the permanent inspection log (field log) and maintenance scheduled in a timely manner.

3 DELIVERABLES/REPORTING

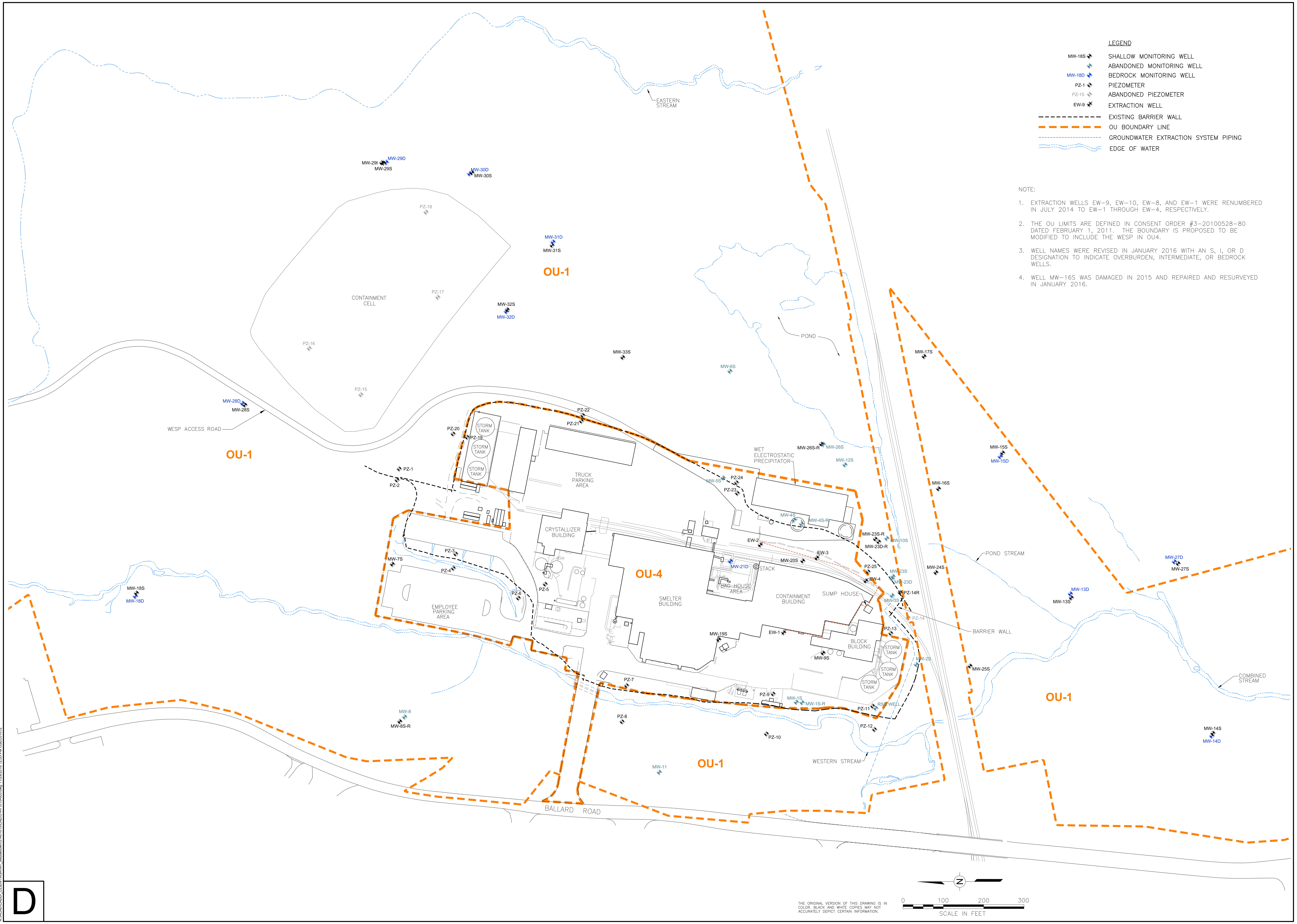
Groundwater quality samples collected under this GWMP will be collected on a quarterly or annual basis. Groundwater sampling activity reports are prepared and submitted to the NYSDEC quarterly as well as to the Town of Wallkill. The quarterly reports include a description of the field sampling activities, a discussion of the laboratory results, and evaluation of the piezometer data. The reports will be modified to include the containment cell monitoring data. The reports shall also include laboratory analytical summary sheets, including quality control summaries, chain-of-custody forms and groundwater purging and sample (field) logs for each well sampled. The quarterly sampling reports are submitted to the NYSDEC and Town of Wallkill approximately 60 days after completion of the groundwater sampling activities. Additionally, the data is submitted electronically to the NYSDEC as part of their Electronic Data Deliverable (EDD) program.

Any changes to the list of wells to be sampled during the subsequent sampling event, including additional monitoring wells or the analytical parameters, will be documented in the quarterly groundwater monitoring reports.

4 REFERENCES

- NYSDEC. 2015. Letter from Mr. William B. Bennett III, P.E. to Mr. Gerry Manley of RSR Corporation regarding OU-1 Phase III Containment Cell Groundwater Monitoring Work Plan, Revere Smelting & Refining Site, Site No. 3-36-053, Operable Unit 1 (OU-1), Town of Wallkill, Orange County. October 23.
- WSP. 2015a. Interim Corrective Measure Completion Report – Phase III Barrier Wall Installation and Phase I and II Barrier Wall Extensions – Operable Unit 4, Revere Smelting & Refining Corporation, Middletown, New York. February 19.
- WSP. 2015b. Letter from Mr. James Sobieraj to Mr. William B. Bennett III, P.E. of the New York State Department of Environmental Conservation regarding the OU1 Phase III Containment Cell Groundwater Monitoring Work Plan, Order on Consent and Administration Settlement Index #3-20100528-80, Revere Smelting & Refining Facility, Middletown, New York (Site #3-36-053). September 4.
- WSP. 2015c. Letter from Mr. James Sobieraj to Mr. William B. Bennett III, P.E. of the New York State Department of Environmental Conservation regarding Response to Proposed Modifications, OU1 Phase III Containment Cell Groundwater Monitoring Work Plan, Order on Consent and Administration Settlement Index #3 20100528-80, Revere Smelting & Refining Facility, Middletown, New York (Site #3-36-053). November 6.
- WSP. 2016. Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4. Revere Smelting & Refining Corporation, Middletown, New York. September 24, 2014; Revised November 9.
- WSP. 2017. Letter from Mr. James Sobieraj and Ms. Christine Albertin to Mr. William B. Bennett III, P.E. of the New York State Department of Environmental Conservation regarding Addendum to the Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4. Revere Smelting & Refining Corporation, Middletown, New York (Site #3-36-053). August 25.
- WSP. 2018. Letter from Mr. James Sobieraj and Ms. Christine Albertin to Mr. William B. Bennett III, P.E. of the New York State Department of Environmental Conservation regarding Completion Report for the Addendum to the Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4. Revere Smelting & Refining Corporation, Middletown, New York (Site #3-36-053). October 30.

SHEET



LEGEND

MW-18S	SHALLOW MONITORING WELL
	ABANDONED MONITORING WELL
MW-18D	BEDROCK MONITORING WELL
PZ-1	PIEZOMETER
PZ-15	ABANDONED PIEZOMETER
EW-9	EXTRACTION WELL
	EXISTING BARRIER WALL
	OU BOUNDARY LINE
	GROUNDWATER EXTRACTION SYSTEM PIPING
	EDGE OF WATER

NOTE:

1. EXTRACTION WELLS EW-9, EW-10, EW-8, AND EW-1 WERE RENUMBERED IN JULY 2014 TO EW-1 THROUGH EW-4, RESPECTIVELY.
2. THE OU LIMITS ARE DEFINED IN CONSENT ORDER #3-20100528-80 DATED FEBRUARY 1, 2011. THE BOUNDARY IS PROPOSED TO BE MODIFIED TO INCLUDE THE WESP IN OU4.
3. WELL NAMES WERE REVISED IN JANUARY 2016 WITH AN S, I, OR D DESIGNATION TO INDICATE OVERBURDEN, INTERMEDIATE, OR BEDROCK WELLS.
4. WELL MW-16S WAS DAMAGED IN 2015 AND REPAIRED AND RESURVEYED IN JANUARY 2016.

THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK AND WHITE COPIES MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.

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REVISIONS

REV	DESCRIPTION

SEAL

DATE

DRAWN BY EGC
CHECKED
APPROVED 10/22/2018

MONITORING WELL AND PIEZOMETER LOCATIONS

GROUNDWATER MONITORING PLAN
REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

PREPARED FOR
RSR CORPORATION
DALLAS, TEXAS

WSP USA Inc.
75 ARLINGTON STREET, 4th FLOOR
BOSTON, MA 02116
TEL: +1 617.426.7330

SHEET 1

Drawing Number
314V1015-003

TABLES

Table 1

Monitoring Well and Piezometer Construction Details
Revere Smelting & Refining Corporation
Middletown, New York

Well ID (b)	Former Well ID	Installation Date	Well Status	Ground Elevation (feet amsl)	Top of Casing Elevation (feet amsl)	Depth to Top of Screen (feet)	Depth to Bottom of Screen (feet)	Total Depth (feet)	Top of Screen Elevation (feet amsl)	Bottom of Screen Elevation (feet amsl)	Bottom Elevation (feet amsl)	Diameter (inches)	Slot Size (inches)
Overburden Wells													
RSR Well (GW-1)	RSR Well (GW-1)	08/10/82	Abandoned	516	519.65	5.1	15.1	17	510.9	500.9	499	4	NA
MW-1S	MW-1	07/29/91	Abandoned	518.9	520.24	8	13	13	510.9	505.9	NA	NA	NA
MW-1S-R	MW-1A	12/22/93	Abandoned	518.8	520.29	19	24	24	499.8	494.8	NA	2	0.01
MW-2S	MW-2	07/30/91	Abandoned	510.9	513.42	22	27	27	488.9	483.9	NA	2	0.01
MW-3S	MW-3	07/26/91	Abandoned	507.1	509.47	17.5	22.5	22.5	489.6	484.6	NA	2	0.01
MW-4S	MW-4	07/25/91	Abandoned	511.4	512.8	13.5	18.5	18.5	497.9	492.9	NA	2	0.01
MW-4S-R	MW-4A	12/21/93	Abandoned	511.7	513.02	23	33	33	488.7	478.7	NA	2	0.01
MW-5S	MW-5	07/22/91	Abandoned	513	514.72	15	20	20	498	493	NA	2	0.01
MW-6S	MW-6A	07/29/91	Abandoned	506.8	509.14	11	16	16	495.8	490.8	NA	2	0.01
MW-7S	MW-7	07/11/91	Active	524.8	526.63	5	15	15	519.8	509.8	NA	2	0.01
MW-8S	MW-8	07/29/91	Abandoned	523.8	525.49	3	8	8	520.8	515.8	NA	2	0.01
MW-8S-R	MW-8R	June 1999	Active	524.06	526.21	NA	NA	NA	NA	NA	NA	NA	NA
MW-9S	MW-9	12/13/93	Active	518.7	519.35	5	10	10	513.7	508.7	NA	2	0.01
MW-10S	MW-10	12/10/93	Abandoned	497.6	499.98	3	8	8	494.6	489.6	NA	2	0.01
MW-11S	MW-11	12/15/93	Abandoned	531.4	533.48	7.1	9.4	9.4	524.3	522	NA	2	0.01
MW-12S	MW-12	12/10/93	Abandoned	500.2	502.09	4	9	9	496.2	491.2	NA	2	0.01
MW-13S	MW-13(A)	07/28/94	Active	480.99	483.32	13	18	18	467.99	462.99	NA	2	0.01
MW-14S	MW-14	12/14/93	Active	481.2	483.38	22	27	27	459.2	454.2	NA	2	0.01
MW-15S	MW-15(A)	06/10/97	Active	484.17	486.47	6	11	11	478.17	473.17	NA	2	0.01
MW-16S (c)	MW-16	06/04/97	Active	492.53	494.62	5.41	15.41	16	487.12	477.12	NA	2	0.01
MW-17S	MW-17(A)	06/06/97	Active	488.87	491.46	3.5	13.5	13.5	485.37	475.37	NA	NA	NA
MW-18S	MW-18	06/13/97	Active	530.92	533.28	5	10	10	525.92	520.92	NA	2	0.01
MW-19S	MW-19	06/14/01	Active	521.99	523.96	5	15	15	516.99	506.99	NA	2	NA
MW-20S	MW-20	06/14/01	Active	512.32	511.94	19	29	29	493.32	483.32	NA	2	NA
MW-23S	MW-23S	11/07/01	Abandoned	496.68	498.5	2	12	12	494.68	484.68	NA	2	NA
MW-23S-R	NA	09/01/16	Active	497.76	500.23	6	16	16	491.76	481.76	481.76	2	0.01
MW-24S	MW-24	11/08/01	Active	485.86	488.09	2	12	12	483.86	473.86	NA	2	NA
MW-25S (d)	MW-25	11/08/01	Damaged	491.65	494.16	2	12	12	489.65	479.65	NA	2	NA
MW-26S	MW-26	11/08/01	Abandoned	501.74	503.99	7.6	14.6	14.6	494.14	487.14	NA	2	NA
MW-26S-R	NA	09/01/16	Active	502.62	505.46	5.5	15.5	15.5	497.12	487.12	487.12	2	0.01
MW-27S	MW-27A	04/09/09	Active	480.19	482.18	10	20	20	470.19	460.19	460.19	2	0.01
MW-28S	MW-28S	12/15/15	Active	532.84	535.50	2.5	12.5	12.5	530.34	520.34	520.34	2	0.01
MW-29S	MW-29S	12/17/15	Active	521.78	524.25	4.5	5.5	5.5	517.28	516.28	516.28	2	0.01
MW-30S	MW-30S	12/18/15	Active	523.32	525.02	4.5	12.5	12.5	518.82	510.82	510.82	2	0.01
MW-31S	MW-31S	09/06/16	Active	515.73	518.37	5	13	13	510.73	502.73	502.73	2	0.01
MW-32S	MW-32S	09/06/16	Active	530.07	532.73	4.5	14.5	14.5	525.57	515.57	515.57	2	0.01
MW-33S	NA	09/01/16	Active	514.80	517.57	4.5	7.5	7.5	510.30	507.30	507.30	2	0.01

Table 1

Monitoring Well and Piezometer Construction Details
Revere Smelting & Refining Corporation
Middletown, New York

Well ID (b)	Former Well ID	Installation Date	Well Status	Ground Elevation (feet amsl)	Top of Casing Elevation (feet amsl)	Depth to Top of Screen (feet)	Depth to Bottom of Screen (feet)	Total Depth (feet)	Top of Screen Elevation (feet amsl)	Bottom of Screen Elevation (feet amsl)	Bottom Elevation (feet amsl)	Diameter (inches)	Slot Size (inches)
Bedrock Wells													
MW-13D	MW-13B	06/12/97	Active	482.21	483.32	32.5	37.5	32.5	449.71	444.71	NA	2	0.01
MW-14D	MW-14B	July 1999	Active	482.8	484.92	NA	NA	NA	NA	NA	NA	NA	NA
MW-15D	MW-15B	July 1999	Active	484.01	486.32	NA	NA	NA	NA	NA	NA	NA	NA
MW-18D	MW-18B	July 1999	Active	531.42	533.39	NA	NA	NA	NA	NA	NA	NA	NA
MW-21D	MW-21B	06/15/01	Active	515.81	515.48	9	19	19	506.81	496.81	NA	2	NA
MW-23D	MW-23(D)	Nov 2001	Abandoned	496.72	498.06	22	26.8	26.8	474.72	469.9	NA	2	NA
MW-23D-R	NA	08/31/16	Active	497.02	499.72	30	35	35	467.02	462.02	462.02	2	0.01
MW-27D	MW-27B	04/09/09	Active	480.71	482.34	27	35	35	453.71	445.71	445.71	2	0.01
MW-28D	MW-28D	12/29/15	Active	532.63	534.40	18.5	23.5	23.5	514.13	509.13	509.13	2	0.01
MW-29I	MW-29I	12/17/15	Active	521.55	523.61	8.0	12.0	12.0	513.5	509.5	509.5	2	0.01
MW-29D	MW-29D	12/30/15	Active	521.68	522.61	18.5	23.5	23.5	503.18	498.18	498.18	2	0.01
MW-30D	MW-30D	12/29/15	Active	522.83	523.78	18.5	23.5	23.5	504.33	499.33	499.33	2	0.01
MW-31D	MW-31D	09/06/16	Active	514.82	517.77	19	24	24	495.82	490.82	490.82	2	0.01
MW-32D	MW-32D	09/01/16	Active	530.21	532.97	22	27	27	508.21	503.21	503.21	2	0.01
Piezometers													
PZ-1	PZ-1	08/23/99	Active	529	531.13	7.2	10.2	10.2	521.8	518.8	518.8	2	0.01
PZ-2	PZ-2	08/24/99	Active	527.69	529.75	7.2	14.2	14.2	520.49	513.49	513.49	2	0.01
PZ-3	PZ-3	08/24/99	Active	523.82	525.72	6	14	14	517.82	509.82	509.82	2	0.01
PZ-4	PZ-4	08/24/99	Active	522.92	524.74	6	14	14	516.92	508.92	508.92	2	0.01
PZ-5	PZ-5	08/30/99	Active	523.06	522.64	6	14	14	517.06	509.06	509.06	2	0.01
PZ-6	PZ-6	08/25/99	Active	522.74	524.39	6	15	15	516.74	507.74	507.74	2	0.01
PZ-7	PZ-7	08/25/99	Active	519.8	521.38	6	10	10	513.8	509.8	509.8	2	0.01
PZ-8	PZ-8	08/25/99	Active	528.86	527.62	7.4	13.4	13.4	521.46	515.46	515.46	2	0.01
PZ-9	PZ-9	08/31/99	Active	519.76	521.52	6.2	15.2	15.2	513.56	504.56	504.56	2	0.01
PZ-10	PZ-10	08/25/99	Active	517.68	519.54	6.1	13.1	13.1	511.58	504.58	504.58	2	0.01
PZ-11	PZ-11	08/31/99	Active	516.84	519.18	6	14	14	510.84	502.84	502.84	2	0.01
PZ-12	PZ-12	08/30/99	Active	512.72	514.80	6	14	14	506.72	498.72	498.72	2	0.01
PZ-13	PZ-13	09/01/99	Active	513.19	514.86	17	27	30	496.19	486.19	483.19	2	0.01
PZ-14	PZ-14	09/02/99	Abandoned	506.85	508.77	16	24	24	490.85	482.85	482.85	2	0.01
PZ-14R	NA	08/16/18	Active	505.79	509.14	14	24	26	491.79	481.7899	479.7899	2	0.01
PZ-15 (e)	PZ-15	09/19/11	Removed	534.3	536.307	3	8	10	531.30	526.3	524.3	2	0.01
PZ-16 (e)	PZ-16	09/19/11	Removed	531.62	533.62	8	13	13	523.62	518.62	518.62	2	0.01
PZ-17 (e)	PZ-17	09/19/11	Removed	531.74	534.245	8	13	13	523.74	518.74	518.74	2	0.01
PZ-18 (e)	PZ-18	09/19/11	Removed	526.48	528.479	8	13	13	518.48	513.48	513.48	2	0.01
PZ-19	NA	08/15/18	Active	529.55	532.19	5	10	11	524.55	519.55	518.55	2	0.01
PZ-20	NA	08/14/18	Active	530.09	533.06	5.5	10.5	11.5	524.59	519.59	518.59	2	0.01
PZ-21	NA	08/15/18	Active	518.73	518.39	3	6	6	515.73	512.73	512.73	2	0.01
PZ-22	NA	08/15/18	Active	517.63	517.09	3	6	6	514.63	511.63	511.63	2	0.01
PZ-23	NA	08/15/18	Active	512.38	511.96	10	20	21	502.38	492.38	491.38	2	0.01
PZ-24	NA	08/15/18	Active	511.49	511.20	14	24	28	497.49	487.49	483.49	2	0.01
PZ-25	NA	08/16/18	Active	508.85	508.47	14	24	24	494.85	484.85	484.85	2	0.01

Table 1

Monitoring Well and Piezometer Construction Details
Revere Smelting & Refining Corporation
Middletown, New York

Well ID (b)	Former Well ID	Installation Date	Well Status	Ground Elevation (feet amsl)	Top of Casing Elevation (feet amsl)	Depth to Top of Screen (feet)	Depth to Bottom of Screen (feet)	Total Depth (feet)	Top of Screen Elevation (feet amsl)	Bottom of Screen Elevation (feet amsl)	Bottom Elevation (feet amsl)	Diameter (inches)	Slot Size (inches)
Extraction Wells													
EW-1	EW-9	07/28/07	Active	518.63	517.71	10	20	20	508.63	498.63	498.63	4	0.04
EW-2	EW-10	07/30/07	Active	513.65	512.80	9	19	19	504.65	494.65	494.65	4	0.04
EW-3	EW-8	07/29/07	Active	511.12	510.27	8	23	23	503.12	488.12	488.12	4	0.04
EW-4	EW-1	07/27/07	Active	509.41	508.29	9.8	19.8	19.8	499.61	489.61	489.61	4	0.04

a) NA = Not available. Boring logs not provided or incomplete.
b) Well names were revised in January 2016 with an S, I, or D to indicate overburden, intermediate, or bedrock wells.
c) Well MW-16S was damaged during the Phase IIB RD/RA, and repaired and resurveyed in January 2016.
d) Monitoring well MW-25S was damaged and approved for removal from the GWMP by the NYSDEC in a letter dated September 8, 2017.
e) Piezometers PZ-15 though PZ-18 were installed to determine depth to water for the design of the containment cell. These piezometers have since been removed.

Table 2

Quarterly Groundwater Monitoring Program
Revere Smelting & Refining Corporation
Middletown, New York

Parameters Monitoring Well ID	Unfiltered Metals (in ug/l)					Miscellaneous Inorganics		
	Total Lead 6010C	Total Antimony 6010C	Total Cadmium 6010C	Total Chromium 6010C	Total Arsenic 6010C	Alkalinity (mg/l) SM2320 B-1997	Sulfate (mg/l) 300	pH 9040B and 9045D
Unconsolidated Wells								
MW-7S	X	X	X	X	X	X	X	X
MW-8S-R	X	X	X	X	X	X	X	X
MW-9S	X	X	X	X	X	X	X	X
MW-13S	X	X	X	X	X	X	X	X
MW-14S	X	X	X	X	X	X	X	X
MW-15S	X	X	X	X	X	X	X	X
MW-16S	X	X	X	X	X	X	X	X
MW-17S	X	X	X	X	X	X	X	X
MW-18S	X	X	X	X	X	X	X	X
MW-19S	X	X	X	X	X	X	X	X
MW-20S	X	X	X	X	X	X	X	X
MW-23S-R	X	X	X	X	X	X	X	X
MW-24S	X	X	X	X	X	X	X	X
MW-26S-R	X	X	X	X	X	X	X	X
MW-27S	X	X	X	X	X	X	X	X
MW-28S	X	X	X	X	X	X	X	X
MW-29S	X	X	X	X	X	X	X	X
MW-30S	X	X	X	X	X	X	X	X
MW-31S	X	X	X	X	X	X	X	X
MW-32S	X	X	X	X	X	X	X	X
MW-33S	X	X	X	X	X	X	X	X
Bedrock Wells								
MW-13D	X	X	X	X	X	X	X	X
MW-14D	X	X	X	X	X	X	X	X
MW-15D	X	X	X	X	X	X	X	X
MW-18D	X	X	X	X	X	X	X	X
MW-21D	X	X	X	X	X	X	X	X
MW-23D-R	X	X	X	X	X	X	X	X
MW-27D	X	X	X	X	X	X	X	X
MW-28D	X	X	X	X	X	X	X	X
MW-29D	X	X	X	X	X	X	X	X
MW-30D	X	X	X	X	X	X	X	X
MW-31D	X	X	X	X	X	X	X	X
MW-32D	X	X	X	X	X	X	X	X
Barrier Wall Piezometers								
PZ-13	X	X	X	X	X	X	X	X

Table 3

Annual Containment Cell Groundwater Monitoring Program
Revere Smelting & Refining Corporation
Middletown, New York

Parameters	Analytical Method
Field Measurements	
Static Water Level	-
Specific Conductance	-
Temperature	-
Floaters or Sinkers	-
pH	-
Oxidation/Reduction Potential (Eh)	-
Turbidity (NTU)	-
Laboratory Analysis	
General Chemistry Parameters:	
Total Kjeldahl Nitrogen (mg/l)	351.2
Ammonia (mg/l)	350.1
Nitrate (mg/l)	300.0
Chemical Oxygen Demand (mg/l)	410.4
Biochemical Oxygen Demand (mg/l)	SM5210 B-2001
Total Organic Carbon (mg/l)	9060A
Total Dissolved Solids (mg/l)	SM2540 C-1997
Sulfate (mg/l)	300.0
Alkalinity, Total as CaCO3 (mg/l)	SM2320 B-1997
Phenols (mg/l)	9066
Chloride (mg/l)	300.0
Bromide (mg/l)	300.0
Total Hardness as CaCO3 (mg/L)	SM2340 C-1997
Inorganic Parameters (mg/l):	
Aluminum	6010C
Barium	6010C
Beryllium	6010C
Boron	6010C
Calcium	6010C
Chromium (Hexavalent)	7196A
Cobalt	6010C
Copper	6010C
Cyanide	9012B
Iron	6010C
Magnesium	6010C
Manganese	6010C
Mercury	7470A
Nickel	6010C
Potassium	6010C
Selenium	6010C
Silver	6010C
Sodium	6010C
Thallium	6010C
Vanadium	6010C
Zinc	6010C
Volatile Organic Compounds (µg/l) (a)	8260C

a) Analysis will include all of the VOCs listed under the baseline parameters in the Water Quality Analysis Tables under 6 NYCRR Part 360-2.11.

Table 4

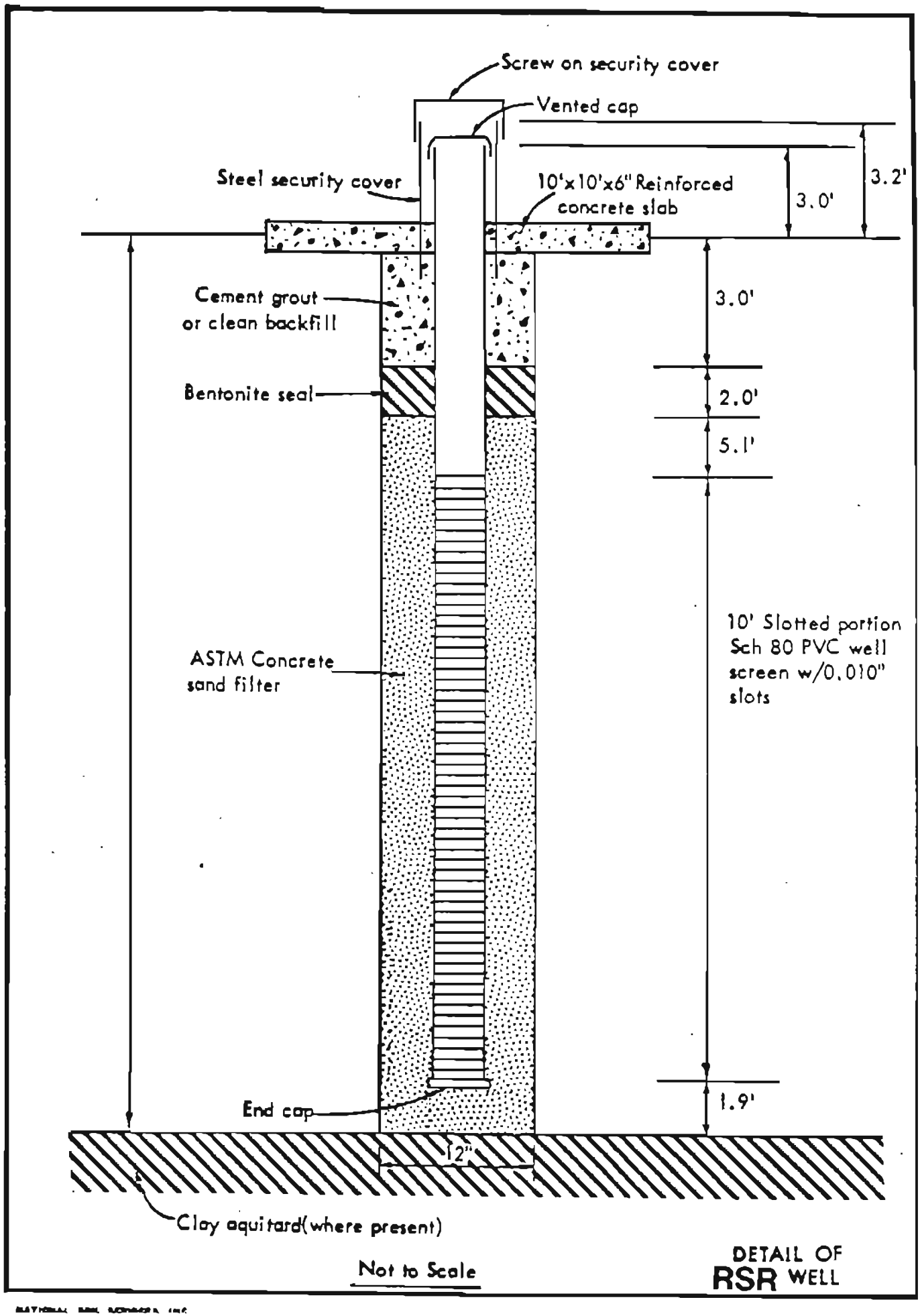
Containment Cell Contingent Groundwater Monitoring Program
Revere Smelting & Refining Corporation
Middletown, New York

Potential Parameters	Analytical Method
Laboratory Analysis	
General Chemistry Parameters:	
Sulfide	9034
Inorganic Parameters (mg/l):	
Tin	6010C
Semi-Volatile Organic Compounds (µg/l) (a)	8270D
Pesticides (µg/l) (a)	8081B
Polychlorinated Biphenyl Compounds (µg/l) (a)	8082A
Herbicides (µg/l) (a)	8151A

a) Analysis will include all of the SVOCs, pesticides, PCBs, or herbicides listed under the expanded parameters in the Water Quality Analysis Tables under 6 NYCRR Part 360-2.11.

APPENDIX

A MONITORING WELL AND PIEZOMETER BORING LOGS AND WELL CONSTRUCTION DIAGRAMS


Screw on security cover
Vented cap
Steel security cover
10'x10'x6" Reinforced concrete slab
3.2'
3.0'
Cement grout or clean backfill
3.0'
Bentonite seal
2.0'
5.1'
10' Slotted portion Sch 80 PVC well screen w/0.010" slots
ASTM Concrete sand filter
End cap
1.9'
12"
Clay aquitard(where present)
Not to Scale
DETAIL OF RSR WELL

LOG OF BORING NO. GW-1

RSR CORPORATION - PROJECT 82-21
MIDDLETOWN, NEW YORK

TYPE BORING: Wash

LOCATION: See Plan of Borings, Plate 1

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT LBS./CU. FT.
0			Brownish-gray sandy clay, w/occasional light tan clay and numerous angular rock fragments							
5			-boulder from 8.0-8.5'							
10			-boulder from 9.5-10.0'							
			-boulder from 13.0-14.0'							
15			(Till)							
			Note: 4" monitor well installed in this boring location							
20										
25										
30										
35										

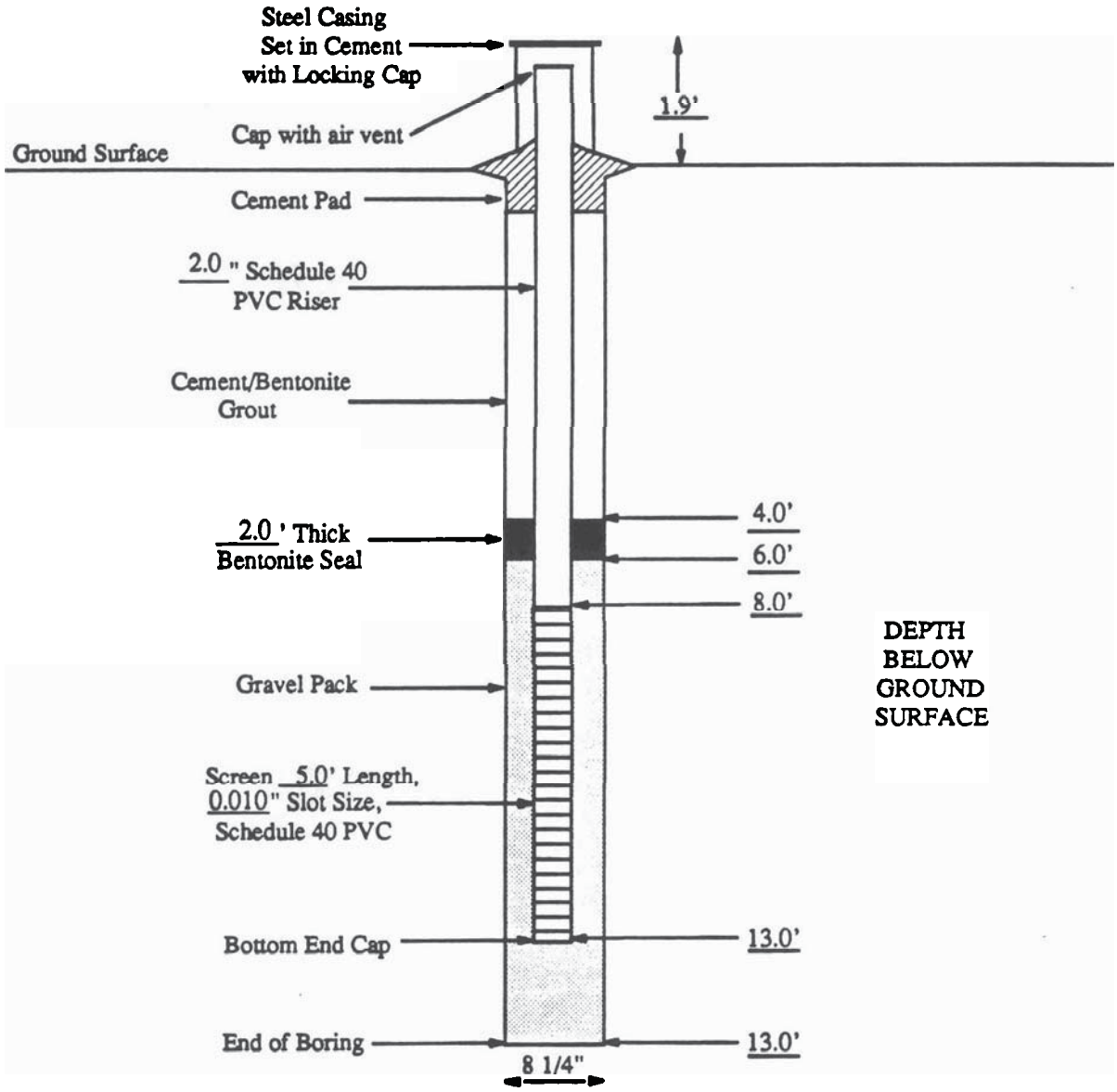
COMPLETION DEPTH: 15.0'
DATE: 8/10/82

DEPTH TO WATER: 6.5' - Caved at 10.9'
DATE: 8/11/82

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 29, 1991



AS-BUILT DIAGRAM FOR WELL MW-1 (MW-1S as of 01/16)

ESC

ENVIRONMENTAL STRATEGIES CORP.
Four Penn Center West, Suite 315
Pittsburgh, Pennsylvania 15276
412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-1 (MW-1S as of 01/16)
Date Drilled: July 26, 1991

Drilling Co.: Environmental Drilling, Inc.
Driller: Greg Pijak
ESC Geologist: E. Michael Riggins

Boring Location: West of battery storage area
Ground Elevation:
TOC Elevation:

Boring		Sampler	
Method:	H.S.A.	Method:	Split-spoon
Hole Diameter:	8.25"	Length Ft.:	2.0
Inside Diameter:	4.25"	Hammer lbs.:	140
Total Depth:	13.0'	Fall ins.:	30

Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-0.4		90	MW1-1 0.0-1.5	10/21/23/21	TOPSOIL-SILT-dark brown, some clay & angular rock fragments
0.4-2.0					SILT-yellowish brown to brown, little clay, trace rock fragments, FILL
2.0-4.0		60	MW1-2 2.0-4.0	15/16/17/22	SILT-grayish brown, little sand & clay, some rock fragments, calcite crystal, plastic, wood, & plastic sheeting material, FILL, damp
4.0-4.5		60	MW1-3 4.0-5.0	42/33/47/45	SILT-same as above to 4.5'
4.5-6.0					SILT-greenish gray, some clay, trace angular rock fragments, native soil (?)
6.0-7.0		40	MW1-4 6.0-7.0	15/50 over 4"	CLAY-grayish brown, orange mottles, little sand & silt, trace rock fragments, rock fragment in spoon tip
8.0-9.0		80	MW1-5 8.0-9.0	7/25/22/13	CLAY-same as above to 9.0'

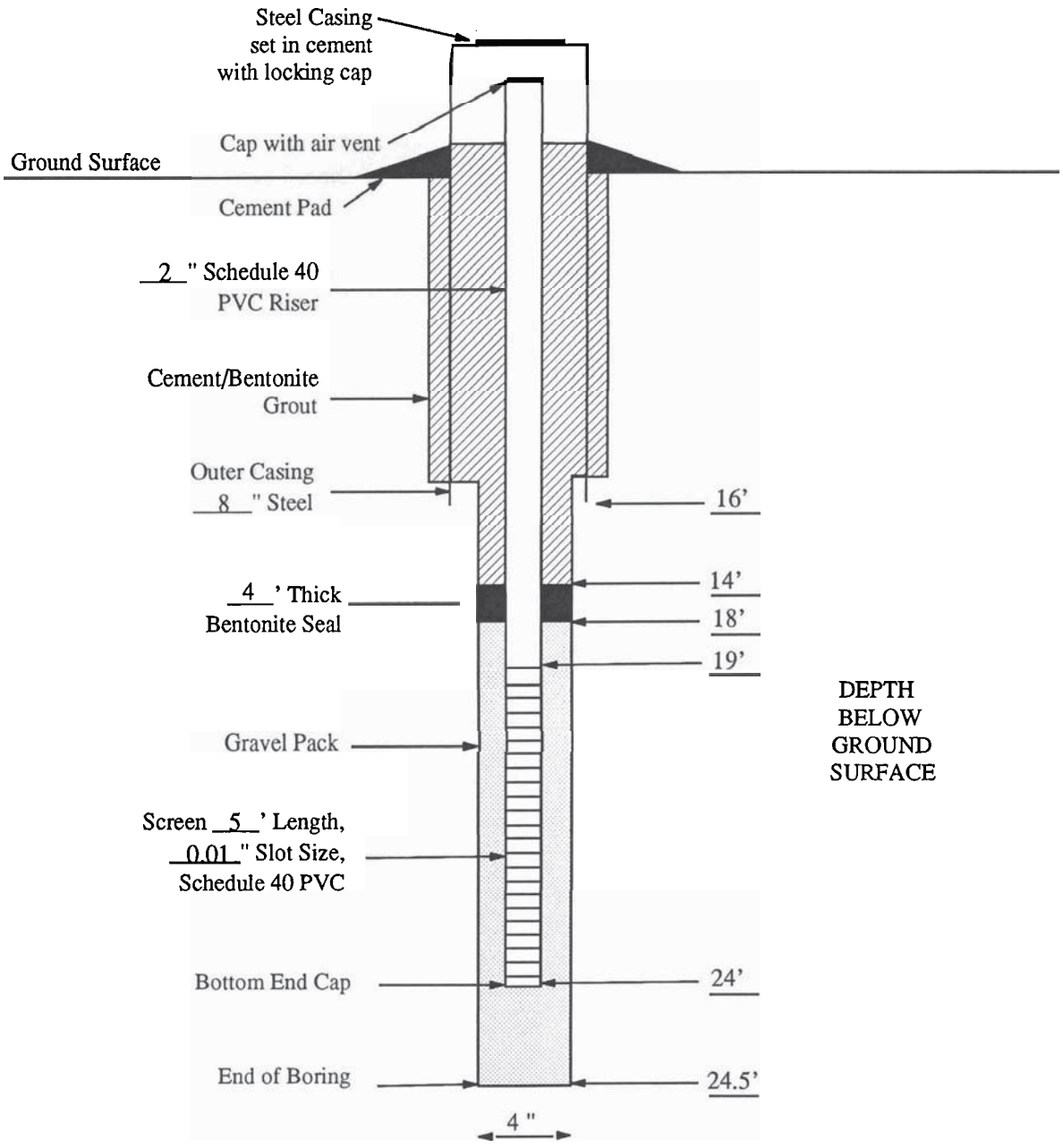
9.0-10.0		SILT & SAND-bluish gray, little rock fragments, trace clay, saturated
10.0-12.0	16/12/12/12	SAND & GRAVEL & ROCK FRAGMENTS-dark bluish gray, trace silt & clay, saturated
12.0-13.0		SAND & GRAVEL & ROCK FRAGMENTS-same as above, augers advanced to 13.0'

NOTE: Groundwater encountered at 9.0'.

SITE NAME: Revere Smelting & Refining

LOCATION: Wallkill, New York

DATE: December 16-22, 1993



ENVIRONMENTAL STRATEGIES CORPORATION
Four Penn Center West • Suite 315
Pittsburgh, Pennsylvania 15276
(412) 787-5100

AS-BUILT DIAGRAM FOR WELL MW-1A
(MW-1S-R as of 01/16)

f:\lotus\as-built\well3

BORING LOG
Environmental Strategies Corporation
Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York
PA1217-02

Boring No. MW-1A
(MW-1S-R as of 01/16)
Sheet 1 of 1

Date Drilled 12/16-22/93

Drilling Co. Empire Soil and Investigations
Driller Scott Bray
ESC Geologist E. Michael Riggins

Boring Location South of MW-1
Ground Elevation NA
TOC Elevation NA

Boring
Method Hollow Stem Augers
Hole Diameter 18"-8"-4"
Inside Diameter 12.25"-4.25"
Total Depth 24.5 feet

Casing/Screen
Type PVC
Diameter 2 inch
Screen Length 5 feet
Screen Slot Size 0.01 inch

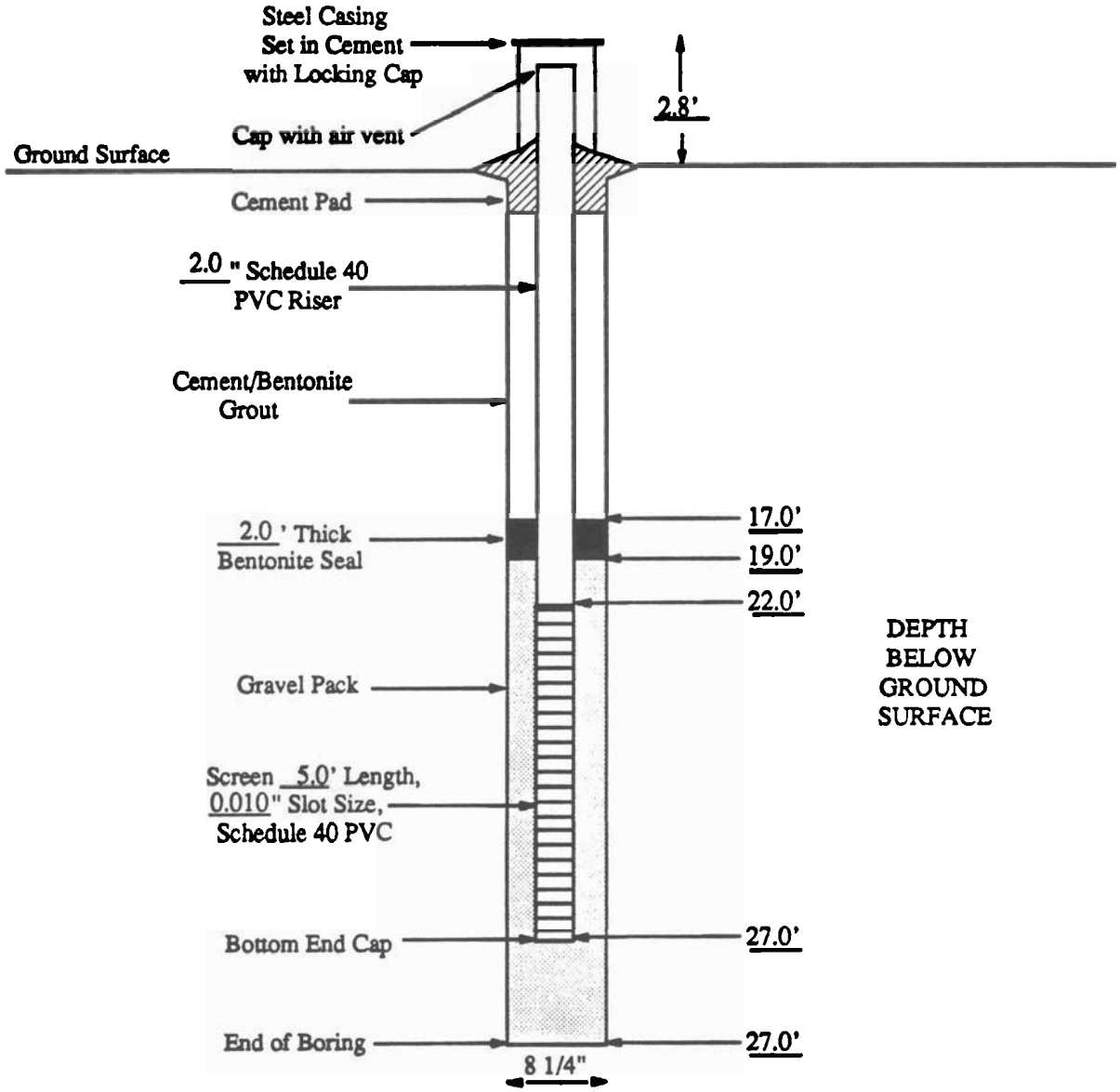
Sampler
Method Split-spoon
Length (ft) 2-foot
Hammer (lb) 140
Fall (in) 30

Depth (ft)	P.I.D. (ppm)	Percent Recovery	Sample Depth (ft)	Blows/6"	Sample Number	Sample Description
0	NA	30	0-2	10-11-10-9	MW1A-1	SILT FILL, some clay and roots,
						trace anthropogenic material, dark
						brown, moist.
2	NA	40	2-3.5	21-23-	MW1A-2	SILT FILL, trace clay and rock
				100/6"		fragments, some calcite fragments,
						yellowish brown, moist; large
						gravel and anthropogenic material
						below 3 feet.
4	NA	100	4-6	12-21-30-30	MW1A-3	Note: Color change to greenish
					MW1A-4	brown from 4 to 4.5 feet.
4.5						Note: color change to yellowish
	NA	50	6-8	21-50-65-33	MW1A-5	brown, trace bluish gray clay and
	NA	45	8-9.5	10-13-13-7	MW1A-6	rock fragments, orange mottling.
10	NA	40	10-12	6-7-8-10		SILT FILL and shale fragments,
						bluish gray, little fine grain
	NA	60	12-14	7-15-23-18		sand, saturated; dark greenish
						gray and moist below 12 feet.
15.5	NA	50	14-16	10-23-30-19		SILT, trace fine sand, clay, and
	NA	40	16-18	20-27-65-60		rock fragments, yellowish brown,
						dry, native soil; set
						8 inch steel casing at 16 feet.
18	NA	50	18-20	23-28-32-67		SILT TILL with shale fragments,
						bluish gray, moist.
20	NA	30	20-24.5	Cored	RUN 1	SHALE, dark gray, horizontal
						fracturing at 30° angles, wet,
						competent.

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 30, 1991



AS-BUILT DIAGRAM FOR WELL MW-2 (MW-2S as of 01/16)

ESC

ENVIRONMENTAL STRATEGIES CORP.
Four Penn Center West, Suite 315
Pittsburgh, Pennsylvania 15276
412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-2 (MW-2S as of 01/16)
Date Drilled: July 30, 1991

Drilling Co.: Environmental Drilling, Inc.
Driller: Greg Pijak
ESC Geologist: E. Michael Riggins

Boring Location: South of facility
Ground Elevation:
TOC Elevation:

Boring		Sampler	
Method:	H.S.A.	Method:	Split-spoon
Hole Diameter:	8.25"	Length Ft.:	2.0
Inside Diameter:	4.25"	Hammer lbs.:	140
Total Depth:	27.0'	Fall ins.:	30

Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-2.0	0	25	MW2-1 0.0-0.5	9/26/42/43	SILT FILL-medium brown, little clay & angular & rounded rock fragments
2.0-2.5		5		50 over 5"	No recovery-calcite crystal in spoon tip, augered to 4.0'
4.0-5.0	300	90	MW2-2 4.0-5.5	14/50/ 50 over 5"	SILT FILL-same as above to 5.0'
5.0-5.5					SAND-yellowish brown, fine grained, trace silt & rock fragments
6.0-6.5	320	90	MW2-3 6.0-7.0	11/50 over 4"	SAND-same as above to 6.5'
6.5-7.0					SILT FILL-grayish brown, little clay, trace sand & rock fragments
8.0-9.0	30	50	MW2-4 8.0-9.0	5/14/8/9	SILT FILL-same as above to 9.0'

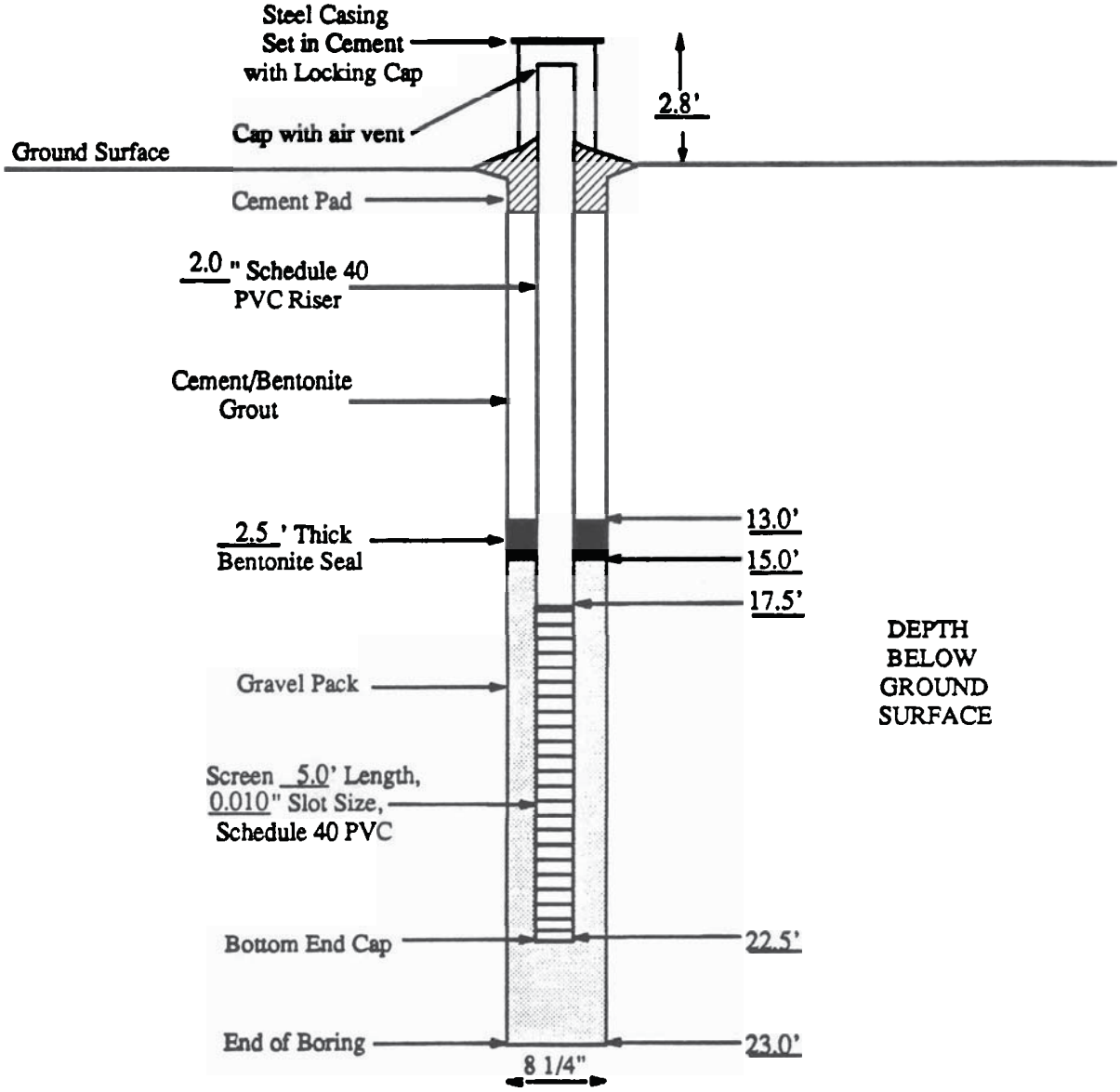
9.0-10.0	3				SILT FILL-dark gray to bluish gray, some clay, little rock fragments, trace sand, poorly sorted, damp
10.0-10.5	3	70	MW2-5 10.0-12.0 MW2-6 10.0-12.0 (dup)	8/9/4/7	SILT-black, organic material, woody material, roots, some clay, trace rock fragments, native soils
10.5-11.2					CLAY-dark gray, some silt, trace rock fragments, organic & root material
11.2-12.0					SILT-yellowish brown, little clay, trace fine sand & rock fragments, TILL
12.0-13.0	3	90	MW2-7 12.0-13.0	9/20/32/42	SILT TILL-yellowish brown, little clay & fine sand, trace rock fragments
13.0-14.0					SILT TILL-yellowish brown, dark orange mottles, little clay & rock fragments
14.0-14.6	3	90	MW2-8 14.0-14.6	29/50 over 2"	SILT TILL-same as above to 14.3', weathered shale fragment in spoon tip
16.0-17.3	4	100	MW2-9 16.0-17.0	48/50/ 50 over 4"	SILT TILL-dark yellowish brown, little clay & rounded rock fragments, poorly sorted
18.0-18.5		5		72	SILT TILL-same as above, very poor recovery
20.0-21.2		30	MW2-10 20.0-21.2	16/19/ 50 over 3"	SILT TILL-yellowish brown, little clay & rock fragments, trace sand, poorly sorted, damp, boulder at 21.0'
22.0-23.2		90	MW2-11 22.0-23.0	27/30/ 50 over 3"	SILT TILL-same as above, sandstone fragments, saturated at 23.0'
23.2-27.0					SILT TILL- same as above, augered to 27.0'

NOTE: Groundwater encountered at 23.0'.

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 26, 1991



AS-BUILT DIAGRAM FOR WELL MW-3 (MW-3S as of 01/16)

ESC

ENVIRONMENTAL STRATEGIES CORP.
Four Penn Center West, Suite 315
Pittsburgh, Pennsylvania 15276
412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-3 (MW-3S as of 01/16)
Date Drilled: July 24 & 25, 1991

Drilling Co.: Environmental Drilling, Inc.
Driller: Greg Pijak
ESC Geologist: E. Michael Riggins

Boring Location: Southeast of facility
Ground Elevation:
TOC Elevation:

Boring		Sampler	
Method:	H.S.A.	Method:	Split-spoon
Hole Diameter:	8.25"	Length Ft.:	2.0
Inside Diameter:	4.25"	Hammer lbs.:	140
Total Depth:	22.0'	Fall ins.:	30

Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-1.0	0	65	MW3-1 0.0-0.5	3/12/30/ 50 over 5"	SAND-brown, fine grained, trace silt & clay, organics & roots, FILL
1.0-2.0	0				SILT FILL-grayish brown, little clay & rock fragments, trace fine sand, trace lead, slag, concrete, & plastic material
2.0-4.0	0	50	MW3-2 2.0-2.5	5/14/8/21	SILT FILL-yellowish brown, little clay & rock fragments, poorly sorted
4.0-6.0	0	75	MW3-3 4.0-4.5	17/10/12/44	SILT TILL-yellowish brown, little clay & rock fragments, rootlets & organics, damp at 4.0', native soils
6.0-8.0	0	100	MW3-4 6.0-6.5	33/50/33/34	SILT TILL-same as above, rock fragments smaller in size
8.0-10.0	0	100	MW3-5 8.0-8.5	50/21/35/22	SILT TILL-same as above
10.0-10.5	0	80	MW3-6 10.0-10.5	50 over 5"	SILT TILL-grayish brown, little clay, trace rock fragments, poorly sorted, dry

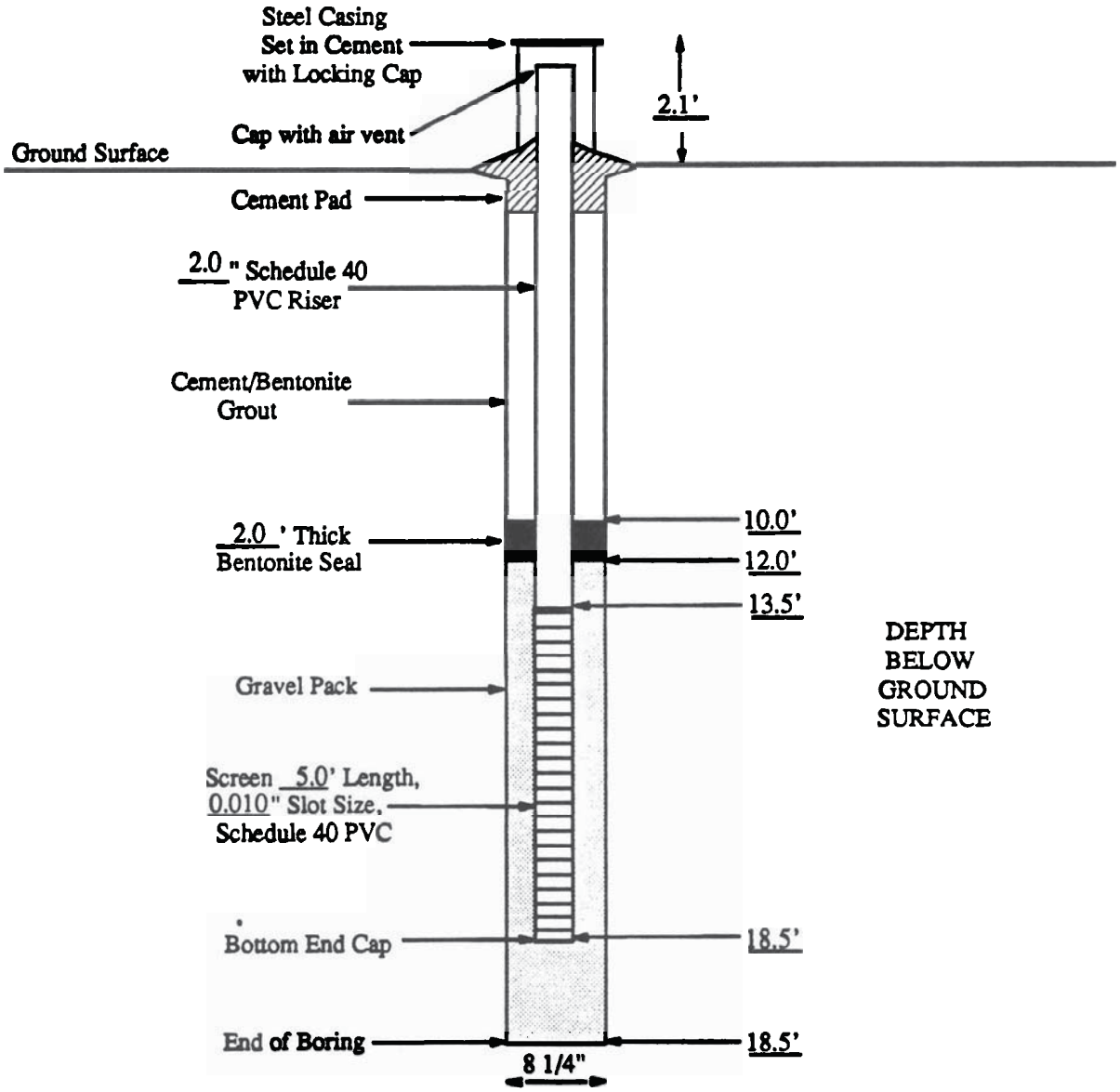
12.0-12.7	40	5/50 over 3"	SILT TILL-same as above
15.0-16.9	20	51/100 over 5"	SILT TILL-same as above, gravel sized fraction has increased

NOTE: Groundwater encountered at 7.0'.

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 25,1991



AS-BUILT DIAGRAM FOR WELL MW-4 (MW-4S as of 01/16)

ESC

ENVIRONMENTAL STRATEGIES CORP.
Four Penn Center West, Suite 315
Pittsburgh, Pennsylvania 15276
412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-4 (MW-4S as of 01/16)
Date Drilled: July 24, 1991

Drilling Co.: Environmental Drilling, Inc.
Driller: Greg Pijak
ESC Geologist: E. Michael Riggins

Boring Location: East of facility
Ground Elevation:
TOC Elevation:

Boring		Sampler	
Method:	H.S.A.	Method:	Split-spoon
Hole Diameter:	8.25"	Length Ft.:	2.0
Inside Diameter:	4.25"	Hammer lbs.:	140
Total Depth:	20.0'	Fall ins.:	30

Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-0.5	0	90	MW4-1 0.0-0.5	1/8/27/24	SAND-fine grained, root zone, trace silt & rock fragments, FILL
0.5-2.0					SILT FILL-some clay, little rock fragments, plastic & lead material
2.0-4.0	3-4	100	MW4-2 2.0-2.5	17/48/18/41	SILT FILL-same as above, concrete fragment in spoon tip
4.0-6.0	6-8	90	MW4-3 4.0-6.0 MW4-4 4.0-6.0 (dup)	40/38/27/ 50 over 4"	SILT FILL-same as above, lead, wood & concrete material
6.0-7.0	0	80		50/50 over 4"	FILL-wood & slag material in spoon tip, no sample collected
8.0-10.0		5		29/8/14/13	FILL-wood material in spoon tip, no recovery, pushing woody material downward through the FILL
10.0-12.0				2/16/29/30	FILL-same as above, no recovery

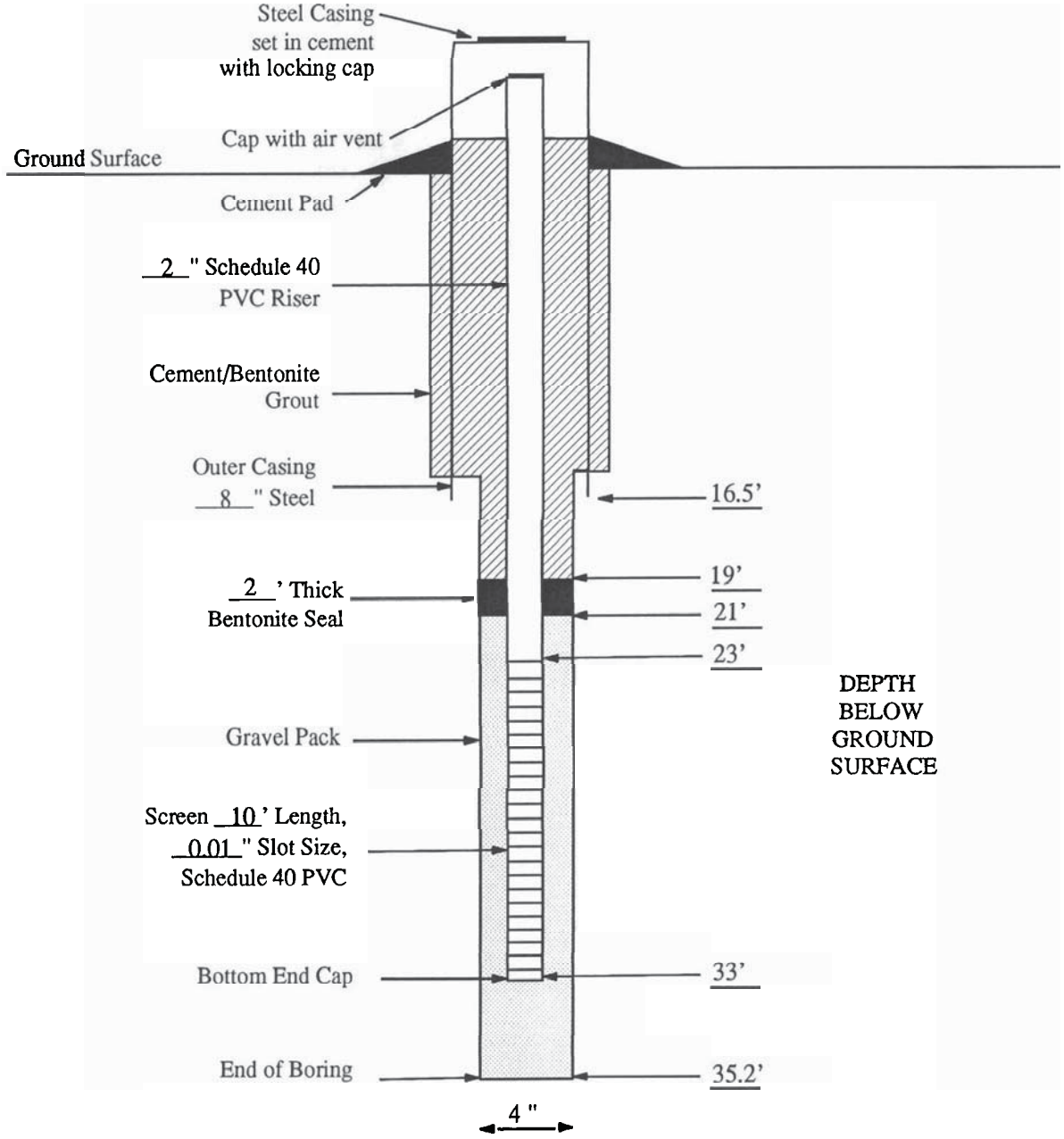
12.0-14.0	0	5	MW4-5 12.0-14.0	4/25/9/34	FILL-slag material, no recovery
14.0-16.0	0	5		25/14/5/7	FILL-SLAG & GRAVEL-dark gray to black, saturated
16.0-16.5	0	90	MW4-6 16.0-17.0	6/3/5/8	SLAG & GRAVEL-same as above to 16.5'
16.5-17.3					SILT-dark gray, little clay, trace fragments, root structures, saturated
17.3-18.0					SILT-yellowish gray to brown, little clay, trace rock fragments, mottled
18.0-20.0	0	90		8/14/18/ 50 over 5"	SILT TILL-light yellowish brown, little clay, trace angular rock fragments, tight formation

NOTE: Groundwater encountered at 16.0'.

SITE NAME: Revere Smelting & Refining

LOCATION: Wallkill, New York

DATE: December 14-21, 1993



ENVIRONMENTAL STRATEGIES CORPORATION
Four Penn Center West • Suite 315
Pittsburgh, Pennsylvania 15276
(412) 787-5100

AS-BUILT DIAGRAM FOR WELL MW-4A
(MW-4S-R as of 01/16)

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BORING LOG
Environmental Strategies Corporation
Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York
PA1217-02

Boring No. MW-4A
(MW-4S-R as of 01/16)
Sheet 1 of 2

Date Drilled 12/08/93

Drilling Co. Empire Soil and Investigations
Driller Scott Bray/Craig Conner
ESC Geologist E. Michael Riggins

Boring Location South of MW4
Ground Elevation NA
TOC Elevation NA

Boring
Method Hollow Stem Augers
Hole Diameter 18"-8"-4"
Inside Diameter 13.25"-4.25"
Total Depth 35.2 feet

Casing/Screen
Type PVC
Diameter 2 inch
Screen Length 10 foot
Screen Slot Size 0.01 inch

Sampler
Method Split-spoon
Length (ft) 2-foot
Hammer (lb) 140
Fall (in) 30

Depth (ft)	P.I.D. (ppm)	Percent Recovery	Sample Depth (ft)	Blows/6"	Sample Number	Sample Description
0	NA	75	0-2	3-12-15-27	MW4A-1	SILT, little sand, trace rock fragments, and roots, brown, moist.
0.5						SILT FILL, little sand and clay, trace rock fragments anthropogenic materials, yellowish brown, moist.
2	NA	80	2-4	12-12-17-13	MW4A-2	SILT FILL, trace sand, anthropogenic material, wood, brownish gray.
5	NA	60	4-6	6-10-17-70/4"	MW4A-3	Note: Large gravel to cobble size rocks at 5 feet.
6	NA	30	6-8	21-11-9-20	MW4A-4	SILT FILL, some gravel, trace rock fragments, dark gray to black.
8	NA	40	8-10	8-10-7-8	MW4A-5	GRAVELLY SILT FILL, trace sand,
	NA	30	10-12	6-4-6-4	MW4A-6	medium to large size gravel, some
	NA	0	12-14	11-8-21-19		wood, slag, and rock fragments, dark gray, dry; saturated at 14 to 15 feet.
15	NA	30	14-16	3-6-3-3		SILT, trace clay and rock fragments, greenish gray, dry, slightly plastic, virgin soil
17	NA	50	16-18	1-6-9-13	MW4A-7	GRAVELLY SAND, little silt, yellowish brown, moist, set 8 inch steel casing to 16.5 feet on 12/14/93.
18	NA	40	18-20	4-10-4-5	MW4A-8	CLAY, some silt, trace rock fragments, reddish brown, plastic,

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PROJECT
Revere Smelting & Refining
Wallkill, New York
PA1217-02

Boring No. MW-4A
(MW-4S-R as of 01/16)
Sheet 2 of 2

Date Drilled 12/21/93

Drilling Co. Empire Soil and Investigations
Driller Scott Bray/Craig Conner
ESC Geologist E. Michael Riggins

Boring Location South of MW-4
Ground Elevation NA
TOC Elevation NA

Boring
Method Hollow Stem Augers
Hole Diameter 18"-8"-4"
Inside Diameter 12.25"-4.25"
Total Depth 35.2 feet

Casing/Screen
Type PVC
Diameter 2 inch
Screen Length 10 foot
Screen Slot Size 0.01 inch

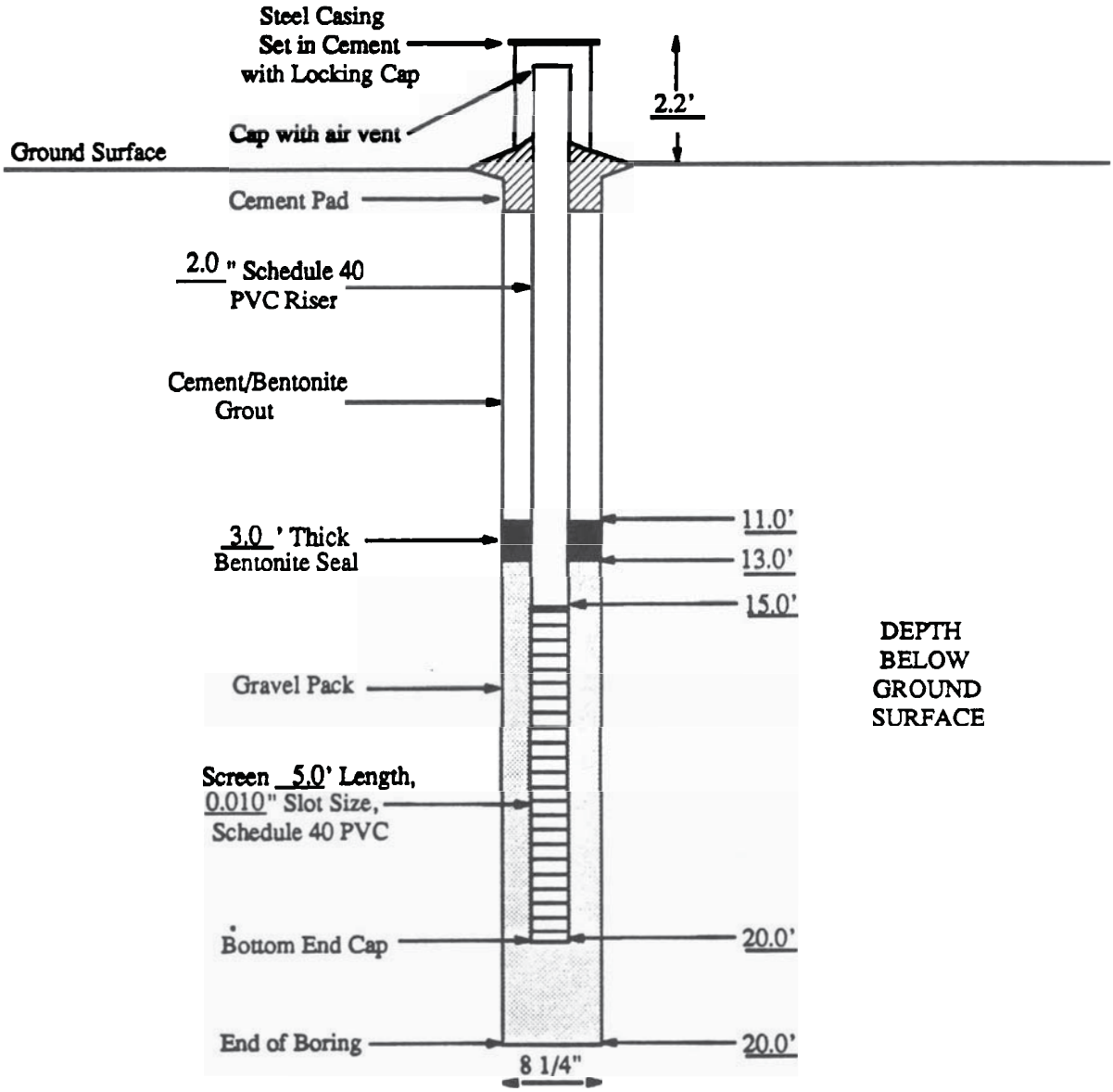
Sampler
Method Split-spoon
Length (ft) 2-foot
Hammer (lb) 140
Fall (in) 30

Depth (ft)	P.I.D. (ppm)	Percent Recovery	Sample Depth (ft)	Blows/6"	Sample Number	Sample Description
18	NA		18-20			CLAY, dry.
20	NA	30	20-22	9-6-9-14		Note: Some rounded gravel, trace
						calcite in tip of sampler, stiff.
22	NA	30	22-24	11-15-15-17	MW4A-8	SILT, some clay, little shale
						fragments, trace fine sand, brown,
						hard, dry.
24	NA	40	24-26	27-36-22-28	MW4A-9	SILT TILL with rock fragments,
						little clay, moist, rock
	NA	70	26-28	21-30-33-60		fragments increase with depth,
	NA	50	28-29	23-100/5"		brown, moist.
29	NA	0	29	100/0"		SHALE, competent, horizontal
	NA		31-35.2		RUN 1	fractures, dark gray, RQD=0.

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 22, 1991



AS-BUILT DIAGRAM FOR WELL MW-5 (MW-5S as of 01/16)

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412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-5 (MW-5S as of 01/16)
Date Drilled: July 22, 1991

Drilling Co.: Environmental Drilling, Inc.
Driller: Greg Pijak
ESC Geologist: E. Michael Riggins

Boring Location: East of facility
Ground Elevation:
TOC Elevation:

Boring		Sampler	
Method:	H.S.A.	Method:	Split-spoon
Hole Diameter:	8.25"	Length Ft.:	2.0
Inside Diameter:	4.25"	Hammer lbs.:	140
Total Depth:	20.0'	Fall ins.:	30

Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-2.0	0	20	MW5-1 0.0-0.5	5/7/6/7	TOPSOIL-SILT-medium to dark brown, little clay, trace rock fragments, FILL
2.0-4.0	0	50	MW5-2 2.0-3.0	50 over 3" 12/16/26	SILT FILL-medium gray, some clay, trace rock & plastic fragments
4.0-4.5	0	80	MW5-3 4.0-4.5	27/42/45/30	SILT FILL-same as above to 4.5'
4.5-6.0					SILT-medium brown to reddish brown, some orange staining, some clay, trace shale & rock fragments, poorly sorted, native soils or TILL (?)
6.0-8.0	0	90	MW5-4 6.0-6.5	20/27/40/43	SILT-same as above, TILL (?)
8.0-10.0	50 at 8.8'	80	MW5-5 8.0-8.5	33/34/34/38	SILT-same as above, increasing shale fragments, micaceous siltstone fragment in spoon tip

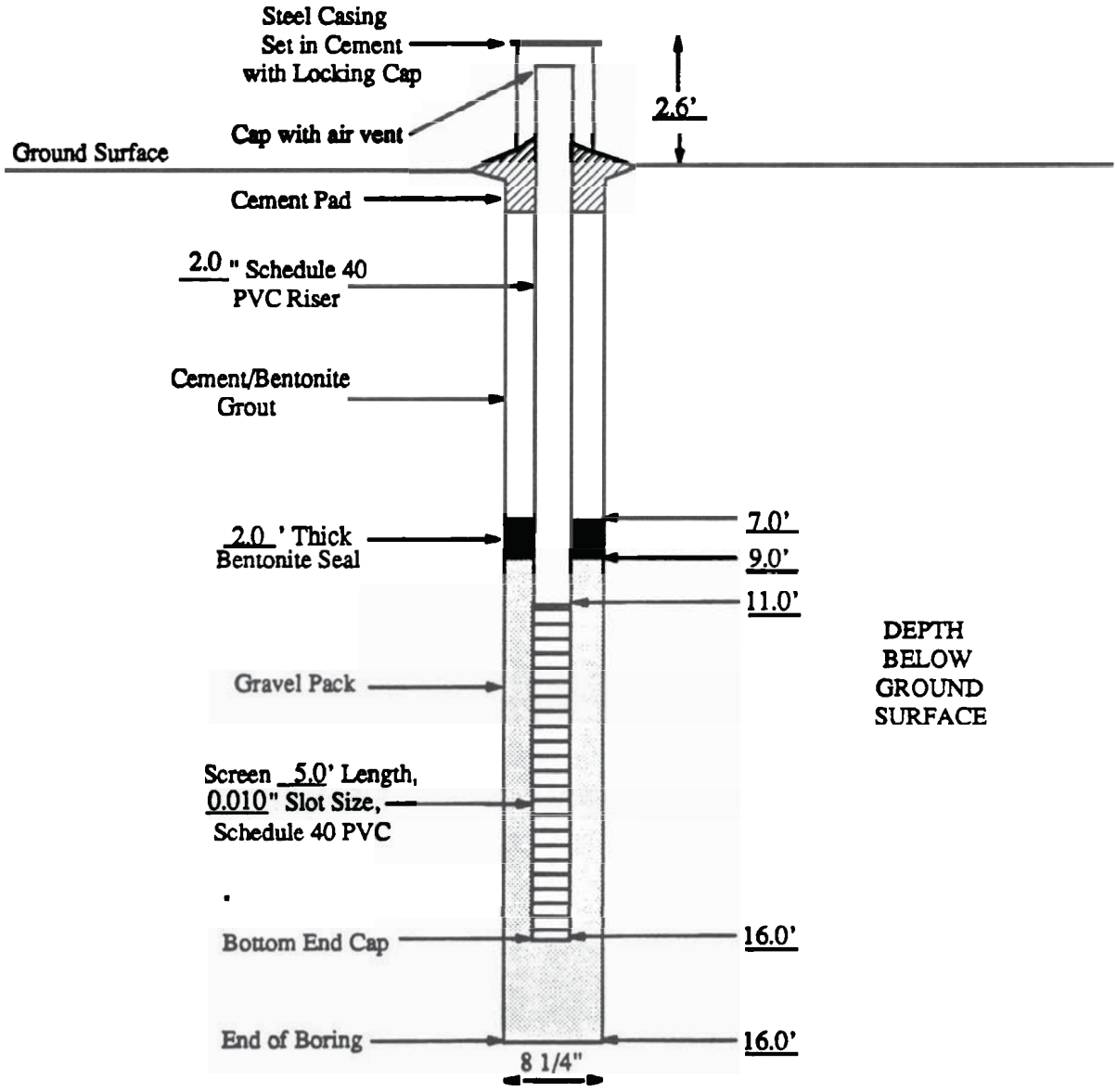
10.0-12.0	30	70	MW5-6 10.0-10.5	19/18/16/16	SILT-same as above, changing color to dark brown
12.0-14.0	0	80	MW5-7 12.0-12.5	33/18/18/29	SILT-same as above, dark brown color, two nails in split-spoon tip
14.0-16.0	0	80	MW5-8 14.0-14.5	8/41/19/25	SILT-same as above, damp at 15.0'
16.0-17.3	0	85	MW5-9 16.0-16.5	60/67/ 50 over 3"	SILT-same as above, shale fragment in spoon tip, saturated at 16.0'
18.0-20.0	0	80		14/33/31/42	Weathered shale fragment to 18.3', SILT TILL-same as above, dry

NOTE: Groundwater encountered at 16.0'

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 29, 1991



AS-BUILT DIAGRAM FOR WELL MW-6A (MW-6S as of 01/16)

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412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-6A (MW-6S as of 01/16)
Date Drilled: July 29, 1991

Drilling Co.: Environmental Drilling, Inc.
Driller: Greg Pijak
ESC Geologist: E. Michael Riggins

Boring Location: East of facility
Ground Elevation:
TOC Elevation:

Boring		Sampler	
Method:	H.S.A.	Method:	Split-spoon
Hole Diameter:	8.25"	Length Ft.:	2.0
Inside Diameter:	4.25"	Hammer lbs.:	140
Total Depth:	16.0'	Fall ins.:	30

Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-2.0	0	60	MW6A-1 0.0-1.0	10/20/22/20	SILT FILL-light brown, little clay & rock fragments, trace sand & slag
2.0-3.5	0	100	MW6A-2 2.0-3.0	9/12/25/28	CLAY-bluish to greenish gray, little silt, trace rock fragments, black organic (peat) material
3.5-4.0					SILT-yellowish brown, little clay, trace sand & rock fragments, poorly sorted, TILL
4.0-5.5	0	80	MW6A-3 4.0-5.0	26/26/30/40	SILT TILL-same as above to 5.5'
5.5-6.0					SILT TILL-medium brown, little clay, trace sand & rock fragments
6.0-6.5	0	10		50 over 5"	SANDSTONE FRAGMENT in spoon tip
8.0-9.0		0		25/50 over 5"	No recovery-pushing cobble
10.0-10.2		5		50 over 3"	Dark gray SILTSTONE fragment in spoon tip

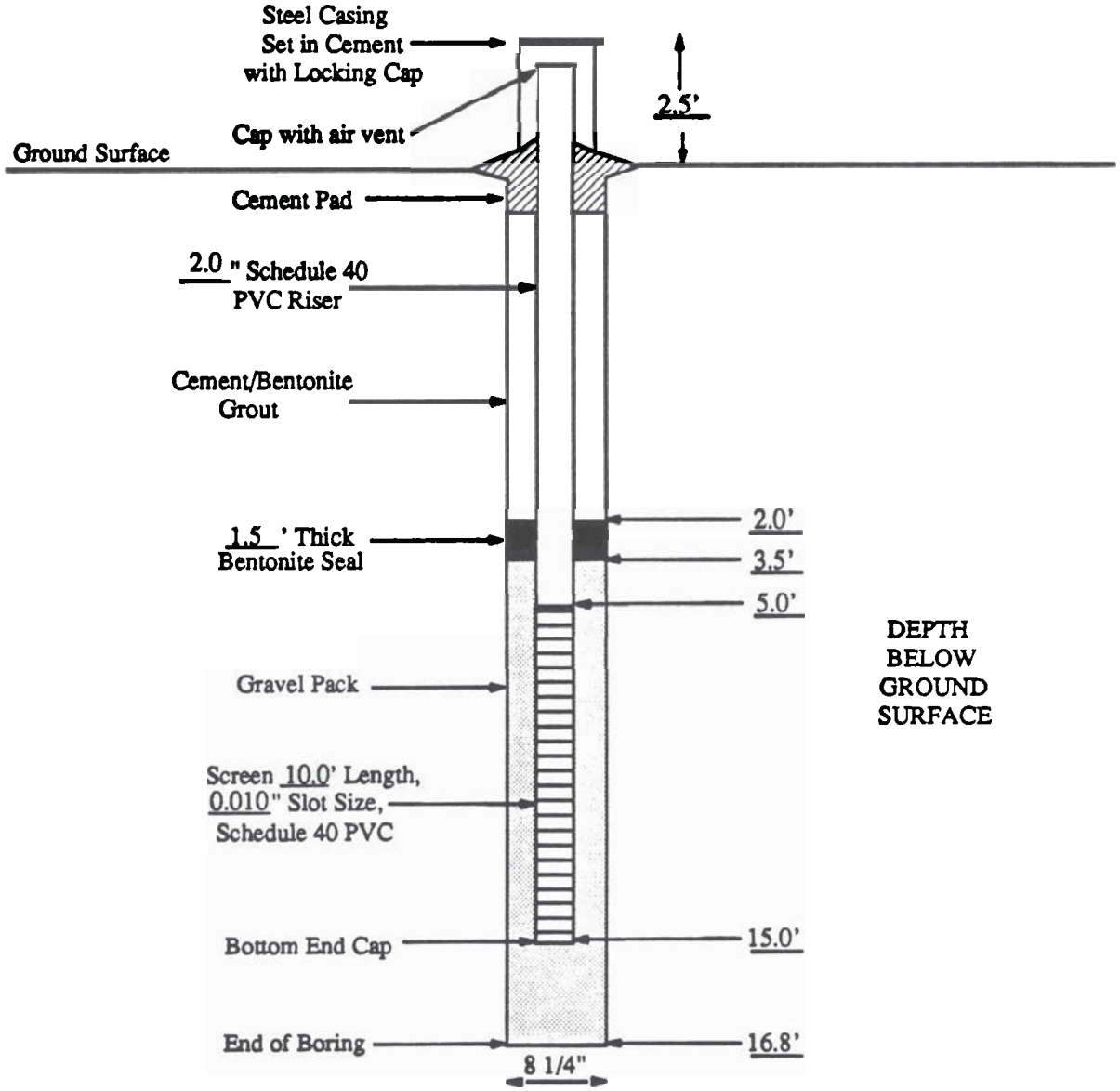
12.0-12.1	10	50 over 1"	SAND & GRAVEL-poor recovery, split-spoon wet, saturated material
12.1-16.0			Material augered, saturated

NOTE: Groundwater encountered at 12.0'.

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 11, 1991



AS-BUILT DIAGRAM FOR WELL MW-7 (MW-7S as of 01/16)

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412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-7 (MW-7S as of 01/16)
Date Drilled: July 10, 1991

Drilling Co.:	Environmental Drilling, Inc.
Driller:	Greg Pijak
ESC Geologist:	E. Michael Riggins

Boring Location: North of facility
Ground Elevation:
TOC Elevation:

Boring	
Method:	H.S.A.
Hole Diameter:	8.25"
Inside Diameter:	4.25"
Total Depth:	16.9'

Sampler	
Method:	Split-spoon
Length Ft.:	2.0
Hammer lbs.:	140
Fall ins.:	30

Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-1.5	0	50	MW7-1 0.0-0.5	4/8/5	TOPSOIL-SILT-medium grayish brown, organic material, trace sand & clay, yellowish brown mottles, wet
1.5-2.5	0	85	MW7-2 2.0-2.5	5/8/12/23	CLAY-yellowish brown, some silt, root structures, mottled
2.5-3.5					SILT-bluish gray, some clay, little sand, trace rock fragments, yellowish brown mottles in upper 0.5'
3.5-5.5	0	85	MW7-3 4.0-4.5	20/23/28/40	SILT TILL-medium grayish brown, some clay, little sand & rock fragments, trace rounded gravel
5.5-7.5	0	60	MW7-4 6.0-6.5	23/17/18/24	SILT TILL-dark bluish gray, trace clay & rock fragments, saturated at 7.0'
8.0-10.0	0	70	MW7-5 8.0-8.5	6/35/23/25	SILT TILL-dark bluish gray, little sand & rock fragments, saturated
10.0-12.0		40		5/13/17/16	SILT TILL-same as above, gravel sized rock fragments

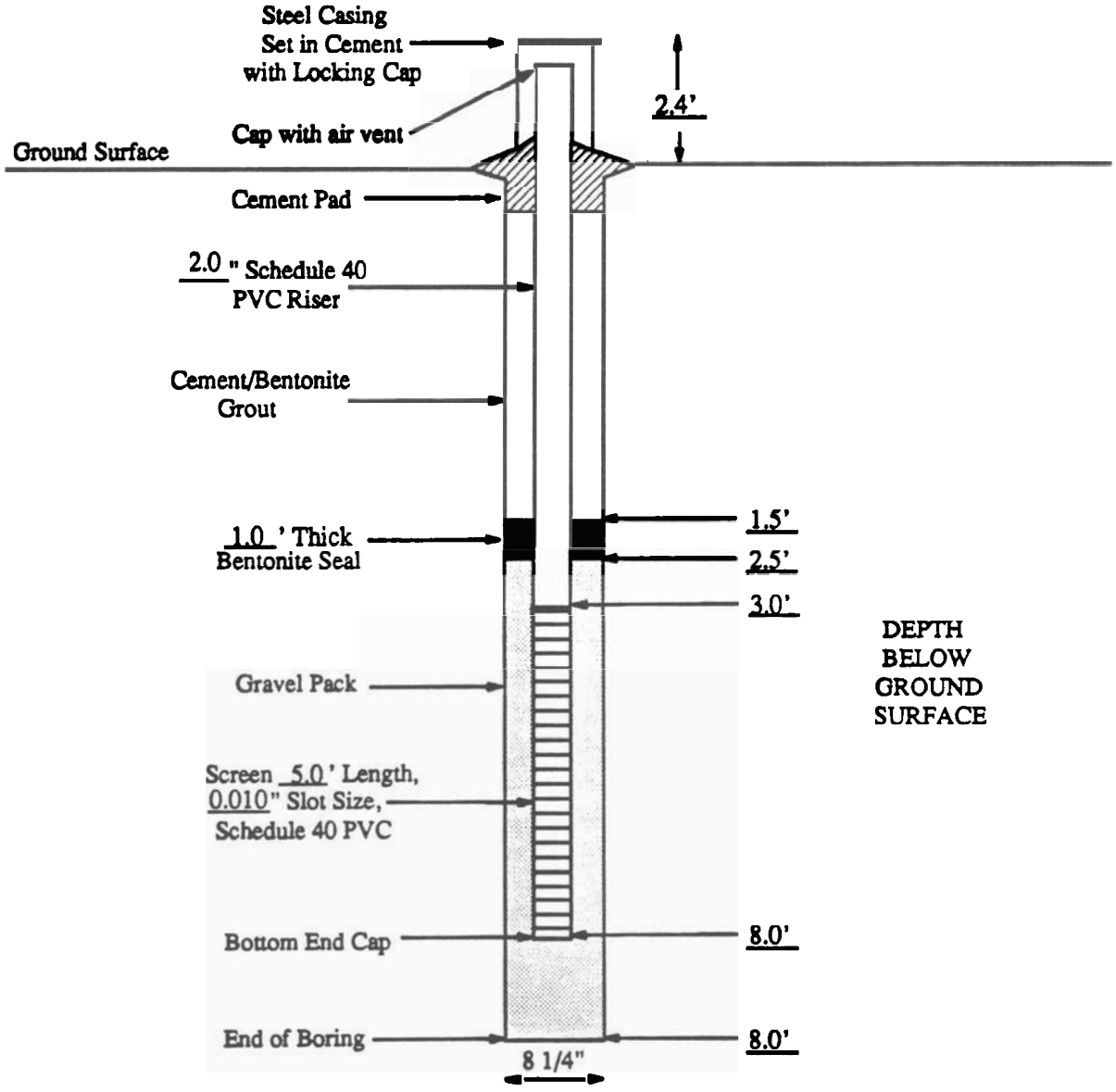
12.0-12.7	40	5/50 over 3"	SILT TILL-same as above
15.0-16.9	20	51/100 over 5"	SILT TILL-same as above, gravel sized fraction has increased

NOTE: Groundwater encountered at 7.0'.

SITE NAME: Revere Smelting & Refining Corporation

LOCATION: Wallkill, New York

DATE: July 29,1991



AS-BUILT DIAGRAM FOR WELL MW-8 (MW-8S as of 01/16)

ESC

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412-787-5100

PROJECT: Revere Smelting & Refining Corporation
Wallkill, New York
PA641-02

Environmental Strategies Corporation
Four Penn Center West, Suite 315
Pittsburgh, PA 15276

Boring No.: MW-8 (MW-8S as of 01/16)
Date Drilled: July 29, 1991

Drilling Co.: Environmental Drilling, Inc.
Driller: Greg Pijak
ESC Geologist: E. Michael Riggins

Boring Location: North of facility
Ground Elevation:
TOC Elevation:

Boring		Sampler	
Method:	H.S.A.	Method:	Split-spoon
Hole Diameter:	8.25"	Length Ft.:	2.0
Inside Diameter:	4.25"	Hammer lbs.:	140
Total Depth:	8.0'	Fall ins.:	30

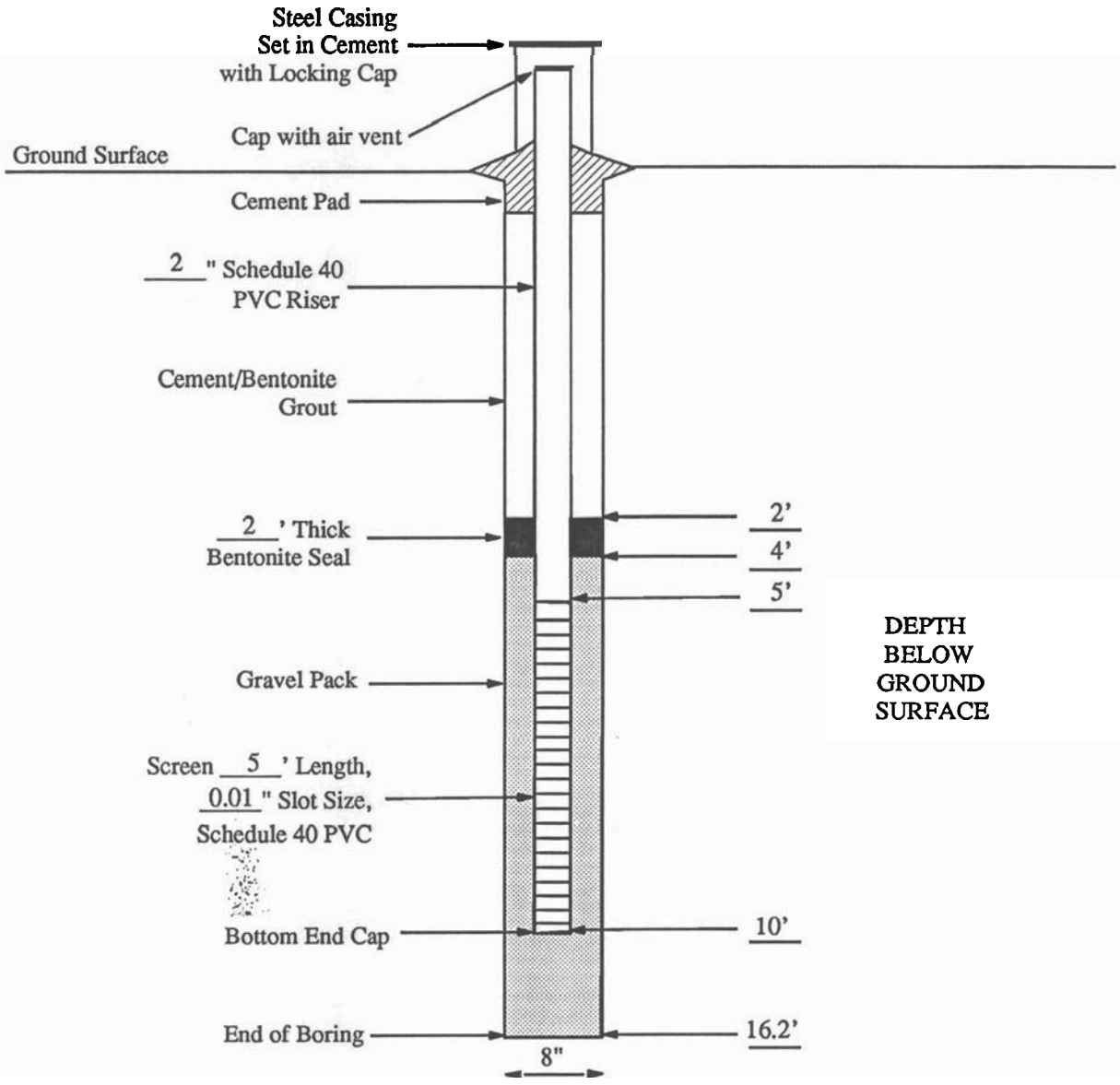
Depth (ft)	PID (ppm)	Percent Rec.	Sample Depth (ft)	Blows/6"	Sample Description
0.0-0.5	0	50	MW8-1 0.0-0.5	2/6/8/14	TOPSOIL-SILT-dark brown, little sand, trace clay, root zone
0.5-2.0					SILT-yellowish brown, some fine sand, trace clay & rock fragments, mottled
2.0-4.0	0	100	MW8-2 2.0-3.0	13/14/11/12	SILT-yellowish brown, little fine grained, gray sand, little clay, trace rock fragments, saturated at 3.5'
4.0-5.0	0	80	MW8-3 4.0-5.0	10/14/18/16	SAND-yellowish brown, some silt, trace rock fragments, grading into gray SAND
5.0-6.0					SAND-dark gray to gray, fine to medium grained, little rock fragments, trace silt, saturated
6.0-7.5	0	100		20/19/15/15	SAND-same as above to 7.5'
7.5-8.0					SAND & GRAVEL & ROCK FRAGMENTS-saturated material

NOTE: Groundwater encountered at 3.5'

SITE NAME: Revere Smelting & Refining

LOCATION: Wallkill, New York

DATE: December 20, 1993



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AS-BUILT DIAGRAM FOR WELL MW-9
(MW-9S as of 01/16)

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BORING LOG
Environmental Strategies Corporation
Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York
PA1217-02

Boring No. MW-9
(MW-9S as of 01/16)
Sheet 1 of 1

Date Drilled 12/13/93

Drilling Co. Empire Soil and Investigations
Driller Glen Stevens
ESC Geologist Patrick Peterson

Boring Location Near wastewater treatment plant
Ground Elevation
TOC Elevation

Boring
Method Hollow Stem Augers
Hole Diameter 8-inch
Inside Diameter 4.25-inch
Total Depth 16.2 feet

Casing/Screen
Type PVC
Diameter 2-inch
Screen Length 5-foot
Screen Slot Size 0.01-inch

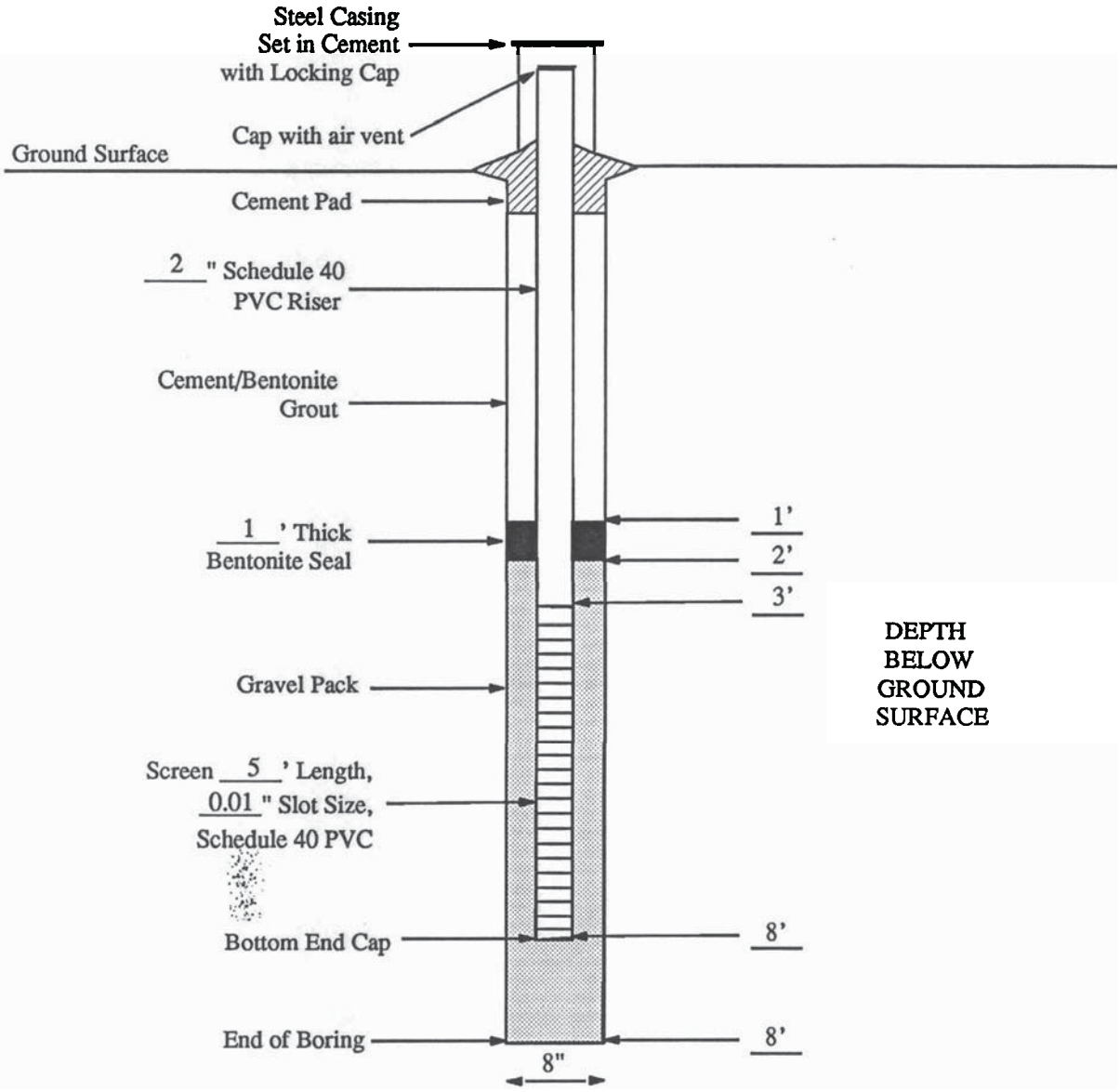
Sampler
Method Split-spoon
Length (ft) 2-foot
Hammer (lb) 140
Fall (in) 30

Depth (ft)	P.I.D. (ppm)	Percent Recovery	Sample Depth (ft)	Blows/6"	Sample Number	Sample Description
0	N/A	N/A	N/A	N/A	N/A	Concrete with re-bar, 1.8'
1.8	N/A	75	2-4	5-14-12-13	MW9-1	GRAVEL, some sand and silt, Fill.
3.5	N/A	75	4-6	12-24-24-26	MW9-2	SILT, some clay, yellowish some mottling, non-plastic, moist.
6	N/A	75	6-8	14-14-15-13	MW9-3	GRAVELLY SILT, some clay and sand, some mottling, rounded medium gravel, non-plastic, natural soil.
	N/A	75	8-10	12-18-14-14	MW9-4	Same as above, wet
10	N/A	100	10-12	17-28-30-24	MW9-5	SILT, some fine sand and fine round gravel, non-plastic, yellowish brown, moist, natural soil.
12	N/A	75	12-14	13-21-22-27	MW9-6	SILTY FINE SAND, some round fine gravel, trace clay, yellowish brown, dense, moist.
	N/A	75	14-16	26-33-50-100/3"	MW9-7	Same as above, with cobble size shale fragments, moist.
16	N/A	0	16-16.2	100/2"		SHALE, dark gray, competent, auger refusal at 16.2 feet.

SITE NAME: Revere Smelting & Refining

LOCATION: Wallkill, New York

DATE: December 10, 1993



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AS-BUILT DIAGRAM FOR WELL MW-10
(MW-10S as of 01/16)

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BORING LOG
Environmental Strategies Corporation
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PROJECT
Revere Smelting & Refining
Wallkill, New York
PA1217-02

Boring No. MW-10
(MW-10S as of 01/16)
Sheet 1 of 1
Date Drilled 12/10/93

Drilling Co. Empire Soil and Investigations
Driller Glen Stevens
ESC Geologist Patrick Peterson

Boring Location Near culvert by R.R. tracks
Ground Elevation
TOC Elevation

Boring
Method Hollow Stem Augers
Hole Diameter 8-inch
Inside Diameter 4.25-inch
Total Depth 8-feet

Casing/Screen
Type PVC
Diameter 2-inch
Screen Length 5-foot
Screen Slot Size 0.01-inch

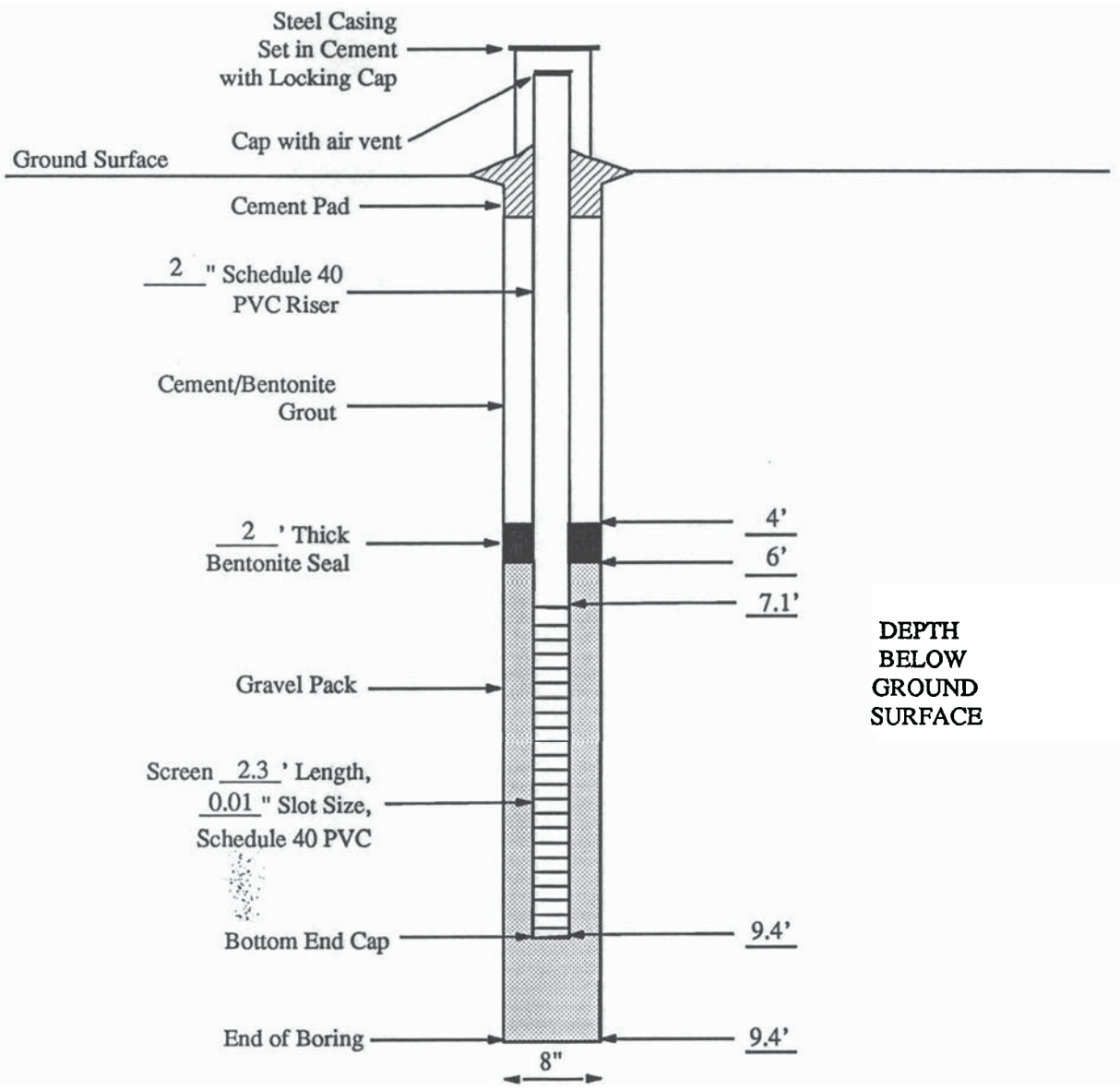
Sampler
Method Split-spoon
Length (ft) 2-foot
Hammer (lb) 140
Fall (in) 30

Depth (ft)	P.I.D. (ppm)	Percent Recovery	Sample Depth (ft)	Blows/6"	Sample Number	Sample Description
0	N/A	75	0-2	3-4-5-7	MW10-1	TOPSOIL, brown, fine sand, trace silt and gravel, moist, Fill.
1						SILT, some sand and fine to medium gravel, trace clay, non-plastic, brown, moist, Fill.
2	N/A	30	2-4	7-5-6-4		GRAVELLY SILT, some fine to coarse sand, saturated, Fill.
3.8	N/A	50	4-6	21-51-49-15		GRAVELLY SAND, dark gray, some anthropogenic material, little fines, saturated, Fill,
7.5	N/A	50	6-8	53-7-9-8		CLAY, some roots, black, trace silt slightly fat, organic rich odor, natural topsoil.
						Note: Water measured at 2 feet.

SITE NAME: Revere Smelting & Refining

LOCATION: Wallkill, New York

DATE: December 15, 1993



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AS-BUILT DIAGRAM FOR WELL MW-11
(MW-11S as of 01/16)

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BORING LOG
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Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York

Boring No. MW-11
(MW-11S as of 01/16)
Sheet 1 of 1
Date Drilled 12/15/93

Drilling Co. Empire Soil and Investigation
Driller Glen Stevens
ESC Geologist Patrick T. Peterson

Boring Location Near Ballard Road
Ground Elevation NA
TOC Elevation NA

Boring
Method Hollow-Stem Auger
Hole Diameter 8.00"
Inside Diameter 4.25"
Total Depth 9.2 feet

Casing/Screen
Type PVC
Diameter 2-inch
Screen Length 2.3 feet
Screen Slot Size 0.010"

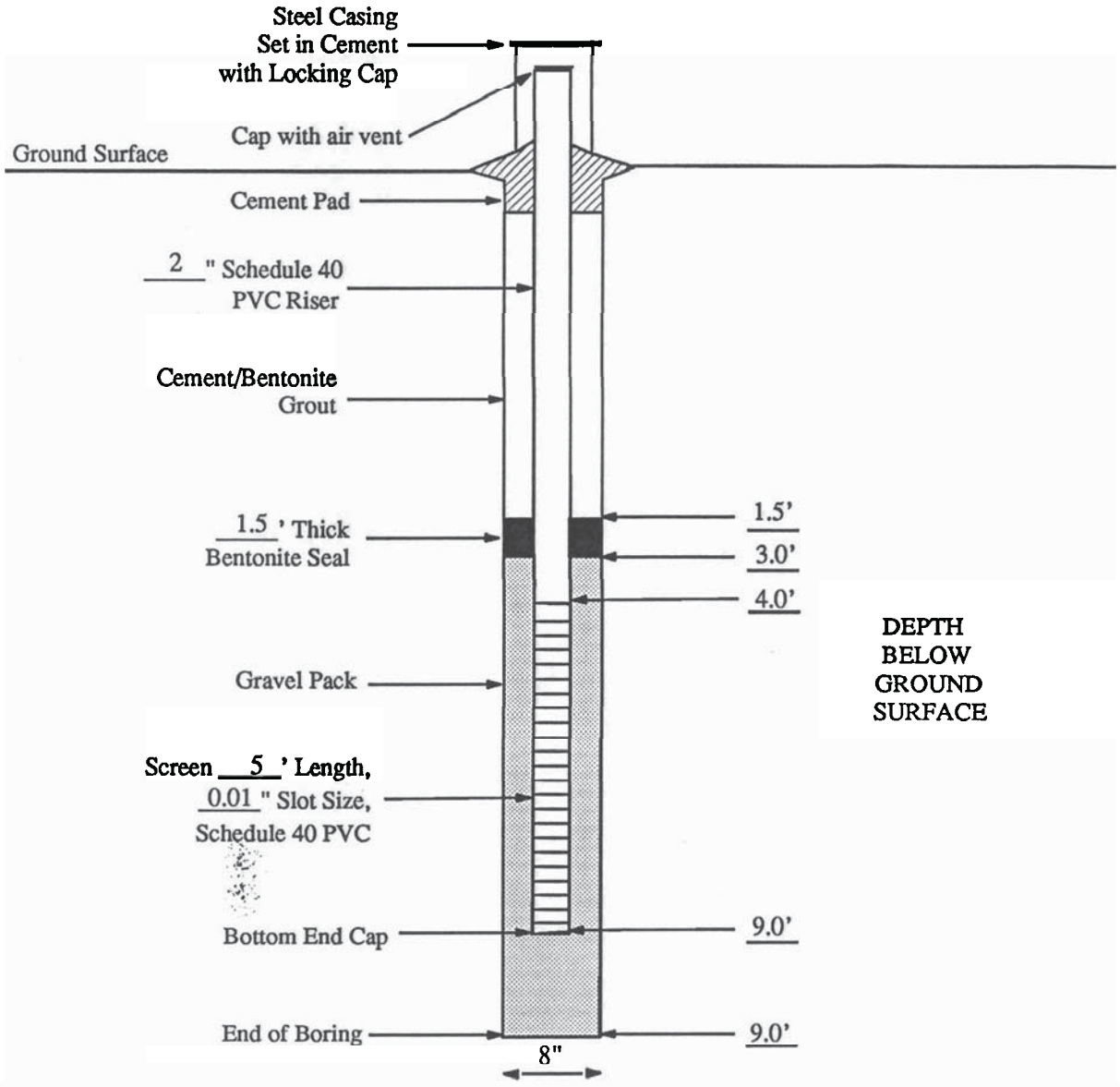
Sampler
Method Split-spoon
Length (ft) 2.0'
Hammer (lb) 140
Fall (in) 30

Depth	P.I.D. (ppm)	% Recov	Sample Depth	Blows/6"	Sample Description
0	NA	75	0-2	3-12-12-9	TOPSOIL, silt, some clay and
			MW11-1		gravel, trace sand, slightly
					plastic, brown, moist
2	NA	100	2-4	9-15-22-48	SILT, weathered shale fragments,
			MW11-2		trace clay, brown and gray, dry,
					natural soil, non-plastic
4	NA	100	4-5.5	18-59-104	WEATHERED SHALE, gray and brown,
			MW11-3		some red oxidized iron staining
6	NA	75	6-8	30-26-18-18	Same as above, wet at 8 feet
			MW11-4		
8	NA	75	8-9.2	21-50-100/2"	SHALE, dark gray, competent, some
					fracturing, saturated.
					Auger refusal at 9.2 feet

SITE NAME: Revere Smelting & Refining

LOCATION: Wallkill, New York

DATE: December 10, 1993



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AS-BUILT DIAGRAM FOR WELL MW-12
(MW-12S as of 01/16)

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BORING LOG
Environmental Strategies Corporation
Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York
PA1217-02

Boring No. MW-12
(MW-12S as of 01/16)
Sheet 1 of 1
Date Drilled 12/10/93

Drilling Co. Empire Soil and Investigations
Driller Glen Stevens
ESC Geologist Patrick Peterson

Boring Location Near pond and R.R. tracks
Ground Elevation .
TOC Elevation

Boring
Method Hollow Stem Augers
Hole Diameter 8-inch
Inside Diameter 4.25-inch
Total Depth 9.7-feet

Casing/Screen
Type PVC
Diameter 2-inch
Screen Length 5-foot
Screen Slot Size 0.01-inch

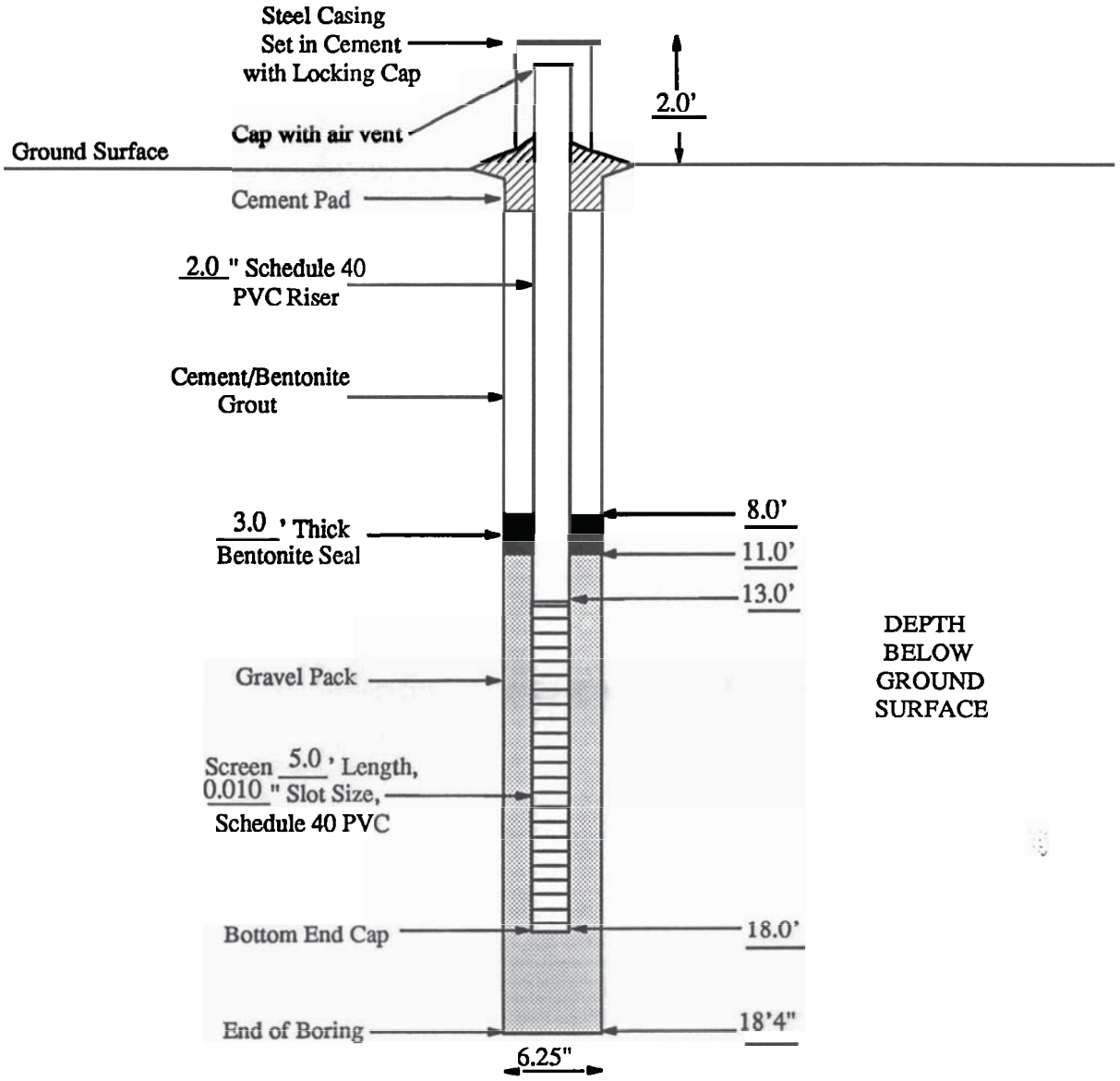
Sampler
Method Split-spoon
Length (ft) 2-foot
Hammer (lb) 140
Fall (in) 30

Depth (ft)	P.I.D. (ppm)	Percent Recovery	Sample Depth (ft)	Blows/6"	Sample Number	Sample Description
0	N/A	75	0-2	1-3-6-10	MW12-1	TOPSOIL, silt, brown, trace sand and gravel, moist.
0.4						CLAY, some silt, little subangular gravel and sand, moderately plastic, brown, gray mottling, no bedding structure, Fill.
2	N/A	60	2-4	3-6-7-12	MW12-2	FINE GRAVELLY CLAY, some silt, low to high plasticity, brown, some roots and asphalt, bluish gray mottling, stiff, moist, Fill.
3.8	N/A	80	4-6	5-4-5-5	MW12-3	CLAY, some silt and organics, dark gray, little sand and fine to medium round gravel, slight to moderate plasticity, moist, natural soil.
6.2	N/A	100	6-8	4-6-8-12	MW12-4	CLAY, light brown, fat clay, little sand, some round fine gravel, moist to well, stiff, natural soil. Increase in silt with depth and little reddish brown mottling.
9.7	N/A	100	8-10	4-2-12-28		GRAVELLY SILT, some sand and fine to medium round gravel, slightly oxidized, dark brown, stiff, wet, Till at 9.7 feet.
						Note: Water measured at 4.2 feet.

SITE NAME: RSR/Wallkill, New York

LOCATION: MW-1

DATE: July 28, 1994



ENVIRONMENTAL STRATEGIES CORPORATION
Four Penn Center West • Suite 315
Pittsburgh, Pennsylvania 15276
(412) 787-5100

AS-BUILT DIAGRAM FOR WELL MW-13
(MW-13S as of 01/16)

BORING LOG
Environmental Strategies Corporation
Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York

Boring No. MW-13 (MW-13S as of 01/16)
Sheet 1 of 2
Date Drilled 7/27-8/94

Drilling Co. Parrat Wolff, Inc.
Driller Glen Lansing\ Arnold Chapel
ESC Geologist E. Michael Riggins

Boring Location East of unnamed tributary
Ground Elevation
TOC Elevation

Boring
Method Hollow-Stem Auger
Hole Diameter 6.25"
Inside Diameter 4.25"
Total Depth 18.4'

Casing/Screen
Type Polyvinyl Chloride
Diameter 2.0"
Screen Length 5.0'
Screen Slot Size 0.010"

Sampler
Method Split-spoon
Length (ft) 2.0
Hammer (lb) 140
Fall (in) 30

Depth	P.I.D. (ppm)	% Recov	Sample Depth	Blows/6"	Sample Description
0.0 - 2.0'	NS	60	0.3 - 2.0'	5/7/6/25	0.0 - 0.3' - Organics decaying
			MW13-1		leaves, and roots
					0.3 - 2.0'- SILT - light yellowish
					brown, little gravel, trace clay,
					dry, non-plastic
2.0 - 4.0'	NS	80	3.0 - 4.0'	12/32/27/35	Same as above to 2.5', little to
			MW13-2		some sandstone rock fragments from
					2.5 - 3.0', then SILT - yellowish
					gray with orange mottling, little
					clay, trace rock fragments, non-
					plastic, dry
4.0 -6.0'	NS	0		50/4"	No recovery- sandstone fragment in
					spoon tip
6.0 - 8.0'	NS	75	7.0 - 8.0'	25/14/11/13	SILT TILL - yellowish brown, trace
			MW13-3		clay and sand, some rock
					fragments, damp at 7.5'
8.0 - 10.0'	NS	90	9.0 -10.0'	16/33/22/46	SILT TILL - and rock fragments,
			MW13-4		trace clay and sand, dry
10.0 -11.0'	NS	100	10.0 - 11.0'	27/70	Rock fragment & SILT TILL - trace
			MW13-5		clay and sand, weathered and
					fresh, gray shale fragments,
					dry
12.0 -14.0'	NS	60	12.0 - 14.0'	20/19/18/18	SILT TILL - dark yellowish brown
			MW13-6		some gray shale fragments, trace
					clay and sand, damp at 13.5'

BORING LOG
Environmental Strategies Corporation
Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York

Boring No. MW-13
(MW-13S as of 01/16)
Sheet 2 of 2

Date Drilled 7/27-28/94

Drilling Co. Parrat Wolff, Inc.
Driller Glen Lansing\ Arnold Chapel
ESC Geologist E. Michael Riggins

Boring Location East of unnamed tributary
Ground Elevation
TOC Elevation

Boring
Method Hollow-Stem Auger
Hole Diameter 6.25"
Inside Diameter 4.25"
Total Depth 18.4'

Casing/Screen
Type Polyvinyl Chloride
Diameter 2.0"
Screen Length 5.0'
Screen Slot Size 0.010"

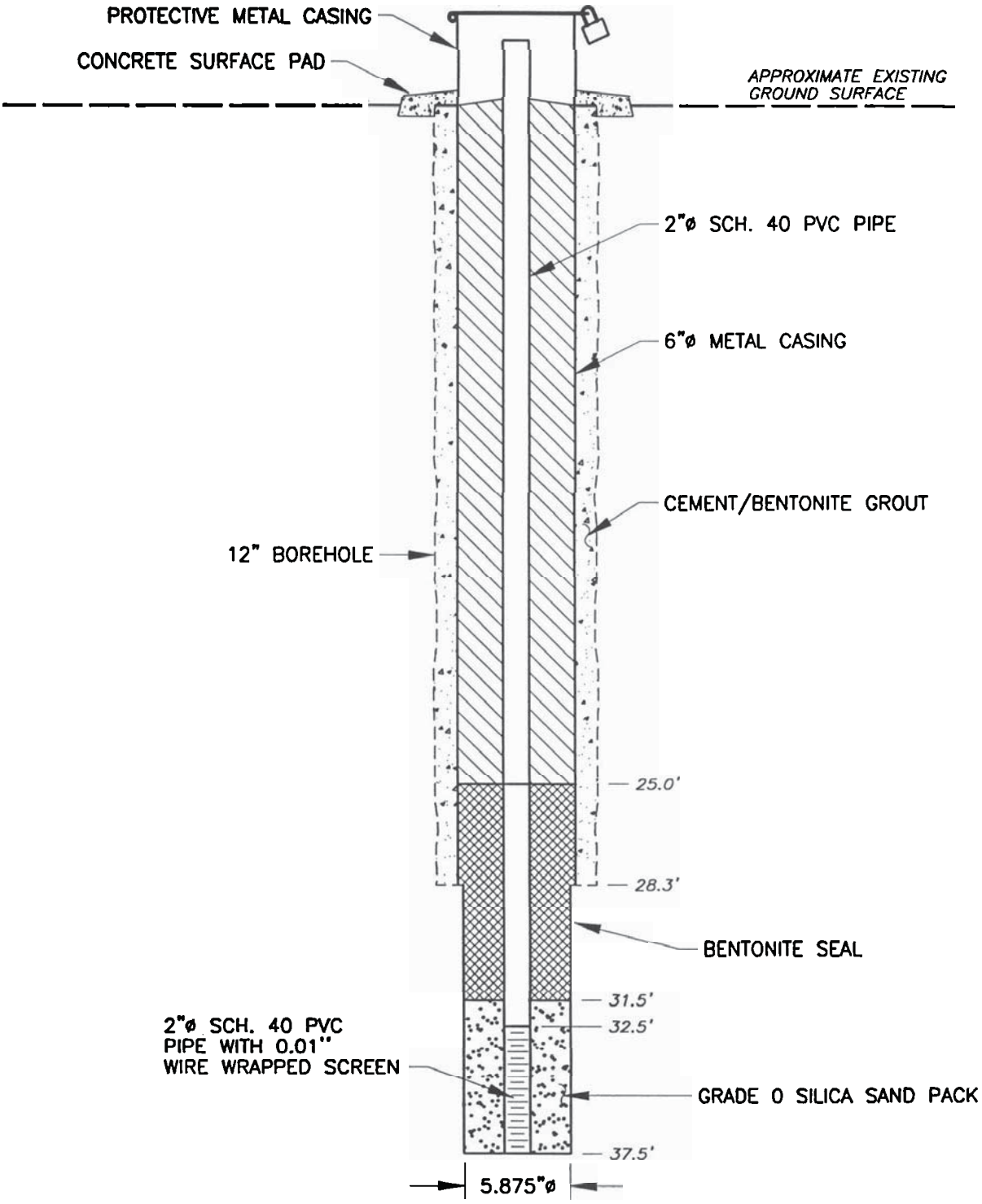
Sampler
Method Split-spoon
Length (ft) 2.0
Hammer (lb) 140
Fall (in) 30

Depth	P.I.D. (ppm)	% Recov	Sample Depth	Blows/6"	Sample Description
14.0 -16.0'	NS	75	14.0 -16.0'	7/29/46/36	SILT TILL - dark yellowish gray,
			MW13-7		sandstone fragment in spoon tip,
					trace gray shale fragments, little
					sand and clay, damp
16.0-18.0'	NS	80	16.0-18.0'	30/42/50/50/4"	SILT TILL - dark bluish gray,
			MW13-8		dense, little clay, trace rock
					fragments and sand, damp to wet
18.0-20.0'	NS	60	18.0-20.0'	27/33/36/38	SILT TILL - dark bluish gray to
					yellowish gray, little sand, trace
					clay and gray shale fragments,
					damp

Drawing Number: 213471-A1

Checked: Approved:

Drawn By: TMB 12/3/97



MW-13B (MW-13D as of 01/16)

NOT TO SCALE

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ESC Environmental Strategies Corporation Four Penn Center West, Suite 315 Pittsburgh, Pennsylvania 15276 (412) 787-5100	Figure "AS-BUILT" MONITORING WELL DIAGRAM FOR MW-13B	REVERE SMELTING & REFINING CORPORATION MIDDLETOWN, NEW YORK PREPARED FOR RSR CORPORATION DALLAS, TEXAS

BORING LOG	PROJECT	
Environmental Strategies Corporation **Campbells Run Road** **Four Penn Center West, Suite 315** **Pittsburgh, PA 15276**	213471-02 REVERE SMELTING AND REFINING 65 BALLARD RD. MIDDLETOWN, NEW YORK	**Boring Number**: MW-13B **Sheet** 1 **of** 2 (MW-13D as of **Date Drilled**: 6/09/97 to 01/16) 6/12/97

Drilling Company: PARRATT WOLFF, INC.
Driller: JIM HAMMOND and KEVIN WHITE
ESC Geologist: E. MICHAEL RIGGINS

Boring Location: North of Wakefern, South of Rail Line
Ground Elevation: 482.21'
TOC Elevation: 483.82'

BORING
Method: HOLLOW STEM AUGERS/AIR ROTARY
Hole Diameter: 12" / 6"
Inside Diameter: 6"
Total Depth: 37.5'

SAMPLER
Method: SPLIT SPOON SAMPLER/BEDROCK CORE
Length (ft): 2 FEET
Hammer (lb): 140 LBS
Fall (in): 30 INCHES

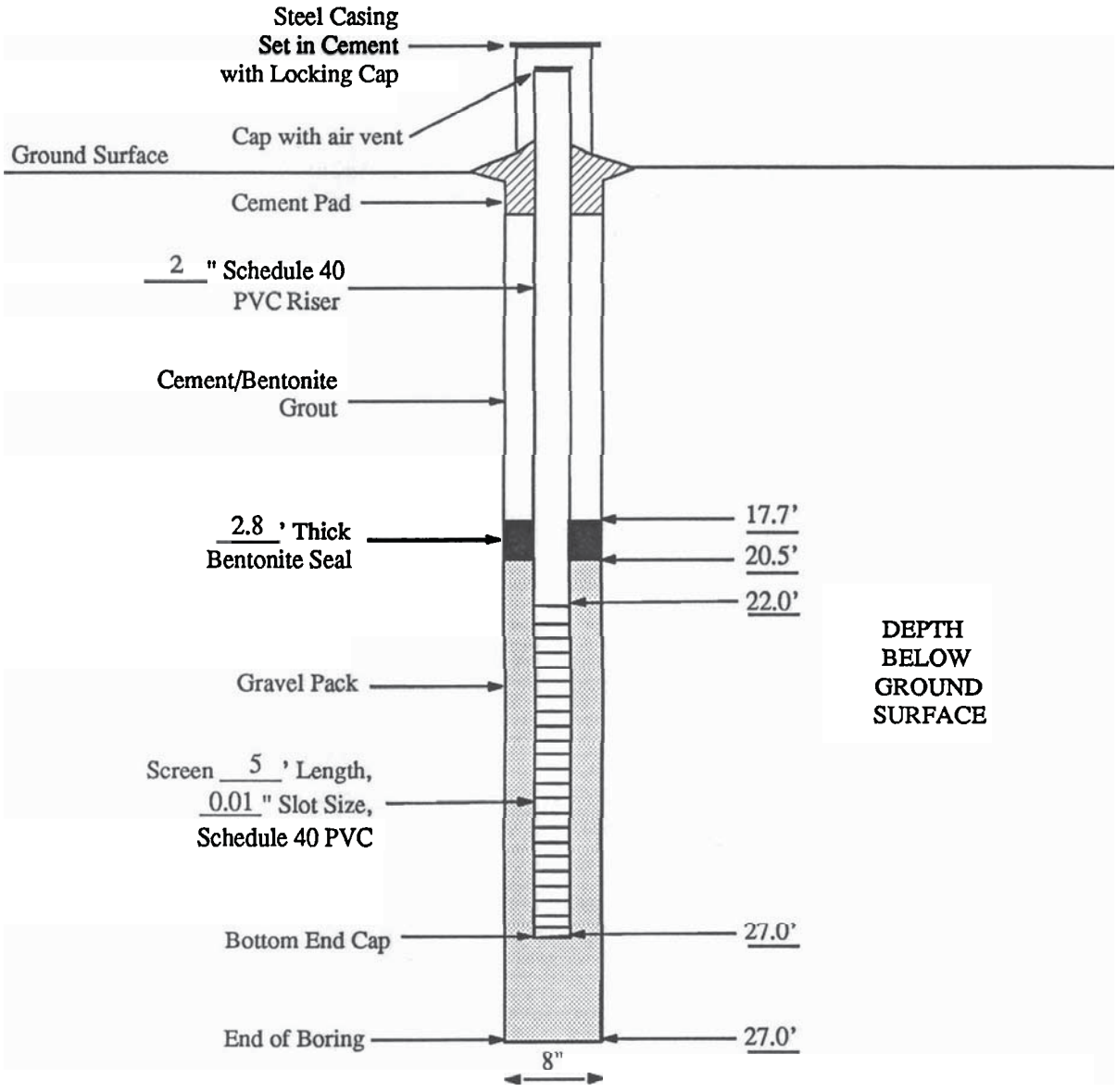
Depth Below Grade (ft)	Samples Collected	Percent Recovery	Sample Depth	Blows/6"	Moisture	Sample Description
0' - 0.4'	MW13B-1 (0'-0.5')	100	0' - 2'	3/5/6/7	Dry	SILT, medium. brown, loamy, non-plastic, trace clay, rock frags., and roots.
0.4' – 2'	MW13B-2 (0.5'-1') MW13B-3 (1'-1.5') MW13B-4 (1.5'-2')					SILT TILL, yellowish brown, non-plastic, trace clay, rock frags., organics to 1.0'.
2' - 4'	MW13B-5 (2'-4')	100	2' - 4'	13/16/19/22	Dry	SILT TILL, light yellowish brown to gray, trace to little clay, rock frags., non-plastic, faint mottling.
4' - 6'	MW13B-6 (4' -6')	100	4' - 6'	14/15/20/27	Damp at 5'	SILT TILL, yellowish to reddish brown to gray, trace sand and clay, little rock frags., slightly plastic.
6' - 8'	MW13B-7 (6'-8')	100	6' - 8'	21/31/25/26	Moist	SILT TILL, same as above, increasing sand content with depth
8' – 10'	MW13B-8 (8'-10)	100	8' - 10'	8/54/26/15	Moist to wet	SILT TILL, same as above to 8.5' then gray shale boulder, Silt Till yellowish to grayish brown, trace sand, clay, little rock frags., slightly plastic.
10' – 12'	MW13B-9 (10'-12')	100	10' - 12'	9/24/26/50	Moist to wet	Same as above, SILT TILL and Rock fragments.
12'-12.6'	MW13B-10 (12'-12.6')	30	12'-12.6'	44/ 50 for 1"		SILT TILL, gray, trace clay, some rock fragments., weathered shale fragments.
12.6' –14'						Augered out to 14.0'.
14' – 16'	MW13B-11 (14'-16')	100	14' - 16'	8/6/14/54	Saturated	SILT TILL, gray, trace clay, little rock fragments., plastic, sticky.
16'- 16.2'		0	16'-16.2'	50 for 3"		No recovery
16.3'-18.5'						Augered out, weathered shale boulder.
18.5'-20'	MW13B-12 (18.5'-20')	70	18.5'-20'	26/53/74	Wet	SILT TILL, dark bluish gray, trace clay, little shale fragments., dark gray shale, hard, plastic.
20' – 22'	MW13B-13 (20'-22')	100	20' - 22'	23/31/44/48		SILT TILL, dark bluish gray to faint yellowish brown, trace sand, clay, and rock frags., plastic, hard, dense.
22' – 24'	MW13B-14 (22'-24')	100	22' - 24'	22/27/30/25		SILT TILL, Same as above, with sand trace to little.
24'- 24.6'		20	24'-24.6'	11/60 for 2"		SHALE, dark gray, weathered.

24.6' – 26'						SHALE, gray to dark gray, weathered.
26' – 28'						SHALE, gray to dark gray, more competent.
28' – 37.5'						SHALE, gray to dark gray
						Bottom of borehole
						G:\wp\files\bcd\midtown\rsrmidt.13b

SITE NAME: Revere Smelting & Refining

LOCATION: Wallkill, New York

DATE: December 14, 1993



ENVIRONMENTAL STRATEGIES CORPORATION
Four Penn Center West • Suite 315
Pittsburgh, Pennsylvania 15276
(412) 787-5100

AS-BUILT DIAGRAM FOR WELL MW-14
(MW-14S as of 01/16)

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BORING LOG
Environmental Strategies Corporation
Four Penn Center West, Ste. 315
Pittsburgh, Pennsylvania 15276

PROJECT
Revere Smelting & Refining
Wallkill, New York
PA1217-02

Boring No. MW-14
(MW-14S as of 01/16)
Sheet 1 of 2

Date Drilled 12/13-14/93

Drilling Co. Empire Soil and Investigations
Driller Glen Stevens
ESC Geologist Patrick Peterson

Boring Location South property line
Ground Elevation .
TOC Elevation

Boring
Method Hollow Stem Augers
Hole Diameter 8-inch
Inside Diameter 4.25-inch
Total Depth 27-feet

Casing/Screen
Type PVC
Diameter 2-inch
Screen Length 5-foot
Screen Slot Size 0.01-inch

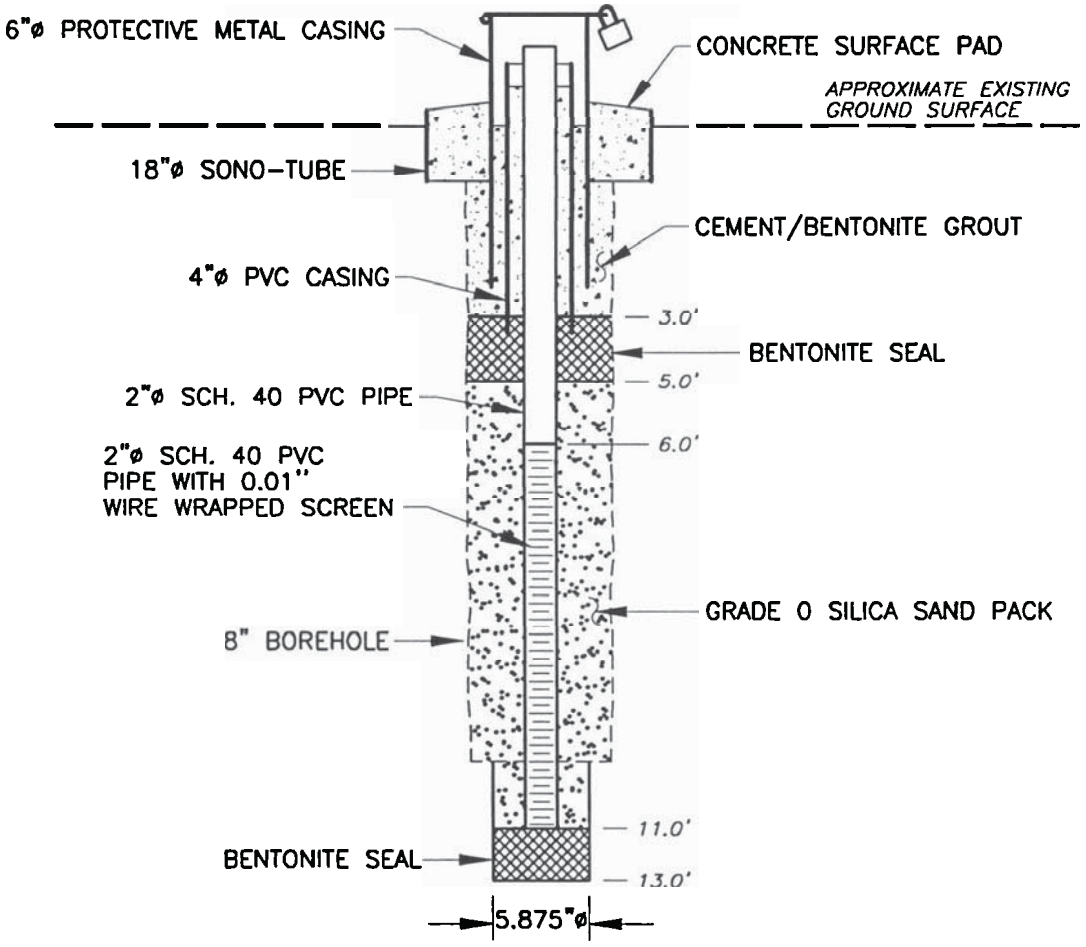
Sampler
Method Split-spoon
Length (ft) 2-foot
Hammer (lb) 140
Fall (in) 30

Depth (ft)	P.I.D. (ppm)	Percent Recovery	Sample Depth (ft)	Blows/6"	Sample Number	Sample Description
0	N/A	50	0-2	7-7-12-14	MW14-1	TOPSOIL, silt with clay, some sand
						and fine gravel, brown, stiff,
						moderately plastic, moist.
1.5						CLAYEY SILT, some sand and shale
						fragments, slight to moderate
						plasticity, brown, moist.
3.7	N/A	75	2-4	5-10-10-11	MW14-2	GRAVELLY SILT, with sand and clay,
	N/A	75	4-6	12-14-17-21	MW14-3	some shale fragments, brown, non-
					MW14-4	plastic, moist, Till.
	N/A	75	6-8	24-36-34-26	MW14-5	
	N/A	75	8-10	24-26-21-17	MW14-6	Note: Color change to gray.
	N/A	75	10-12	16-18-17-13	MW14-7	Note: Some orange brown mottling.
12	N/A	75	12-14	30-26-24-22	MW14-8	GRAVELLY SILT, some sand and clay,
						little shale fragments, non-plastic
						slight mottling, moist, wet zone
						13.8 feet, hard Till.
14	N/A	75	14-16	12-24-26-26	MW14-9	GRAVELLY CLAY, some silt and sand,
	N/A	75	16-18	18-22-24-21	MW14-10	brown/gray, moist, moderately
						plastic, hard, Till.
18	N/A	100	18-20	12-20-18-19	MW14-11	CLAYEY SILT, some round gravel and
						sand, trace shale fragments, moist,
	N/A	90	20-22	16-21-19-18	MW14-12	brown, hard, Till, color change to
						gray at 19.5 feet.
22.5	N/A	80	22-24	17-50-67-97	MW14-13	SILT, with shale fragments, dry,
	N/A	75	24-26	37-60-33-32	MW14-14	hard, little clay, gray.
26	N/A	75	26-27.5	37-58-100/4"		SILT with shale fragments,
						saturated at 26 feet. Auger to 27
						feet.

Drawing Number: 213471-A2

Checked: Approved:

Drawn By: TMB 12/3/97



MW-15A (MW-15S as of 01/16)

NOT TO SCALE

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ENVIRONMENTAL STRATEGIES CORPORATION Four Penn Center West, Suite 315 Pittsburgh, Pennsylvania 15276 (412) 787-5100	Figure "AS-BUILT" MONITORING WELL DIAGRAM FOR MW-15A	REVERE SMELTING & REFINING CORPORATION MIDDLETOWN, NEW YORK PREPARED FOR RSR CORPORATION DALLAS, TEXAS

BORING LOG	PROJECT	
Environmental Strategies Corporation **Campbells Run Road** **Four Penn Center West, Suite 315** **Pittsburgh, PA 15276**	213471-02 REVERE SMELTING AND REFINING 65 BALLARD RD. MIDDLETOWN, NEW YORK	**Boring Number:** MW-15A **Sheet** 1 **of** 1 (MW-15S as of 01/16) **Date Drilled:** 6/10/97

Drilling Company: PARRATT WOLFF, INC.
Driller: JIM HAMMOND and KEVIN WHITE
ESC Geologist: E. MICHAEL RIGGINS

Boring Location: North of Wakefern, South of Rail Line
Ground Elevation: 484.17'
TOC Elevation: 486.46'

BORING
Method: HOLLOW STEM AUGERS/AIR ROTARY
Hole Diameter: 8" / 6"
Inside Diameter: 4.25" /6"
Total Depth: 13'

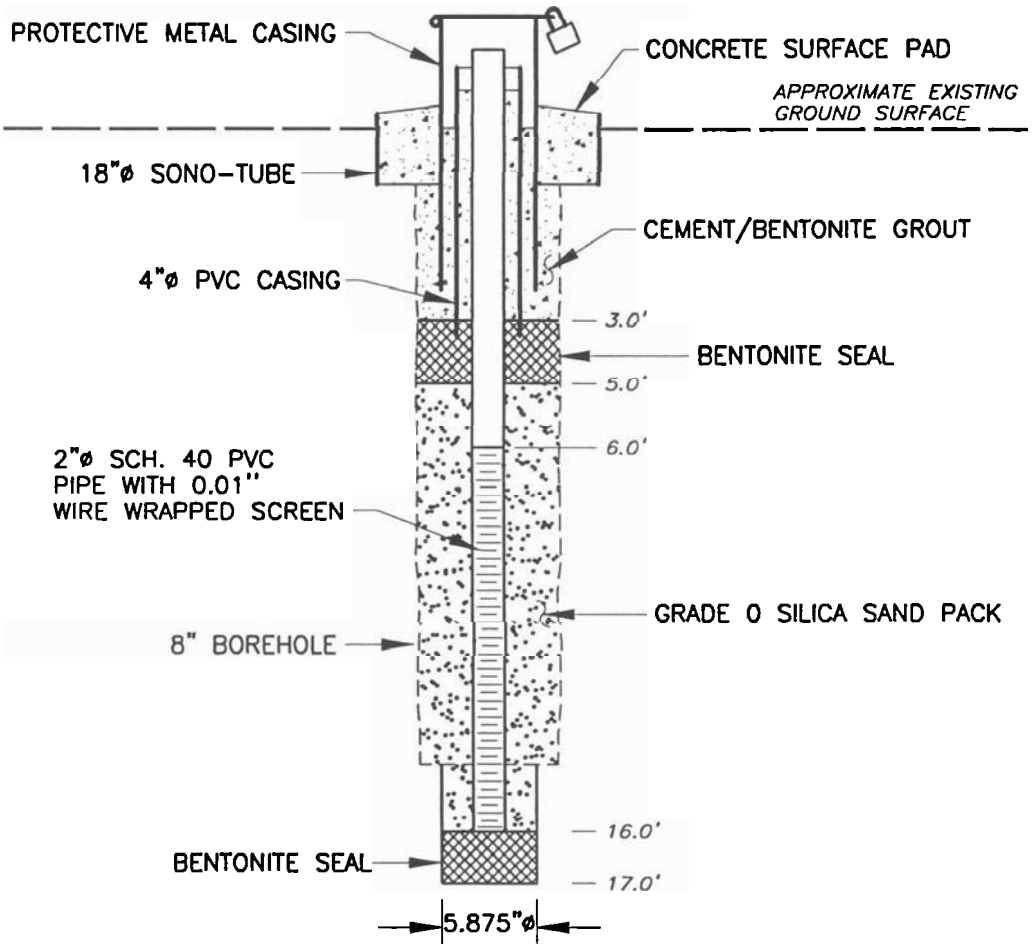
SAMPLER
Method: SPLIT SPOON SAMPLER/BEDROCK CORE
Length (ft): 2 FEET
Hammer (lb): 140 LBS
Fall (in): 30 INCHES

Depth Below Grade (ft)	Samples Collected	Percent Recovery	Sample Depth	Blows/6"	Moisture	Sample Description
0' - 0.5'	MW15A-1 (0'-0.5')	100	0' - 2'	2/2/2/1	Wet	SILT, dark brown, loamy, trace clay, plastic, root zone.
0.5' - 2'	MW15A-2 (0.5'-1') MW15A-3 (1'-1.5') MW15A-4 (1.5'-2')				Wet	SAND and GRAVEL, medium gray, little silt, plastic.
2' - 4'	MW15A-5 (2'-4')	100	2' - 4'	2/3/5/5	Saturated to 3.5'	SAND and GRAVEL, gray, medium to coarse sand and gravel, trace silt and clay, sticky, to 3.5' then SAND, yellowish brown, little silt, trace clay, slightly plastic, fine-grained.
4' - 6'	MW15A-6 (4' - 6')	100	4' - 6'	14/20/18/13	Saturated	SAND, same as above to 4.5' then, SAND and GRAVEL, gray, medium to coarse, trace silt, plastic to slightly plastic.
6' - 8'	MW15A-7 (6'-8')	70	6' - 7.4'	12/22/50 for 4"	Wet	SAND and GRAVEL, same as above to 7.5' , then, SILT TILL, bluish gray to light. yellowish brown, little sand, trace gravel and clay, slightly plastic.
8' - 10'	MW15A-8 (8'-10')	70	8' - 9.5'	37/37/74		SILT TILL, same as above to 10', then weathered shale.
10'- 13'						SHALE, gray to dark gray, weathered on top to competent at bottom.
						Bottom of Borehole
						G:\wp\files\bcd\midtown\rsrmidt.15

Drawing Number: 213471-A3

Checked: Approved:

Drawn By: TMB 12/3/97



MW-16 (MW-16S as of 01/16)

NOT TO SCALE

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ENVIRONMENTAL STRATEGIES CORPORATION Four Penn Center West, Suite 315 Pittsburgh, Pennsylvania 15276 (412) 787-5100	Figure "AS-BUILT" MONITORING WELL DIAGRAM FOR MW-16	REVERE SMELTING & REFINING CORPORATION MIDDLETOWN, NEW YORK PREPARED FOR RSR CORPORATION DALLAS, TEXAS

BORING LOG	PROJECT	
Environmental Strategies Corporation **Campbells Run Road** **Four Penn Center West, Suite 315** **Pittsburgh, PA 15276**	213471-02 REVERE SMELTING AND REFINING 65 BALLARD RD. MIDDLETOWN, NEW YORK	**Boring Number:** MW-16 **Sheet** 1 **of** 1 (MW-16S as of **Date Drilled:** 6/03/97 to 01/16) 6/04/97

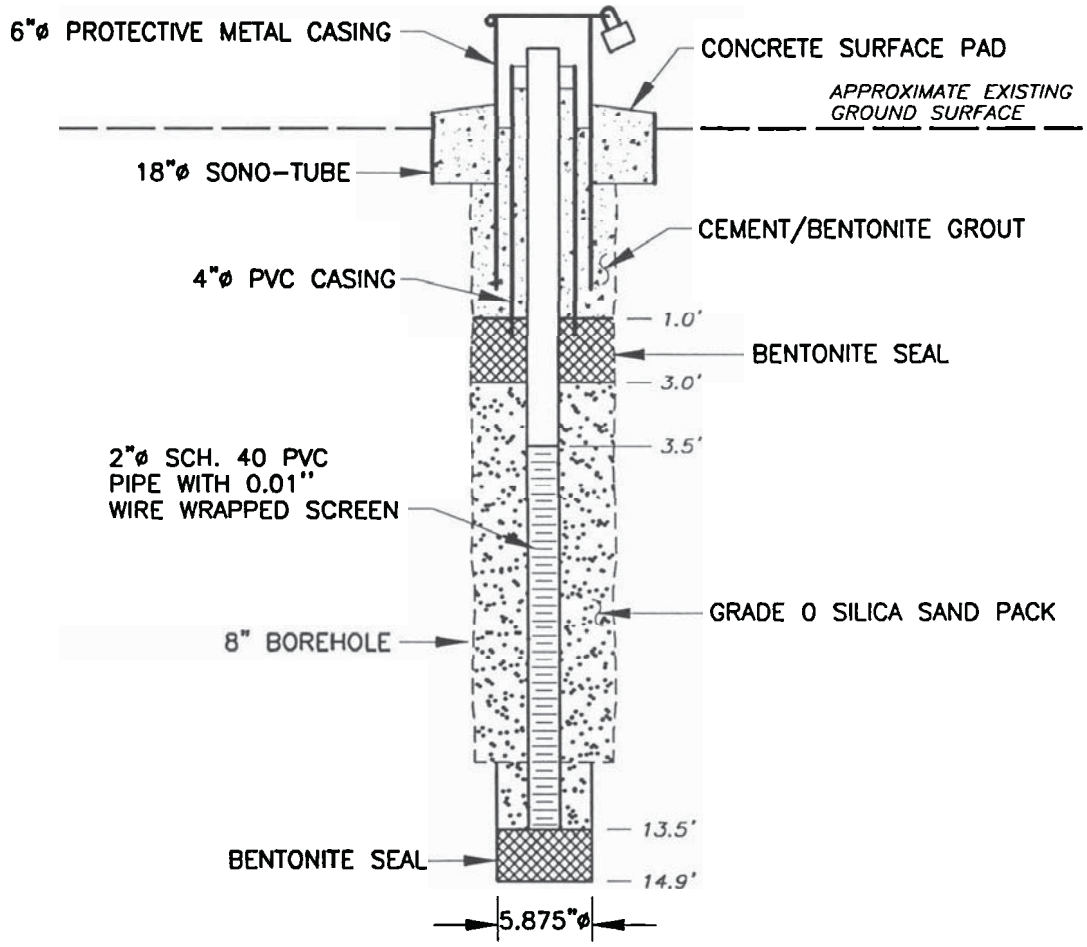
Drilling Company: PARRATT WOLFF, INC.
Driller: JIM HAMMOND and KEVIN WHITE
ESC Geologist: E. MICHAEL RIGGINS

Boring Location: North of Wakefern, South of Rail Line
Ground Elevation: ~~493.12'~~ 492.53 (as of 01/16)
TOC Elevation: ~~495.22'~~ 494.62 (as of 01/16)

BORING
Method: HOLLOW STEM AUGERS/AIR ROTARY
Hole Diameter: 8" / 6"
Inside Diameter: 4.25" /6"
Total Depth: 17'

SAMPLER
Method: SPLIT SPOON SAMPLER/BEDROCK CORE
Length (ft): 2 FEET
Hammer (lb): 140 LBS
Fall (in): 30 INCHES

Depth Below Grade (ft)	Samples Collected	Percent Recovery	Sample Depth	Blows/6"	Moisture	Sample Description
0' - 0.6'	MW16A-1 (0'-0.5')	100	0' - 2'	1/3/4/3	Dry	SILT, root zone, trace clay and rock fragments, medium brown.
0.6' - 2'	MW16A-2 (0.5'-1') MW16A-3 (1'-1.5') MW16A-4 (1.5'-2')				Dry	SILT, trace clay and rock frags, non-plastic, tannish brown.
2' - 4'	MW16A-5 (2'-4')	100	2' - 4'	18/22/27/32	Dry	SILT, trace clay and rock frags., faint mottling, light yellowish to yellowish brown, non-plastic, brittle.
4' - 6'	MW16A-6 (4'-6')	100	4' - 6'	27/17/28/18	Dry	SILT same as above to 5.0', then shale fragments to 5.1', then SILT, dark brown to dark. Bluish gray, trace clay and dark gray shale fragments, non-plastic.
6' - 7.5'	MW16A-7 (6'-8')	100	6' - 8'	13/16/17/21	Moist at 7'	SILT, trace clay and rock fragments, light brown, brittle.
7.5' - 8'					Moist to wet	SILT, olive gray to gray, trace sand, clay, little rock fragments, slightly plastic.
8' - 9.5'	MW16A-8 (8'-10')	100	8' - 10'	3/106/7	Wet	SILT and Rock Fragments, dark brown to gray, non-plastic.
9.5' - 10'					Dry	CLAY, med. gray to yellowish brown, little silt.
10' - 12'	MW16A-9 (10'-12')	100	10' - 12'	10/14/13/15	Saturated	ROCK FRAGMENTS, shale, dark gray, some silt, trace clay.
12' – 13.6'	MW16A-10	70	12'-13.6'	20/30/34/50 for 1"	Wet to Saturated	ROCK FRAGMENTS, and SILT, dark brown with dark gray shale fragments, trace clay, slightly plastic.
13.6'- 17'						SHALE, black to dark gray.
						Bottom of borehole.



MW-17 (MW-17S as of 01/16)

NOT TO SCALE

Drawing Number: 213471-A4

Drawn By: TMB 12/3/97 | ecked: | proved:

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ENVIRONMENTAL STRATEGIES CORPORATION Four Penn Center West, Suite 315 Pittsburgh, Pennsylvania 15276 (412) 787-5100	Figure "AS-BUILT" MONITORING WELL DIAGRAM FOR MW-17	REVERE SMELTING & REFINING CORPORATION MIDDLETOWN, NEW YORK PREPARED FOR RSR CORPORATION DALLAS, TEXAS

BORING LOG	PROJECT	
Environmental Strategies Corporation **Campbells Run Road** **Four Penn Center West, Suite 315** **Pittsburgh, PA 15276**	213471-02 REVERE SMELTING AND REFINING 65 BALLARD RD. MIDDLETOWN, NEW YORK	**Boring Number:** MW-17 **Sheet** 1 **of** 1 (MW-17S as of 01/16) **Date Drilled:** 6/05/97, 6/06/97

Drilling Company: PARRATT WOLFF, INC.
Driller: JIM HAMMOND and KEVIN WHITE
ESC Geologist: E. MICHAEL RIGGINS

Boring Location: North of Wakefern, South of Rail Line
Ground Elevation: 488.87'
TOC Elevation: 491.46'

BORING
Method: HOLLOW STEM AUGERS/AIRROTARY
Hole Diameter: 8" / 6"
Inside Diameter: 4.25" /6"
Total Depth: 14.9'

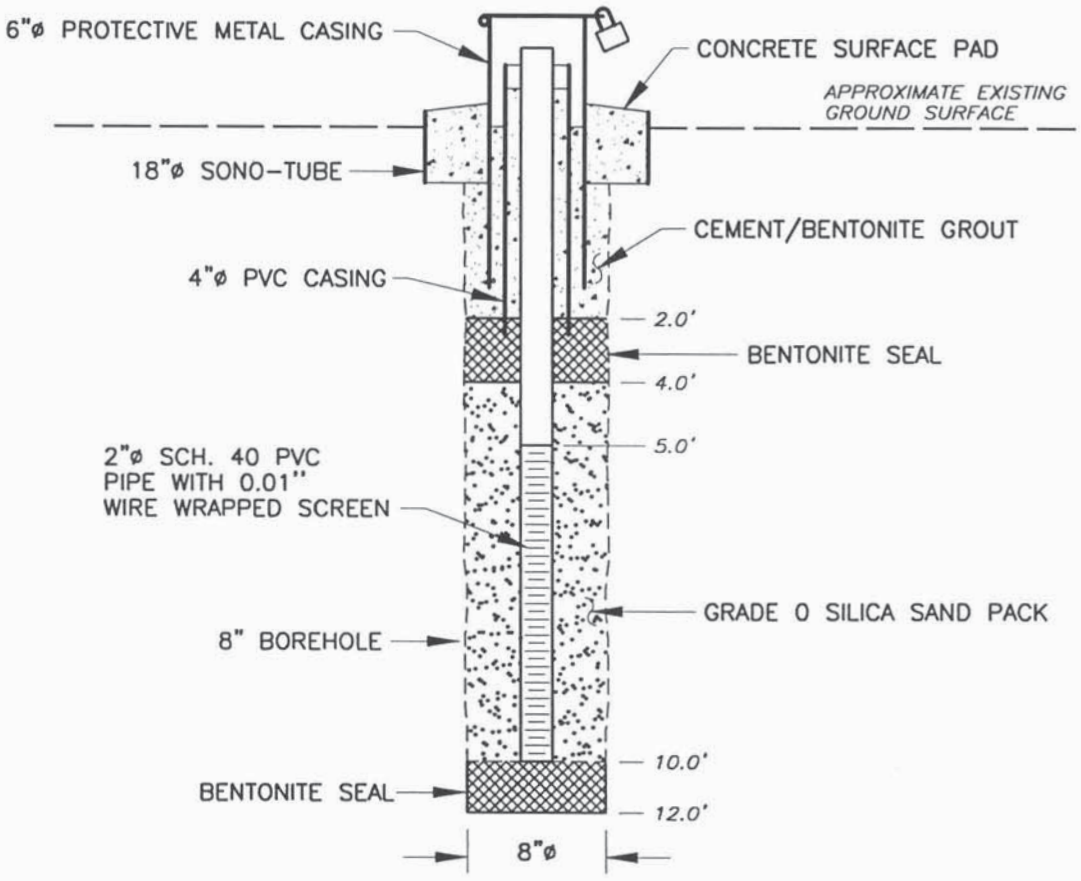
SAMPLER
Method: SPLIT SPOON SAMPLER/BEDROCK CORE
Length (ft): 2 FEET
Hammer (lb): 140 LBS
Fall (in): 30 INCHES

Depth Below Grade (ft)	Samples Collected	Percent Recovery	Sample Depth	Blows/6"	Moisture	Sample Description
0'- 0.5'	MW17A-1	100	0' - 2'	4/5/8/7	Moist	SILT, loam, black, roots, some clay, slightly plastic.
0.5' - 1'	MW17A-2				Wet	CLAY, black, plastic to sticky, little silt, trace rock frags., and roots.
1' - 2'	MW17A-3				Wet	ROCK FRAGMENTS, dark gray, some silt, trace clay.
2' - 4'	MW17A-4	100	2' - 4'	46/32/28/26	Moist to wet	CLAY, gray with some rock fragments, trace silt, yellowish brown mottles, plastic and sticky.
4' - 6'	MW17A-5	100	4' - 6'	4/7/6/8	Moist	SILT TILL, gray, some clay, trace rock fragments, plastic, mottled.
6' - 8'	MW17A-6	100	6' - 8'	7/8/11/13	Moist	SILT TILL, gray, mottled, trace clay, fine sand, and rock fragments, slightly plastic, shale fragment in tip.
8' - 10'		0	8' - 10'	23/24/23/20		No recovery, siltstone fragment in tip, dark gray.
10' - 10.9'	MW17A-7	30	10' - 10.9'	18/50 for 4"		SHALE, dark gray, weathered, bedrock.
10.9' - 14.9'			10.9' - 14.9'			SHALE, dark gray, weathered top 4", weathered zone at @ 12.5' for 2" ,calcite streaks in competent shale in core bottom.
						Bottom of borehole.
						G:\wp\files\bcd\midtown\rsrmidt.17

Drawing Number: 213471-A5

Checked: Approved:

Drawn By: TMB 12/3/97



MW-18 (MW-18S as of 01/16)

NOT TO SCALE

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ENVIRONMENTAL STRATEGIES CORPORATION
Four Penn Center West, Suite 315
Pittsburgh, Pennsylvania 15276
(412) 787-5100

Figure

"AS-BUILT" MONITORING WELL DIAGRAM FOR MW-18

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK
PREPARED FOR
RSR CORPORATION
DALLAS, TEXAS

BORING LOG	PROJECT	
Environmental Strategies Corporation **Campbells Run Road** **Four Penn Center West, Suite 315** **Pittsburgh, PA 15276**	213471-02 REVERE SMELTING AND REFINING 65 BALLARD RD. MIDDLETOWN, NEW YORK	**Boring Number:** MW-18 **Sheet** 1 **of** 1(MW-18S as of **Date Drilled:** 6/13/97 01/16)

Drilling Company: PARRATT WOLFF,INC.
Driller: JIM HAMMOND and KEVIN WHITE
ESC Geologist: E. MICHAEL RIGGINS

Boring Location: Upgradient Well, North of Revere Facility
Ground Elevation: 530.92'
TOC Elevation: 533.28'

BORING
Method: HOLLOW STEM AUGERS
Hole Diameter: 8"
Inside Diameter: 4.25"
Total Depth: 12'

SAMPLER
Method: SPLIT SPOON SAMPLER
Length (ft): 2 FEET
Hammer (lb): 140 LBS
Fall (in): 30 INCHES

Depth Below Grade (ft)	Samples Collected	Percent Recovery	Sample Depth	Blows/6"	Moisture	Sample Description
0' - 1'	MW18-1 (0'-0.5') MW18-2 (0.5'-1')	100	0' - 2'	5/6/5/5	Dry	SILT, brown, loamy, trace rock fragments and clay, slightly plastic.
1' - 2'	MW18-3 (1'-1.5') MW18-4 (1.5'-2')				Dry	SILT, faint yellowish brown, trace silt, mottled, slightly plastic.
2' - 3.8'	MW18-5 (2'-4')	100	2' - 4'	3/5/12/12	Moist	CLAY, bluish gray to yellowish brown, trace silt, plastic.
3.8' - 4'					Wet	SAND and GRAVEL, medium to coarse sand, fine to coarse gravel, trace silt and clay.
4' - 6'	MW18-6 (4'-6')	30	4' - 6'	13/20/17/16	Moist	SILT, medium brown, trace clay and rock fragments, plastic, sticky.
6' - 8'	MW18-7 (6' - 8')	100	6' - 8'	11/12/10/12	Saturated	SAND and GRAVEL, medium to coarse sand, fine gravel, trace silt and clay, dark brown.
8' - 10'	MW18-8 (8'-10')	100	8' - 10'	7/13/11/12	Saturated	SAND and GRAVEL, same as above.
10' - 12'	MW18-8 (10'-12')	100	10' - 12'	6/8/21/34	Saturated	SAND and GRAVEL, medium to coarse sand, fine to coarse gravel, trace silt and clay, shale fragments in spoon tip, dark brown.
						Bottom of borehole.
						G:\wp\files\bcd\midtown\rsrmidt.18

Ground Water Investigations, Inc.
Pine Bush, New York
(845) 744 - 6191

Test Boring Log
MW-19
(MW-19S as of 01/16)

Project:	Monitoring Well Installation								Boring No.:	MW-19
Client:	RSR Corporation, Middletown, New York								Sheet No.:	1 of 1
Drilling Contractor:	Kendrick Drilling, Inc.								Project No.:	272-01-01
Groundwater Information				Boring/Sampling Methodology					G.S. Elevation:	521.99
Date	Water Depth	Water Elev.	Intake		Cas.	Samp.	Core	Tube	W.L. Ref. Elev.:	523.96
25-Jun-01	8.13	515.83	5-15'	Type	F.J.	S.S.			Date Started:	14-Jun-01
				Diam.	5"	2"			Date Finished:	14-Jun-01
				Wt.	300 #	140 #			Driller:	T. Kendrick
				Fall	30"	30"			Inspector:	M. Colantuono

Well Construction	Depth (feet)	Samples No.	PID (ppm)	Rec. (in.)	Blows Per 6"	Classifications	Remarks
	0	S-1	0.0	6	2		
					2	***FILL***	Drive & wash 5" casing
					2		0 to 5.5 feet below grade.
					3	0 - 5.5' "Historical Fill" Material	
		S-2	0.0	6	2		Advanced borehole by
					2	yellow brown fmc SAND, little Clayey Silt,	rotary drilling to 16.0 feet
					4	little fm Gravel, damp, grading to	below grade.
					3	brown to grayish brown Clayey SILT,	
		S-3	0.0	18	3	little(-)fm sand, little(-) fm Gravel, moist	
	5				3		
					8	5.5'	
					35	***ICE CONTACT DEPOSITS***	
		S-4	0.0	12	24	Yellow Brown to dk. brown cmf SAND,	
	10				58	little to some fmc Gravel, little Clayey Silt	
					41	moist to wet	
					43		
						Grades to brownish Gray to Gray	Angular Gravels
						finer sand to clayey silt matrix	
						Gray Br. Clayey SILT, some to little fmc Sand,	Subangular Gravel with
		S-5	0.0	12	20	little cmf Gravel (shale fragments)	shale fragments
	15				28	saturated	
					24		Washed-out to 16.0' bgs.
					24	End of Boring @ 16.0'	
	20						Well Installation:
							Sandpack 4.0' - 16.0' bgs
							Screen 5.0' - 15.0 ' bgs
							Bentonite Slurry 2.0' - 4.0' bgs
							Concrete Seal 0 - 2.0' bgs
							Stick-Up Protective Pipe (4")
							2" Sched. 40 PVC Screen & Riser
	25						2" ID Sched. 40 PVC Screen

Ground Water Investigations, Inc.
Pine Bush, New York
(845) 744 - 6191

Test Boring Log
MW-20
(MW-20S as of 01/16)

Project:	Monitoring Well Installation
Client:	RSR Corporation, Middletown, New York
Drilling Contractor:	Kendrick Drilling, Inc.

Boring No.:	MW-20
Sheet No.:	1 of 2
Project No.:	272-01-01
G.S. Elevation:	512.32
W.L. Ref. Elev.:	511.94
Date Started:	14-Jun-01
Date Finished:	14-Jun-01
Driller:	T. Kendrick
Inspector:	M. Colantuono

Groundwater Information

Date	Water Depth	Water Elev.	Intake
25-Jun-01	11.26	500.68	19-29'

Boring/Sampling Methodology

	Cas.	Samp.	Core	Tube
Type	F.J.	S.S.		
Diam.	5"	2"		
Wt.	300 #	140 #		
Fall	30"	30"		

Well Construction	Depth (feet)	Sample No.	PID (ppm)	Rec. (in.)	Blows Per 6"	Classifications	Remarks
	0	S-1	0.0	6	20 26 32 43	***FILL/REWORKED GLACIAL TILL*** Tan Brown Clayey SILT, little (+) f Gravel, little(-) f Sand, dry, dense	Drive & wash 5" casing 0 to 7.5 feet below grade. Advanced borehole by rotary drilling to 29.0 feet below grade.
	5	S-2	0.0	12	20 12 12 17	Brown f Sand and Clayey Silt, little fmc Gravel, damp, dense	
	10	S-3	0.0	14.5	23 30 34 53	Brown fm Sand and Clayey Silt, some (-) fmc Gravel, damp, dense ***GLACIAL TILL***	
	15	S-4	0.0	14.5	65 55 55 48	Brown fmc SAND, little to some Clayey Silt, little (+) fmc Gravel, wet, v. dense	
	20	S-5	0.0	12	45 35* 35* 35*	Gray Brown Clayey SILT, little f Sand, little fmc Gravel, trace shale fragments saturated, very dense	* Denotes 300 lb. Hammer
	25	S-6	0.0	12	18* 20* 27* 40*	Gray Brown Clayey SILT, little to some f Sand, little fmc Gravel, trace shale fragments saturated, very dense	

Ground Water Investigations, Inc.
Pine Bush, New York
(845) 744 - 6191

Test Boring Log
MW-20
(MW-20S as of 01/16)

Project:	Monitoring Well Installation
Client:	RSR Corporation, Middletown, New York
Drilling Contractor:	Kendrick Drilling, Inc.

Boring No.:	MW-20
Sheet No.:	2 of 2
Project No.:	272-01-01
G.S. Elevation:	512.32
W.L. Ref. Elev.:	511.94
Date Started:	14-Jun-01
Date Finished:	14-Jun-01
Driller:	T. Kendrick
Inspector:	M. Colantuono

Groundwater Information

Date	Water Depth	Water Elev.	Intake
25-Jun-01	11.26	500.68	19-29'

Boring/Sampling Methodology

	Cas.	Samp.	Core	Tube
Type	F.J.	S.S.		
Diam.	5"	2"		
Wt.	300 #	140 #		
Fall	30"	30"		

Well Construction	Depth (feet)	Samples No.	Samples PID (ppm)	Samples Rec. (in.)	Samples Blows Per 6"	Classifications	Remarks
	25					***GLACIAL TILL***	Advanced borehole by rotary drilling to 29.0 feet below grade.
						End of Boring @ 29.0'	
	30						Well Installation:
	35						Sandpack 16.0' - 29.0' bgs Screen 19.0' - 29.0 ' bgs Bentonite Slurry 2.0' - 16.0' bgs Concrete Seal 0 - 2.0' bgs
	40						Flush Mount Manhole Cover 2" Sched. 40 PVC Screen & Riser 2" ID Sched. 40 PVC Screen
	45						
	50						

Ground Water Investigations, Inc.
Pine Bush, New York
(845) 744 - 6191

Test Boring Log
MW-21B
(MW-21D as of 01/16)

Project:	Monitoring Well Installation
Client:	RSR Corporation, Middletown, New York
Drilling Contractor:	Kendrick Drilling, Inc.

Boring No.:	MW-21B
Sheet No.:	1 of 1
Project No.:	272-01-01
G.S. Elevation:	515.81
W.L. Ref. Elev.:	515.48
Date Started:	15-Jun-01
Date Finished:	15-Jun-01
Driller:	T. Kendrick
Inspector:	L. Coddington

Groundwater Information

Date	Water Depth	Water Elev.	Intake
25-Jun-01	4.21	511.27	19-29'

Boring/Sampling Methodology

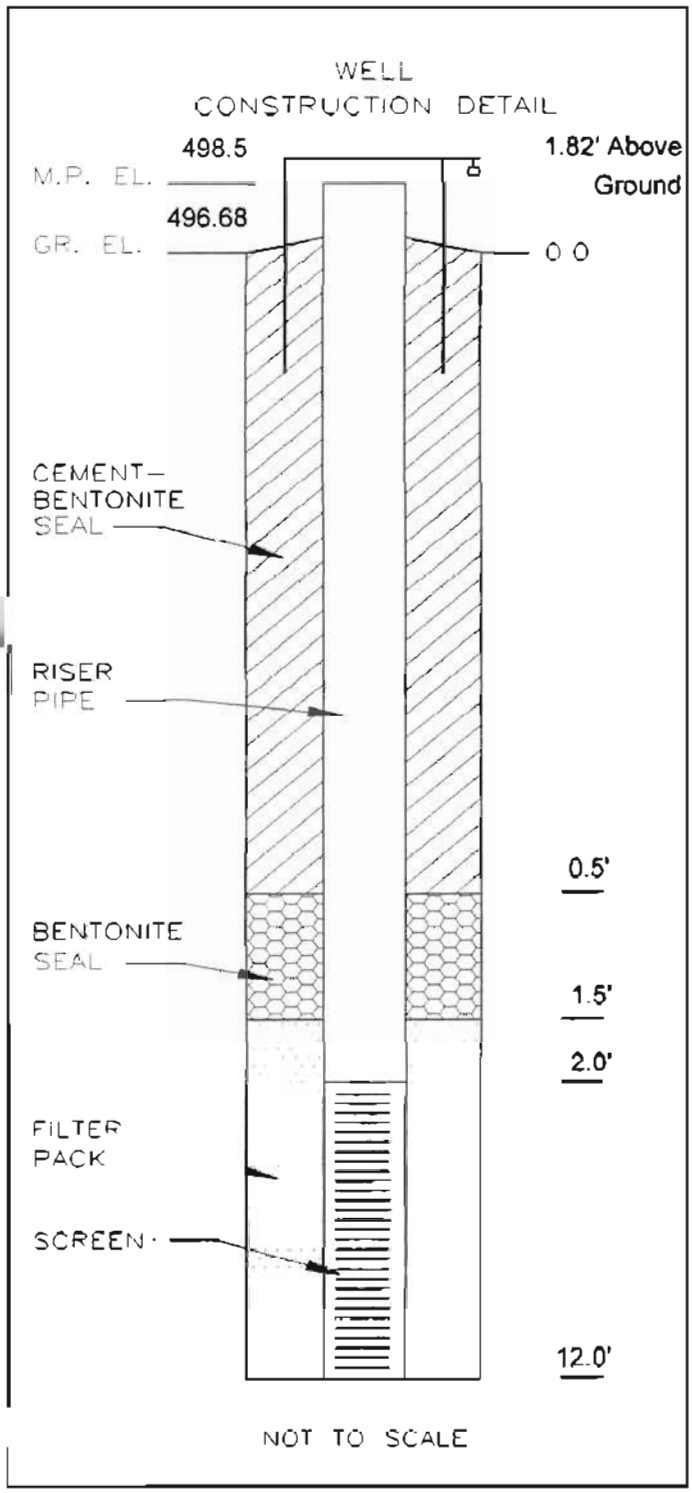
	Cas.	Samp.	Core	Tube
Type	F.J.	S.S.	NX	
Diam.	5"	2"	2"	
Wt.	300 #	140 #		
Fall	30"	30"		

Well Construction	Depth (feet)	Samples No.	PID (ppm)	Rec. (in.)	Blows Per 6"	Classifications	Remarks
	0					***FILL/REWORKED ICE CONTACT***	Cut Concrete 2.0' by 2.0' Area
							Drive & wash 5" casing 0 to 4.0 feet below grade.
						Yellow Brown cmf SAND, little fm Gravel to Gray cmf SAND and cmf Gravel, little Clayey Silt, damp to moist	Advanced borehole by rotary drilling to 19.0 feet below grade.
		S-1	0.0	2	100/4.5	4.5'	
	5					***BEDROCK***	Split Spoon Refusal at 4.5 feet.
						Dark Gray to Black Shale	Hard uniform rotary drilling from 4.5 to 9.0 feet.
							Fine shale rock cuttings in wash. Trace gray silty clay (from fractures)
		S-2	n/a	0	100/0		Split Spoon Refusal at 9.0 feet. (Spoon Bouncing)
	10						Rollerbit to 14.0' bgs.
							Hard uniform drilling, fine shale rock cuttings in wash.
		Core	n/a	60	NX 14.0' to 19.0'	Dark Gray Shale Bedrock, horizontal fractures, trace silty clay filling in fractures.	NX Rock Core 14.0' to 19.0' bgs. RQD = 0.69
	15						Borehole reamed to 19.0' bgs.
						End of Boring @ 19.0' bgs.	
	20						Well Installation:
							Sandpack 6.0' - 19.0' bgs Screen 9.0' - 19.0 ' bgs Bentonite Slurry 2.0' - 6.0' bgs Concrete Seal 0 - 2.0' bgs
							Flush Mount Manhole Cover 2" Sched. 40 PVC Screen & Riser 2" ID Sched. 40 PVC Screen
	25						

WELL COMPLETION LOG

Well ID: MW-23S

Project:	Revere Smelting & Refining	**Client:**	NYSDEC
Location:	Middletown, New York	**Date Drilled:**	11/7/2001
Project No.:	26408.004.400	**Date Developed:**	11/9/2001



Inspection Notes:

Inspector: Garrett Sleeman
Drilling Contractor: Parratt Wolff, Inc.
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 4.3 Date: 11/09/01
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 13.82

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 2.0' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade:
Interval: 2.0'-12.0' BS

Seal(s):

Type:	Cement-Bentonite	Interval:	0.0'-0.5' BS
Type:	Bentonite Pellets	Interval:	0.5'-1.5' BS
Type:		Interval:	

Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

Form 003

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

BORING NO. MW-23S

PROJECT: Revere Smelting and Refining						SHEET 1 OF 2
CLIENT: NYSDEC						JOB NO. 26408.004.400
DRILLING CONTRACTOR: Parratt Wolff Inc.						MEAS. PT. ELEV.
PURPOSE: Overburden Monitoring Well South of Sediment Pond						GROUND ELEV. 498.50
DRILLING METHOD: 4.5 Split Barrel		SAMPLE	CORE	CASING		DATUM Ground Surface
DRILL RIG TYPE: 850 Track	TYPE					DATE STARTED 11/7/2001
GROUND WATER DEPTH:	DIA.					DATE FINISHED 11/7/2001
MEASURING POINT:	WEIGHT					DRILLER J. Percy & J. Wheeler
DATE OF MEASUREMENT.	FALL					INSPECTOR G. Sleeman

Depth Ft.	Sample Number	Blows on Sample Spoon per 6"	Penetration/Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
1	1	Weight of Hammer	0-1.3'		0-1.3' Brown SILT CLAY, some medium fine(+) Sand, trace medium(+) fine Gravel	"Clean" Fill Moist MW-23S (0-1.3' BS) 11:40
2						
3	2	Weight of Hammer	2.0-2.4'		2.0-2.4' Brown SILT CLAY, some medium fine(+) Sand, trace medium fine Gravel	"Clean" Fill Very Moist MW-23S (2.0-2.4' BS) 11:45
4						
5	3	Weight of Hammer	4-4.2'		4.0-4.2' Brown SILTY CLAY, and medium fine(+) SAND	Saturated "Clean" Fill MW-23S (4.0-4.2' BS) "Clean" Fill 11:50
6					6.0'	
7	4	Weight of Hammer	6.0-7.3'		6.0-7.3' Brown SILT CLAY, some medium fine(+) Sand, little medium(+) fine Gravel	MW-23S (6.0-7.3' BS) 12:05 Native Till
8	5				NR	No Recovery
9						
10						

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

BORING NO. MW-23S

PROJECT: Revere Smelting and Refining

SHEET 2 OF 2

CLIENT: NYSDEC

JOB NO. 26408.004.400

Depth Ft.	Sample Number	Blows on Sample Spoon per 6"	Penetration Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
			10.0-10.5'		10.0-10.5' Brown CLAY, some medium fine(+) Sand, trace medium fine Gravel 10.5'	MW-23S (10.0-10.5' BS)
11	6				Brown CLAY, some medium, fine(+) sand, trace medium fine gravel.	
12					12.0'	Completed MW-23S Drilling
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

Boring Log: MW-23S-R

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: September 1, 2016

Surface Elevation (feet AMSL*): 497.76
TOC Elevation (feet AMSL*): 500.23
Total Depth (feet): 16
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) Brown; fine to medium-grained sand with gravel. Loose. Dry.	
5						***Silty Clay with Gravel (CL)*** Gray and brown; with gravel and shale chips. Trace fine to medium sand. Stiff. Wet at ~8 ft bgs.	
10							
15						***Siltstone*** Dark gray.	
						Bottom of Boring at 16 feet	
20							
25							

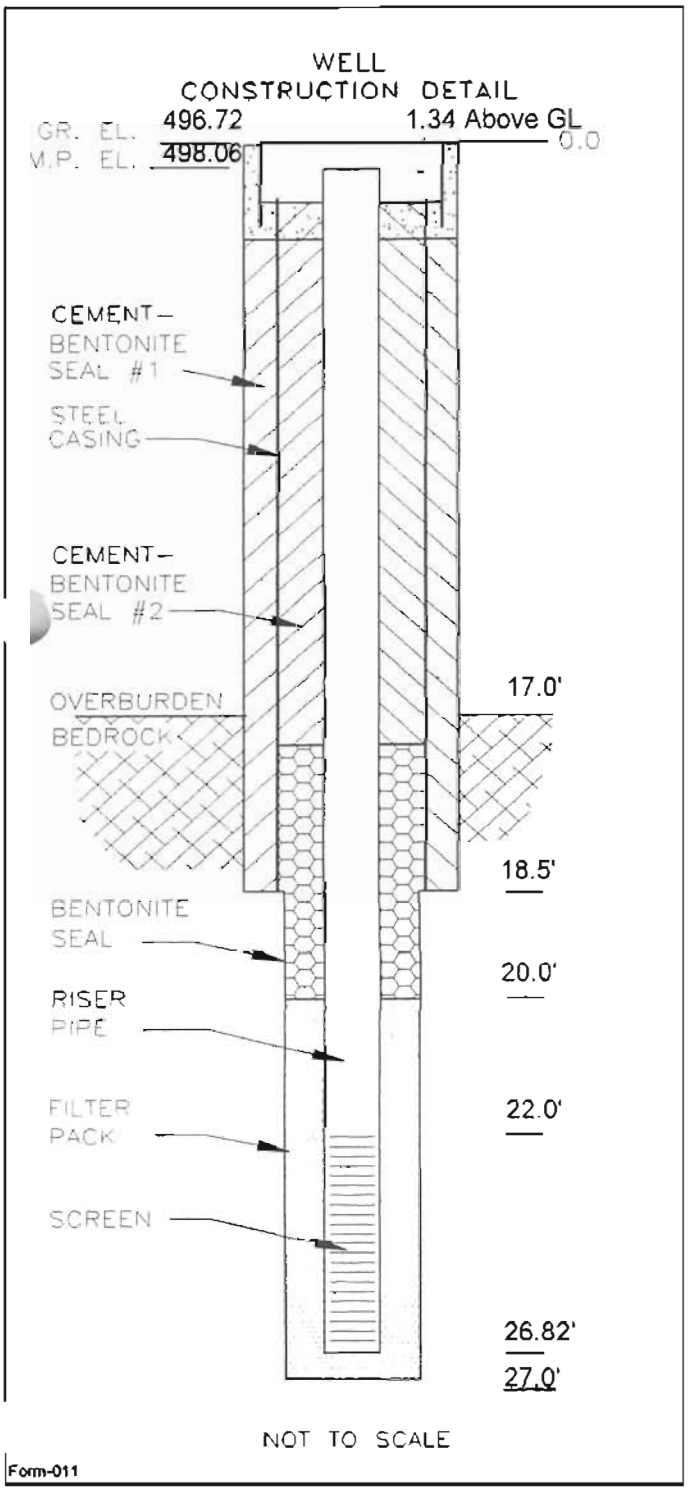
Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

WELL COMPLETION LOG

Well ID: MW-23D

Project:	Revere Smelting & Refining	**Client:**	NYSDEC
Location:	Middleton, New York	**Date Drilled:**	11/6/01 - 11/7/01
Project No.:	26408.004.400	**Date Developed:**	11/09/01



Form-011

Inspection Notes:

Inspector:	Garrett Sleeman
Drilling Contractor:	Parratt Wolff, Inc.
Type of Well:	Environmental Monitoring Well

Static Water Level (ft bmp): 7.04 Date: 11/7/2001
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 28.34

Drilling Method - Overburden: 6 1/4"

Type: HSA Diameter: 4 1/4" ID
Casing: 4.5' Steel

Sampling Method - Overburden:

Type: --- Diameter: ---
Weight: --- Fall: ---
Interval: ---

Drilling Method - Bedrock:

Type: HX Dimond Bit Core Diameter: 4"
Casing: 2" PVC

Sampling Method - Bedrock:

Type: 4" OD (HX) Diamond B Diameter: 25"
Interval: ---

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 23.70 Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: 0
Interval: 27.0-20.0'

Seal(s):

Type:	Cement-Bentonite Grout #1	Interval: 0-18.5'
Type:	Bentonite	Interval: 16.5-20.0'
Type:	Cement-Bentonite Grout #2	Interval: 0.16-5.0'

Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	BORING NO. MW-23D

PROJECT: Revere Smelting and Refining					SHEET 1 OF 2	
CLIENT: NYSDEC					JOB NO. 26408.004.400	
DRILLING CONTRACTOR: Parratt Wolff Inc.					MEAS. PT. ELEV.	
PURPOSE: Overburden Monitoring Well South of Sediment Pond					GROUND ELEV. 498.50	
DRILLING METHOD: 4.5 Split Barrel		SAMPLE	CORE	CASING	DATUM Ground Surface	
DRILL RIG TYPE: 850 Track	TYPE				DATE STARTED	11/7/2001
GROUND WATER DEPTH:	DIA.				DATE FINISHED	11/7/2001
MEASURING POINT:	WEIGHT				DRILLER	J. Percy & J. Wheeler
DATE OF MEASUREMENT:	FALL				INSPECTOR	G. Sleeman

Depth	Sample Number	Blows on Sample Spoon per 6"	Penetration/ Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
1	1	Weight of Hammer	0-1.3'		0-1.3' Brown SILT CLAY, some medium fine(+) Sand, trace medium(+) fine Gravel	"Clean" Fill Moist
2						
2	2	Weight of Hammer	2.0-2.4'		2.0-2.4' Brown SILT CLAY, some medium fine(+) Sand, trace medium fine Gravel	"Clean" Fill Very Moist
3						
4	3	Weight of Hammer	4-4.2'		4.0-4.2' Brown SILTY CLAY, and medium fine(+) SAND	Saturated "Clean" Fill
5						
6					6.0'	
6	4	Weight of Hammer	6.0-7.3'		6.0-7.3' Brown SILT CLAY, some medium fine(+) Sand, little medium(+) fine Gravel	Native Till
7						
8	5				NR	No Recovery
9						
10						

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

BORING NO. MW-23D

PROJECT: Revere Smelting and Refining

SHEET 2 OF 2

CLIENT: NYSDEC

JOB NO. 26408.004.400

Depth	Sample Number	Blows on Sample Spoon per 6"	Penetration Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
			10.0-10.5'		10.0-10.5' Brown CLAY, some medium fine(+) Sand, trace medium fine Gravel 10.5'	
11	6				Brown CLAY, some medium, fine(+) sand, trace medium fine gravel. 12.0'	
12					See Core Log for MW-23D Coring completed at 27 ft.	
13					Note: Soil descriptions taken from MW-23S log.	
14						
15						
16						
17						
18						
19						
20						
21						
22						

O'BRIEN & GERE ENGINEERS, INC. 22 Computer[illegible]e, West Albany, New York 12205	CORE LOG	Hole No.: MW-23D	Job No.: 26408.004.400
		Sheet 1 of 1	Date Started: 6-Nov-0[illegible]
Project: Revere Smelting and Refining	Drilling Contractor: Parratt Wolff, Inc		Date Finished: 11/7/01
Client: NYDEC	Driller: J. Percy, J Wheeler		Total Depth:10' (27' bgs)
Purpose: Observe Shallow Bedrock Infillration	Geologist: Garrett Sleeman		Ground Elev.: 496.72
Location: South of RSR Facility	Length of Casing: 10 ft		S.W.L.: NA
Hole Location: In Culvert, North of Rail Road Tracks	Casing Size: 2" PVC	Core Size: 2.5" 18.5-27'	Inclination/Bearing: NA

Formation Member Unit	Run No. Depth	Pen. Rate (min. per foot)	Depth Scale	Lithologic Description (include in order: ROCK TYPE, color, grain size, texture, bedding, fracture & minerals.)	Core Recovery Length	Core Recovery Percent	RQD
			17	Bedrock (Limestone) at 17', set BIP at 18.0 Began coring at 18.5			
	1 18.5-23.2	`3-4 (avg.)	19 21	Run #1 Limestone: Dark gray, fine grained, shaley limestone to Limey shale with horizontal bedding dipping approximately 45 degrees to the east. Occasional fractures infilled with argillaceous carbonate stringers, mostly massive.	4.4'	93.6%	89%
	2 23.2-27	5 (avg.)	23 25 27	Run #2 Limestone: Dark gray, fine grained, massive Limestone to muddy Limestone with fewrer jointings and fracture than the overlying material	3.8'	100%	100%

Boring Log: MW-23D-R

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: August 31, 2016

Surface Elevation (feet AMSL*): 497.02
TOC Elevation (feet AMSL*): 499.72
Total Depth (feet): 35
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) Brown; fine to medium-grained sand with gravel. Loose. Dry.	
5						***Silty Clay with Gravel (CL)*** Gray and brown; with gravel. Stiff. Wet at ~8 ft bgs.	
10							
15						***Clayey Sand with Gravel (SC)*** 13-15 ft bgs: Gray-brown coarse sand and rocks. Wet. 15-18.5 ft bgs: Brown clayey med-v.cse sand and rocks. Wet. 18.5-20 ft bgs: Gray clayey medium sand and shale fragments. Wet.	
20						***Clay with Gravel (CL)*** Gray and brown clay with gravel and shale fragments. Stiff. Damp.	
25							

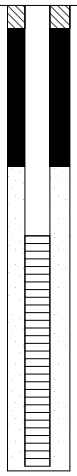
Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

Boring Log: MW-23D-R

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: August 31, 2016

Surface Elevation (feet AMSL*): 497.02
TOC Elevation (feet AMSL*): 499.72
Total Depth (feet): 35
Borehole Diameter (inches): 6
**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
30						***Siltstone*** Dark gray. Thinly to massively bedded. Fractured. *(continued)*	
35						Bottom of Boring at 35 feet	
40							
45							
50							

Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

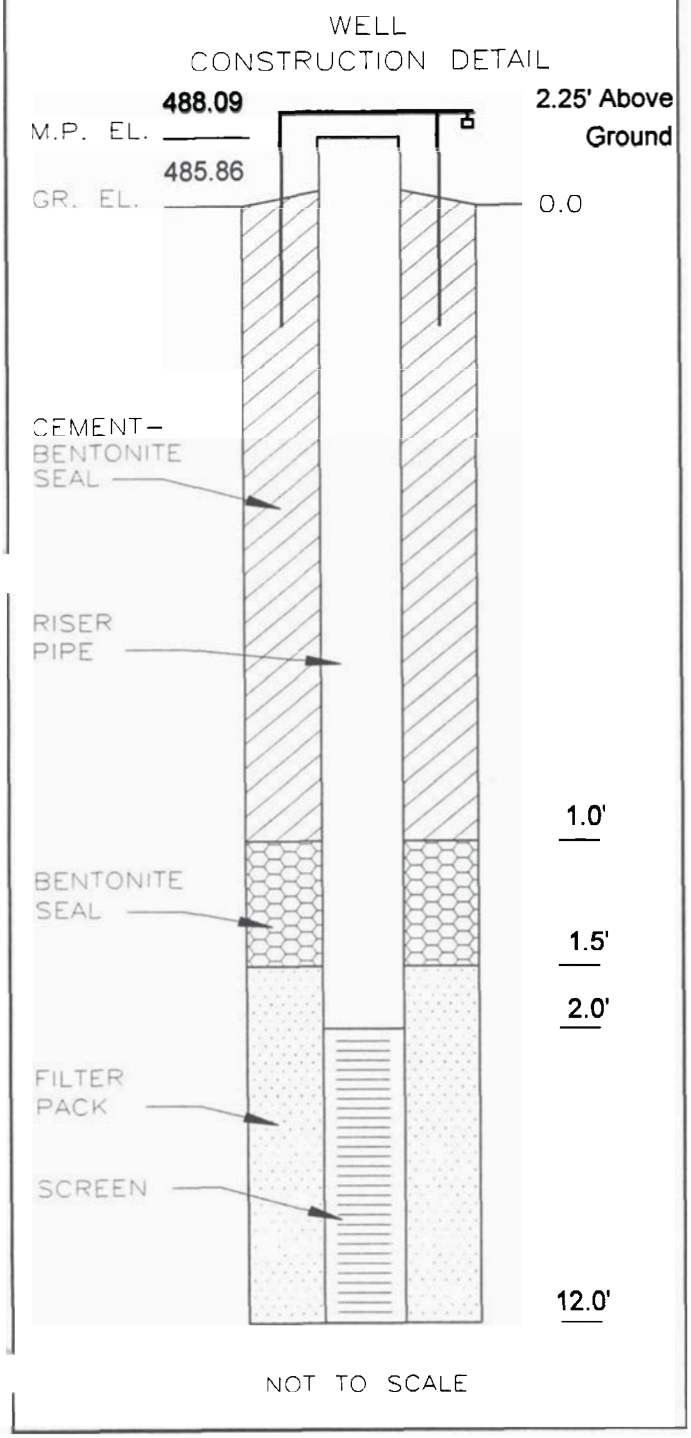
WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

WELL COMPLETION LOG

Well ID: **MW-24**

(MW-24S as of 01/16)

Project:	Revere Smelting & Refining	**Client:**	NYSDEC
Location:	Middletown, New York	**Date Drilled:**	11/8/2001
Project No.:	26408.004.400	**Date Developed:**	11/9/2001



Inspection Notes:

Inspector: Garrett Sleeman
Drilling Contractor: Parratt Wolff, Inc.
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 3.28 Date: 11/09/01
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 14.25

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous Sampling

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 4.45' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade:
Interval: 15.0-12.2' BS

Seal(s):

Type: Cement-Bentonite Interval: 0-1.0' BS
Type: Bentonite Pellets Interval: 1.0-1.5' BS
Type: Interval:

Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

Form 003

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

BORING NO. MW-24
(MW-24S as of 01/16)

PROJECT: Revere Smelting and Refining					SHEET 1 OF 2	
CLIENT: NYSDEC					JOB NO. 26408.004.400	
DRILLING CONTRACTOR: Parratt Wolff Inc.					MEAS. PT. ELEV.	
PURPOSE: Monitoring Well Installation South of Railroad Tracks					GROUND ELEV.	
DRILLING METHOD: 4.5 Split Barrel		SAMPLE	CORE	CASING	DATUM Ground Surface	
DRILL RIG TYPE: 850 Track	TYPE				DATE STARTED	11/8/2001
GROUND WATER DEPTH:	DIA.	1.5"	2.0" OD	4¼"	DATE FINISHED	11/8/2001
MEASURING POINT:	WEIGHT				DRILLER	J. Percy & J. Wheeler
DATE OF MEASUREMENT:	FALL				INSPECTOR	G. Sleeman

Depth Ft.	Sample Number	Blows on Sample Spoon per 6"	Penetration/ Recovery	Unified Classi-fication	GEOLOGIC DESCRIPTION	REMARKS
		Weight of Hammer	0.0-0.8'		0-0.4' Grayish Brown SILT, little Clay, Organics with roots	A_o Horizon Moist
		1			0.4-0.8' Yellowish Gray CLAY, trace coarse Gravel, little Silt	Moderately Compact Histic B_{tg} Horizon MW-24 (0-0.8' BS) 14:10
1		4				
		5				
2		5	2.0-3.9'		2.0-2.6' Yellowish Brown CLAY, trace coarse Gravel little Silt	Saturated B_{tg} (Histic Soils)
		5			2.6-3.9' Yellowish Brown CLAY, some Silt, little coarse medium fine Gravel, little medium fine Sand	MW-24 (2.0-3.9' BS) 14:15
3		13				
		13				
4		9	4.0-4.9'		4.0-4.9' Grayish Brown SILT CLAY, little medium fine Sand, some coarse medium fine Gravel	Dry Perched/Water Table Confining Clay Layer Poorly Sorted MW-24 (4.0-4.9' BS) 14:45
		13				
5		14				
		11				
6		13	6.0-7.2'		6.0-7.2' Dark Yellowish Brown CLAY, little coarse(+) medium Sand, little Silt, some coarse medium fine(+) Gravel	MW-24 (6.0-7.2' BS) 14:40 Firmly Compact
		20				
7		20				
		15				
8		22	8.0-		8.0-9.0' Dark Yellowish Brown CLAY, little coarse(+) medium Sand, little Silt, some coarse medium fine(+) Gravel	MW-24 (8.0-9.5' BS) 14:50
		17				
9		10				
		7				
10						

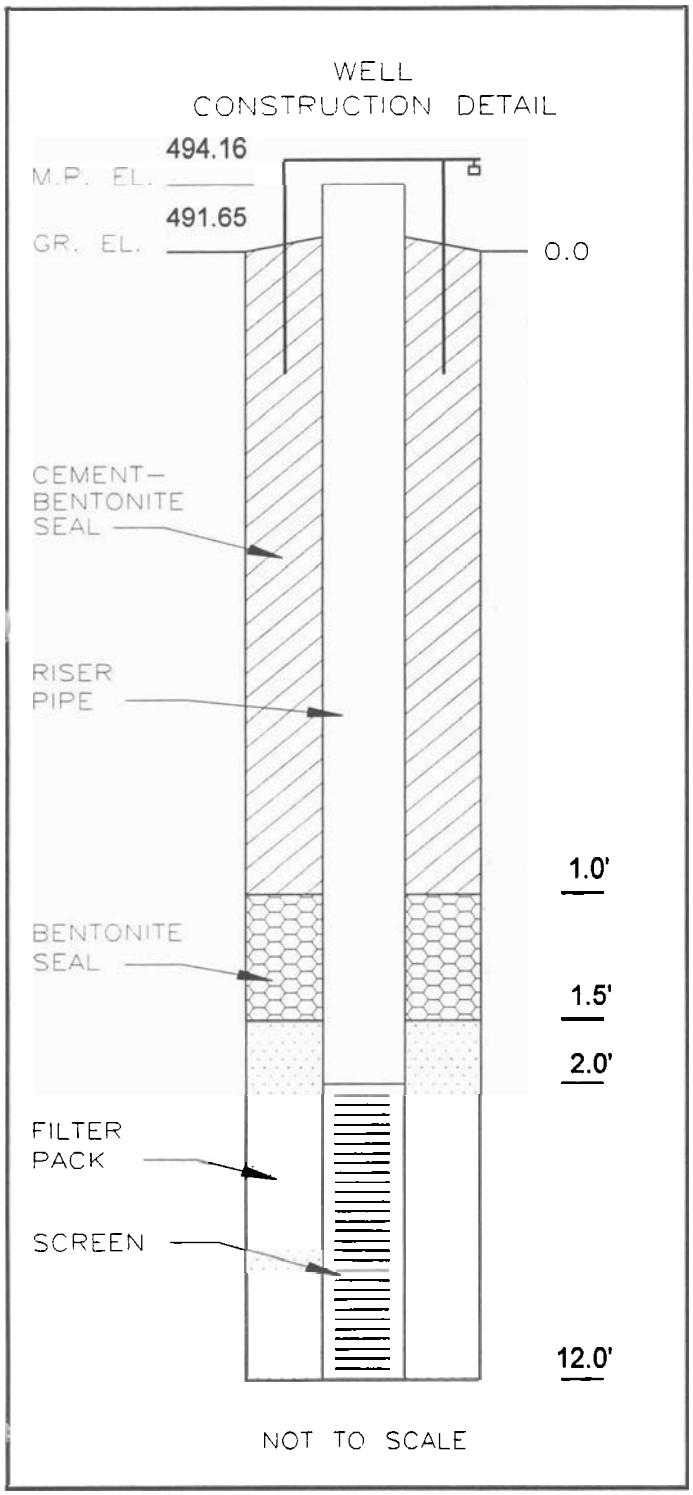
O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	BORING NO. MW-24 (MW-24S as of 01/16)
PROJECT: Revere Smelting and Refining		SHEET 2 OF 2
CLIENT: NYSDEC		JOB NO. 26408.004.400

Depth	Sample Number	Blows on Sample Spoon per 6"	Penetration Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
11		6 20 37 37	10.0-11.5'		10.0-11.5' Dark Yellowish Brown CLAY, little coarse(+) medium Sand, some coarse(-) medium fine(+) Gravel 11.5'	MW-24 (20.0-11.5' BS) 15:05 Base of 12.0' Tip of Spoon Shale - Possible Bedrock End of Drilling
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

WELL COMPLETION LOG

Well ID: **MW-25**
(MW-25S as of 01/16)

Project:	Revere Smelting & Refining	**Client:**	NYSDEC
Location:	Middletown, New York	**Date Drilled:**	11/8/2001
Project No.:	26408.004.400	**Date Developed:**	11/9/2001



Inspection Notes:

Inspector: Garrett Sleeman
Drilling Contractor: Parratt Wolff, Inc.
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 4.26 Date: 11/09/01
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 14.51

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous Sampling

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade:
Interval: 15.0-12.0' BS

Seal(s):

Type: Cement-Bentonite Interval:
Type: Bentonite Pellets Interval: 1.0-1.5' BS
Type: Interval:

Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

Form 003

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	BORING NO. MW-25 (MW-25S as of 01/16)
PROJECT: Revere Smelting and Refining		SHEET 1 OF 2
CLIENT: NYSDEC		JOB NO. 26408.004.400
DRILLING CONTRACTOR: Parratt Wolff Inc.		MEAS. PT. ELEV.
PURPOSE: Monitoring Well Installation South of Railroad Tracks		GROUND ELEV.
DRILLING METHOD: 4.5 Split Barrel	SAMPLE / CORE / CASING	DATUM Ground Surface
DRILL RIG TYPE:	TYPE	DATE STARTED 11/8/2001
GROUND WATER DEPTH:	DIA.	DATE FINISHED 11/8/2001
MEASURING POINT:	WEIGHT	DRILLER J. Percy & J. Wheeler
DATE OF MEASUREMENT:	FALL	INSPECTOR G. Sleeman

Depth	Sample Number	Blows on Sample Spoon per 6"	Penetration/ Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
			0-0.9'		0-0.2' Dark Brown CLAY, organic roots, wood	
		1			0.2-0.9' Yellowish Brown CLAY, trace Silt, little coarse	0.5' BS - Saturated
		2			medium Sand, some medium fine(+) Gravel	MW-25 (0-0.9' BS)
1						12:25
		3				Native
						Subangular Gravel
		6				
2			2.0-3.0'		2.0-3.0' Yellowish Brown CLAY, and coarse medium	Firmly Compact
		12			SAND, some medium fine(+) Gravel	Till
						MW-25 (2.0-3.0' BS)
		21				12:35
3						Angular-Subangular
		17				Gravel
		19				
4			4.0-5.1'		4.0-4.8' Yellowish Brown CLAY and coarse medium	MW-25 (4.0-5.1' BS)
		5			SAND, some medium fine(+) Gravel	12:45
						Firmly Compact
		8				Till
5					4.8-5.1' Yellowish Brown SILT and medium fine(+)	
		7			SAND, some CLAY	
		5				
6			6.0-7.0'		6.0-7.0' Grayish Brown SILT CLAY, some medium fine	MW-25 (6.0-7.0' BS)
		5			Sand, little medium fine(+) Gravel	12:50
		11				
7						
		11				
		12				
8			8.0-9.6'		8.0-9.6' Yellowish Brown-Grayish Brown SILT CLAY and	Very firmly Compact
		2			coarse(+) medium SAND, some coarse medium fine(+)	MW-25 (8.0-9.6' BS)
					Gravel, alternating Clay Silt partings	12:55
9		3				
		13				
		11				
10						

O'BRIEN & GERE

TEST BORING LOG

BORING NO. MW-25
(MW-25S as of 01/16)

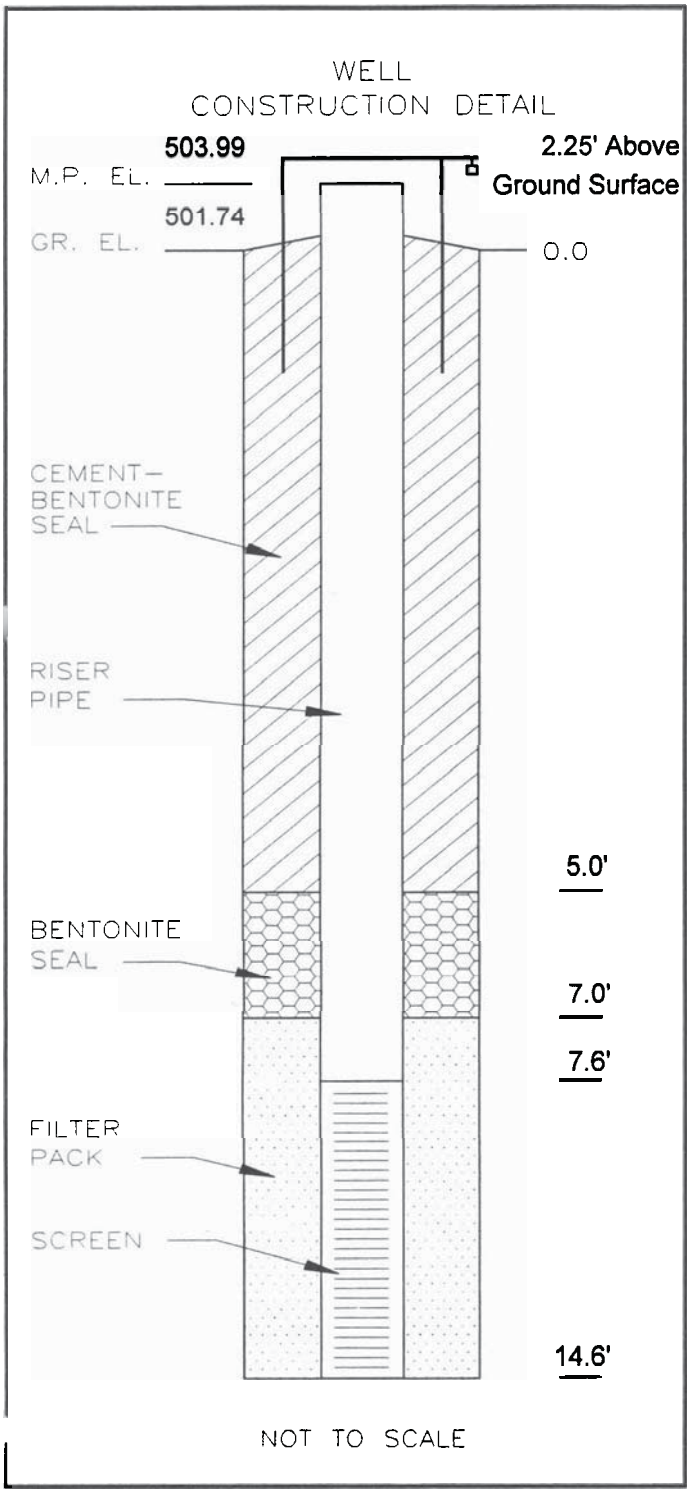
PROJECT: Revere Smelting and Refining
SHEET 2 OF 2
CLIENT: NYSDEC
JOB NO. 26408.004.400

Depth Ft.	Sample Number	Blows on Sample Spoon per 6"	Penetration Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
		6	10.0-10.6'		10.0-10.6' Yellowish Brown coarse medium fine(+) Gravel, little Silt Clay, some coarse(+) medium Sand 10.6'	MW-25 (10.0-10.6 BS) 13:00 Very Compact Till Gravel Angular Subrounded Completed MW-25 Drilling
11		13				
		10				
		10				
12						
13						
14						
16						
17						
18						
19						
20						
21						
22						

WELL COMPLETION LOG

Well ID: **MW-26**
(MW-26S as of 01/16)

Project:	Revere Smelting & Refining	**Client:**	NYSDEC
Location:	Middletown, New York	**Date Drilled:**	11/8/2001
Project No.:	26408.004.400	**Date Developed:**	11/9/2001



Inspection Notes:

Inspector: Garrett Sleeman
Drilling Contractor: Parratt Wolff, Inc.
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 9.07 Date: 11/09/01
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 16.85

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous Sampling

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 10.0' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade:
Interval: 7.0-15.0' BS

Seal(s):

Type:	Cement-Bentonite	Interval:	0-5.0' BS
Type:	Bentonite Pellets	Interval:	5.0-7.0' BS
Type:		Interval:	

Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

Form 003

O'BRIEN & GERE ENGINEERS

TEST BORING LOG

BORING NO. MW-26
(MW-26S as of 01/16)

PROJECT: Revere Smelting and Refining						SHEET 1 OF 2
CLIENT: NYSDEC						JOB NO. 26408.004.400
DRILLING CONTRACTOR: Parratt Wolff Inc.						MEAS. PT. ELEV.
PURPOSE: Monitoring Well Installation, Just East of Pond						GROUND ELEV.
DRILLING METHOD: 4.5 Split Barrel		SAMPLE	CORE	CASING		DATUM Ground Surface
DRILL RIG TYPE:	TYPE					DATE STARTED 11/8/2001
GROUND WATER DEPTH:	DIA.					DATE FINISHED 11/8/2001
MEASURING POINT:	WEIGHT					DRILLER J. Percy & J. Wheeler
DATE OF MEASUREMENT:	FALL					INSPECTOR G. Sleeman

Depth	Sample Number	Blows on Sample Spoon per 6"	Penetration/Recovery	Unified Classification	GEOLOGIC DESCRIPTION	REMARKS
		3	0-0.7'		0-0.7' Brown SILT, little medium fine Sand, trace medium fine Gravel	Fill, Dry, Loose MW-26 (0-0.7' BS) 8:05
1		8				
		7				
		6				
2		6	2.0-2.7'		2.0-2.7' Brown SILT, trace fine Sand, little medium(+) fine Gravel	Fill, Dry, Loose MW-26 (2.0-2.7' BS) 8:10
3		8				
		7				
		4				
4		2	4.0-5.5'		4.0-4.1' Brown SILT, trace fine Sand, little coarse medium(+) fine Gravel 4.1-5.4' Gray CLAY, trace fine Sand, little medium fine(+) Gravel	Moist Fill Possible Native MW-26 (4.0-5.5' BS) 8:20
5		4				
		7			5.4'	
		6			5.4-5.5' Yellowish Brown to Gray SILT CLAY, some medium fine(+) Gravel	
6		4	6.0-6.6'		6.0-6.6' Yellowish Brown to Gray CLAY, some medium fine(+) Gravel	Moist MW-26 (6.0-6.6' BS) 8:30
7		5				
		8				
		9				
8		5	8.0-8.7'		8.0-8.7' Brownish Gray CLAY, trace medium fine Sand, little medium fine(+) Gravel	Moist MW-26 (8.0-8.7' BS) 8:35
9		10				
		10				
		12				
10						

O'BRIEN & GERE ENGINEERS

TEST BORING LOG

BORING NO. MW-26
(MW-26S as of 01/16)

PROJECT: Revere Smelting and Refining
SHEET 2 OF 2

CLIENT: NYSDEC
JOB NO. 26408.004.400

Depth Ft.	Sample Number	Blows on Sample Spoon per 6"	Penetration Recovery	Unified Classi-fication	GEOLOGIC DESCRIPTION	REMARKS
		8			No Recovery	Saturated No Recovery
11		16				
		8				
		8				
12		12	12.0-13.0'		12.0-13.0' Yellowish Brown CLAY SILT, little coarse(+) medium Sand, some coarse medium fine(+) Gravel	MW-26 (12.0-13.0' BS) 8:50
		11				
13		12				
		10				
14		5	14.0-15.0'		14.0-14.5' Yellowish Brown CLAY SILT, some medium fine(+) Gravel 14.5'	MW-26 (14.0-15.5' BS) 9:15
		9			14.5-15.0' Gray Shale 15.0'	Bedrock at 15.0'
		24				
16		30				
17						
18						
19						
20						
21						
22						

Boring Log: MW-26S-R

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: September 1, 2016

Surface Elevation (feet AMSL*): 502.62
TOC Elevation (feet AMSL*): 505.46
Total Depth (feet): 15.5
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) Brown; fine to medium-grained sand with gravel. Loose. Dry.	
						Silty Clay with Gravel (CL) Brown and gray; with gravel. Stiff. Dry.	
5						***Silty Clay with Gravel (CL)*** Brown, dark gray, black, and green-gray; occasional 1/4" thick layer silty medium sand. Layered. Soft. Wet at ~8 ft bgs.	
10						***Silty Clay with Sand and Gravel*** 10-11.5 ft bgs: Gray silty fine-cse sand. Dense. Wet. 11.5-12.5 ft bgs: Gray and brown silty clay with pebbles. 12.5-14 ft bgs: Yellow-brown and gray silty clay and rocks. Dark gray shale chips at 13 ft bgs. 14-15.5 ft bgs: Brown clayey fine to very coarse sand and gravel. Loose. Wet.	
15						Bottom of Boring at 15.5 feet	
20							
25							

Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

Boring Log: ***MW-27A*** (MW-27S as of 01/16)

Project: Revere Smelting and Refining
Project No.: 080309
Location: Middletown, NY
Completion Date: April 9, 2009

Surface Elevation (feet AMSL*): 480.19
TOC Elevation (feet AMSL*): 482.18
Total Depth (feet): 20
Borehole Diameter (inches): 8.25

*AMSL = Above mean sea level

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Not sampled. See log for soil boring WSP-DP-01 for lithology at this location.	
5							
10							
15							
20						Bottom of Boring at 20 feet	

Geologist(s): Erik S. Reinert
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Lee Penrod
Method: Hollow Stem Auger

WSP Environment & Energy
11190 Sunrise Valley Drive
Reston, VA 20191
(703) 709-6500

Boring Log: WSP-DP-01

Project: Revere Smelting and Refining
Project No.: 080309
Location: Middletown, NY
Completion Date: March 30, 2009

Surface Elevation (feet AMSL*): NM
Total Depth (feet): 19
Borehole Diameter (inches): 3.25

*AMSL = Above mean sea level

Sample Data					Subsurface Profile	
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description
						Ground Surface
	1	NA	- - - -	70		***Silty Gravel with Sand (GM)*** Yellowish-brown (10YR 5/4) sub-rounded gravel, little fine to medium-grained sand, little silt; dense; dry.
5	2	NA	- - - -	50		***Silt (ML)*** Light brownish-gray (2.5Y 6/2) silt, little clay, trace fine to coarse-grained sand, trace sub-rounded gravel, trace roots; loose to medium dense; moist.
10	3	NA	- - - -	60		***Poorly-Graded Gravel with Silt and Sand (GP-GM)*** Grayish-brown (2.5Y 5/2) gravel and cobbles, some fine to medium-grained sand, trace to little silt; dense; moist. ***Poorly-Graded Gravel with Sand (GP)*** Light olive brown (2.5Y 5/4) sub-angular gravel, some fine to coarse-grained sand, trace silt; loose; moist, becoming wet between 13 and 18.8 feet.
15	4	NA	- - - -	100		
20						***Shale*** Dark gray (2.5Y 4/1) shale. Bottom of Boring at 19 feet Refusal on bedrock interface. Set 5 feet of 0.010-inch-slotted 1-inch-diameter polyvinyl chloride screen to collect groundwater sample.

Geologist(s): Erik S. Reinert
Subcontractor: Nothnagle Drilling, Inc.
Driller/Operator: Jeff Schweitzer
Method: Direct Push

WSP Environment & Energy
11190 Sunrise Valley Drive
Reston, VA 20191
(703) 709-6500

Boring Log: ***MW-27B*** (MW-27D as of 01/16)

Project: Revere Smelting and Refining
Project No.: 080309
Location: Middletown, NY
Completion Date: April 9, 2009

Surface Elevation (feet AMSL*): 480.71
TOC Elevation (feet AMSL*): 482.34
Total Depth (feet): 37
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Not Sampled	
2							
4							
6							
8							
10							
12							
14							
16							
18							
20							

Geologist(s): Erik S. Reinert
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Lee Penrod
Method: Down-Hole Air Hammer

WSP Environment & Energy
11190 Sunrise Valley Drive
Reston, VA 20191
(703) 709-6500

Boring Log: ***MW-27B*** (MW-27D as of 01/16)

Project: Revere Smelting and Refining
Project No.: 080309
Location: Middletown, NY
Completion Date: April 9, 2009

Surface Elevation (feet AMSL*): 480.71
TOC Elevation (feet AMSL*): 482.34
Total Depth (feet): 37
Borehole Diameter (inches): 6

*AMSL = Above mean sea level

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
22						Not Sampled *(continued)*	
24							
26	1	NA	- - - -	Total: 70 Solid: 42 RQD: 32		***Shale*** Bluish-black (5PB 2.5/1) shale; strong; fresh; wet; aphanitic, slaty; thinly bedded; slightly decomposed in fractures zones; competent; intensely fractured; fracture zone at 26.5 to 27 feet, 27.9 to 28.7 feet, and 29.2 to 29.5 feet, unknown dip, not healed, infilled with cohesive sediment, oxidized, rough, wet with continuous seepage; joints at 28.9 and 29.1 feet, 10-degree dip, extremely narrow, not healed, surface oxidation, rough, planar, wet with minor seepage.	
28							
30	2	NA	- - - -	Total: 100 Solid: 100 RQD: 95		***Shale*** Bluish-black (5PB 2.5/1) shale; strong; fresh; wet; aphanitic, slaty; thin to medium bedded, slaty texture is not parallel to bedding; fresh; competent; mechanical breaks parallel to slaty cleavage at 30.8, 31.3, 33.3, and 34.1 feet, 35-degree dip, extremely narrow or tight, not healed, no infilling or mineralization, smooth, dry.	
32							
34							
36	3	NA	- - - -	Total: 100 Solid: 100 RQD: 96		***Shale*** Bluish-black (5PB 2.5/1) shale; strong; fresh; wet; aphanitic, slaty; thin to medium bedded, slaty texture is not parallel to bedding; fresh; competent; joints at 35.4 and 35.5 feet, 10-degree dip, extremely to very narrow, not healed, secondary mineralization on fracture surfaces, rough, wet with continuous seepage.	
38						Bottom of Boring at 37 feet Bottom 2 feet of borehole lost due to cave-in from above.	
40							

Geologist(s): Erik S. Reinert
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Lee Penrod
Method: Down-Hole Air Hammer

WSP Environment & Energy
11190 Sunrise Valley Drive
Reston, VA 20191
(703) 709-6500

Boring Log: MW-28S

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: December 15, 2015

Surface Elevation (feet AMSL*): 532.84
TOC Elevation (feet AMSL*): 535.50
Total Depth (feet): 12.5
Borehole Diameter (inches): 8

**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
			1 2 1 6	70		***Lean Clay with Gravel (CL)*** Brown clay with pebbles. Moist. Soft.	
			8 12 15 12	80		***Lean Clay with Gravel (CL)*** Brown, gray, red-brown; clay with shale fragments. Dense. Damp at 6 feet bgs.	
5			28 28 28 25	45			
			16 18 15 20	85			
			38 50/3"	100		***Weathered Siltstone*** Dark gray; dense.	
10							
						Bottom of Boring at 12.5 feet	
15							
20							
25							

Geologist(s): GMB
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Richard Navatla
Method: Hollow Stem Auger

WSP
1740 Massachusetts Avenue
Boxborough, MA 01719

Boring Log: MW-28D

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: December 29, 2015

Surface Elevation (feet AMSL*): 532.625
TOC Elevation (feet AMSL*): 534.40
Total Depth (feet): 23.5
Borehole Diameter (inches): 8/4

**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
			1 2 1 6	70		***Lean Clay with Gravel (CL)*** Brown clay with pebbles. Moist. Soft.	
			8 12 15 12	80		***Lean Clay with Gravel (CL)*** Brown, gray, red-brown; clay with shale fragments and subrounded pebbles. Dense. Damp at 6 feet bgs.	
5			28 28 28 25	45			
			16 18 15 20	85			
			38 50/3"	100		***Weathered Siltstone*** Dark gray; dense. Wet at 11 feet bgs.	
10							
						Siltstone Run 1: Total: 100%; Solid: 75%; RQD 0. Gray laminated siltstone. Fractures approx 15 degree angle.	
15							
						Run 2: Total 100%, solid 97%, RQD 40 % (poor). Slightly inclined bedding, fractures parallel to bedding. Some calcite.	
20							
						Bottom of Boring at 23.5 feet	
25							

Geologist(s): GMB
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Richard Navatla
Method: HSA/core

WSP
1740 Massachusetts Avenue
Boxborough, MA 01719

Boring Log: MW-29S

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: December 17, 2015

Surface Elevation (feet AMSL*): 521.78
TOC Elevation (feet AMSL*): 524.25
Total Depth (feet): 5.5
Borehole Diameter (inches): 8

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
			2 2 1 3	50		***Lean Clay (CL)*** Brown and orange-brown; silty clay. Soft.	
			4 11 10 12	95		***Lean Clay with Gravel (CL)*** Brown; silty clay, rock fragments, subrounded pebbles. Stiff. Damp at 6 ft bgs.	
5			8 10 11 14	50		Bottom of Boring at 5.5 feet	
10							
15							
20							
25							

Geologist(s): GMB
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Richard Navatla
Method: Hollow Stem Auger

WSP
1740 Massachusetts Avenue
Boxborough, MA 01719

Boring Log: MW-29 I

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: December 17, 2015

Surface Elevation (feet AMSL*): 521.545
TOC Elevation (feet AMSL*): 523.61
Total Depth (feet): 15
Borehole Diameter (inches): 8/4

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
			2 2 1 3	50		***Lean Clay (CL)*** Brown and orange-brown; silty clay. Soft.	
			4 11 10 12	95		***Lean Clay with Gravel (CL)*** Brown; silty clay, rock fragments, subrounded pebbles. Stiff. Damp at 6 ft bgs.	
5			8 10 11 14	50			
				100		***Weathered Siltstone*** Run 1: Total recovery 25%. Not intact. Siltstone/shale fragments, some clay.	
10				100		***Siltstone*** Run 2: Total 90%; Solid 62%; RQD 43% (poor). 10-12.5 ft bgs: Rubble. 12.5-15 ft bgs: Gray thinly bedded siltstone, moderately fractured. Fresh.	
15						Bottom of Boring at 15 feet	
20							
25							

Geologist(s): GMB
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Richard Navatla
Method: HSA/core

WSP
1740 Massachusetts Avenue
Boxborough, MA 01719

Boring Log: MW-29D

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: December 30, 2015

Surface Elevation (feet AMSL*): 521.68
TOC Elevation (feet AMSL*): 522.61
Total Depth (feet): 23.5
Borehole Diameter (inches): 8/4

**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
			2 2 1 3	50		***Lean Clay (CL)*** Brown and orange-brown; silty clay. Soft.	
			4 11 10 12	95		***Lean Clay with Gravel (CL)*** Brown; silty clay, rock fragments, subrounded pebbles. Stiff. Damp at 6 ft bgs.	
5			8 10 11 14	50			
			15 15 15 15	50		***Weathered Siltstone***	
10							
15				100		***Siltstone*** Run 1: Total: 100%; Solid 95%; RQD 53% (fair). Pieces 1"-3" from 13.5 to 16.25 ft bgs; slightly broken 16.25-18.5 ft bgs, fractures approx 10 degrees. Gray laminated siltstone. Fresh.	
20				100		Run 2: Total 100%; Solid 100%; RQD 100%. Gray laminated siltstone. Vertical fracture at 19-19.75 ft bgs. Clay on fracture face. Bedding plane fracture at 20.75 ft bgs. Other fractures at ~30 degrees.	
25						Bottom of Boring at 23.5 feet	

Geologist(s): GMB
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Richard Navatla
Method: HSA/core

WSP
1740 Massachusetts Avenue
Boxborough, MA 01719

Boring Log: MW-30S

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: December 18, 2015

Surface Elevation (feet AMSL*): 523.315
TOC Elevation (feet AMSL*): 525.02
Total Depth (feet): 12.5
Borehole Diameter (inches): 8

**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
			4 4 3 3	35		***Lean Clay (CL)*** Orange-brown; silty clay; dense.	
			10 28 17 30	50		***Poorly-Graded Gravel with Clay (GP-GC)*** Brown and gray; subrounded limesstone pebbles, fine sand, clay. Loose, becoming dense at 6 feet bgs. Damp at 11 ft bgs.	
5			12 33 40 20	65			
			30 24 26 20	75			
			10 22 28 40	50			
10			22 50/4"	50			
			50/2'			***Weathered Siltstone*** Gray siltstone and clay.	
						Bottom of Boring at 12.5 feet	
15							
20							
25							

Geologist(s): GMB
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Richard Navatla
Method: Hollow Stem Auger

WSP
1740 Massachusetts Avenue
Boxborough, MA 01719

Boring Log: MW-30D

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: December 29, 2015

Surface Elevation (feet AMSL*): 522.83
TOC Elevation (feet AMSL*): 523.78
Total Depth (feet): 23.5
Borehole Diameter (inches): 8/4

**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
			4 4 3 3	35		***Lean Clay (CL)*** Orange-brown; silty clay; dense.	
			10 28 17 30	50		***Poorly-Graded Gravel with Clay (GP-GC)*** Brown and gray; subrounded limesstone pebbles, fine sand, clay. Loose, becoming dense at 6 feet bgs. Damp at 11 ft bgs.	
5			12 33 40 20	65			
			30 24 26 20	75			
			10 22 28 40	50			
10			22 50/4"	50			
			50/2'			***Weathered Siltstone*** Gray siltstone fragments and clay.	
15						***Siltstone*** Run 1: Total 100%, solid 95%, RQD 62% (fair). Dark gray laminated siltstone. Fresh. Intensely fractured 16-18.5 ft bgs.	
20						Run 2: Toral 100%, Solid 97%, RQD 85% (good). Vertical fracture at ~22.7-23 ft bgs.	
25						Bottom of Boring at 23.5 feet	

Geologist(s): GMB
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Richard Navatla
Method: HSA/core

WSP
1740 Massachusetts Avenue
Boxborough, MA 01719

Boring Log: MW-31S

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: September 6, 2016

Surface Elevation (feet AMSL*): 515.73
TOC Elevation (feet AMSL*): 518.37
Total Depth (feet): 13
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) Brown; fine to medium-grained sand with gravel. Loose. Dry.	
						Silty Clay with Gravel (CL) Gray and brown; with gravel and shale chips. Stiff. Wet at ~11 ft bgs.	
5							
10							
						Siltstone Dark gray. Weathered.	
15						Bottom of Boring at 13 feet	
20							
25							

Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

Boring Log: MW-31D

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: September 6, 2016

Surface Elevation (feet AMSL*): 514.82
TOC Elevation (feet AMSL*): 517.77
Total Depth (feet): 24
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) Brown; fine to medium-grained sand with gravel. Loose. Dry.	
						Silty Clay with Gravel (CL) Gray and brown; with gravel and shale chips. Stiff.	
5							
10							
						Siltstone Dark gray. Thinly to massively bedded.	
15							
20							
						Bottom of Boring at 24 feet	
25							

Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

Boring Log: MW-32S

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: September 6, 2016

Surface Elevation (feet AMSL*): 530.07
TOC Elevation (feet AMSL*): 532.73
Total Depth (feet): 14.5
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) Brown; fine to medium-grained sand with gravel. Loose. Dry.	
5						***Silty Clay with Gravel (CL)*** Gray and brown; with gravel and shale chips. Stiff. Damp at ~11 ft bgs.	
10							
						Siltstone Dark gray. Weathered.	
15						Bottom of Boring at 14.5 feet	
20							
25							

Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

Boring Log: MW-32D

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: September 1, 2016

Surface Elevation (feet AMSL*): 530.21
TOC Elevation (feet AMSL*): 532.97
Total Depth (feet): 27
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) Brown; fine to medium-grained sand with gravel. Loose. Dry.	
5						***Silty Clay with Gravel (CL)*** Dark gray, black, brown, bluish; with gravel and shale chips. Stiff. Dry.	
						Silty Clay with Gravel (CL) Brown and gray; with pebbles and rocks. Dense.	
10							
15							
						Siltstone Dark gray. Thinly to massively bedded. Fractured.	
20							
25							
						Bottom of Boring at 27 feet	
30							

Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

Boring Log: MW-33S

Project: Revere Smelting & Refining
Project No.: E0031786
Location: Middletown, NY
Completion Date: August 30, 2016

Surface Elevation (feet AMSL*): 514.80
TOC Elevation (feet AMSL*): 517.57
Total Depth (feet): 7.5
Borehole Diameter (inches): 6

**AMSL = Above mean sea level*

WSP PARSONS BRINCKERHOFF

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silty Sand with Gravel (SM) 1" topsoil Brown; silty fine to medium-grained sand with gravel. Loose. Dry.	
5						***Silty Clay with Gravel (CL)*** Gray, orange-brown, and brown; with gravel and shale chips. Stiff.	
						Siltstone Dark gray.	
10						Bottom of Boring at 7.5 feet	
15							
20							
25							

Geologist(s): GMB
Subcontractor: ADT-Cascade
Driller/Operator: Brian Karshick
Method: Rotosonic

WSP USA Corp.
75 Arlington St., 4th Floor
Boston, MA 02116

Boring Log: PZ-1

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 23, 1999

Surface Elevation (feet AMSL*): 529.00

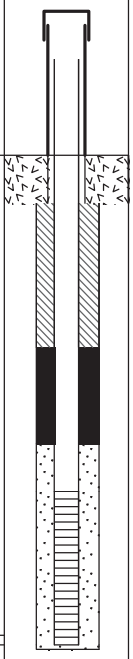
TOC Elevation (feet AMSL*): 531.13

Total Depth (feet): 10.2

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	9 11 18 23	NR		Silt (GM) Brown silt, little to some gravel, little to some fine to medium-grained sand; moist; very loose to medium dense	
	2	NA	21 20 23 13	NR			
5	3	NA	8 10 8 13	NR			
	4	NA	12 13 7 6	NR			
	5	NA	- - - -	NR			
10						Weathered Bedrock Dark grey weathered shale; moist; dense. Bottom of Boring at 10.2 feet	
15							
20							



Geologist(s): E. Michael Riggins

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

Environmental Strategies Consulting LLC
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Reston, VA 20190
703-709-6500

Boring Log: PZ-2

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 24, 1999

Surface Elevation (feet AMSL*): 527.69

TOC Elevation (feet AMSL*): 529.75

Total Depth (feet): 14.2

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	7 10 10 13	NR		Silt (GM) Brown silt, little to some gravel, little to some fine to medium-grained sand; trace to little clay; dry; medium dense to dense. Moist between 6 and 8 feet. Wet between 8 and 10 feet.	
	2	NA	21 25 25 23	NR			
5	3	NA	9 18 24 16	NR			
	4	NA	14 20 16 12	NR			
	5	NA	6 7 7 55	NR			
10	6	NA	11 14 16 17	NR		Weathered Bedrock Dark grey weathered shale; moist to wet; dense.	
	7	NA	12 15 14 11	NR			
15						Bottom of Boring at 14.2 feet	
20							

Geologist(s): E. Michael Riggins

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

Environmental Strategies Consulting LLC
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Boring Log: PZ-3

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 24, 1999

Surface Elevation (feet AMSL*): 523.82

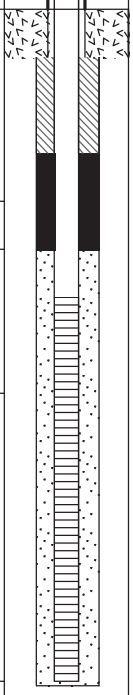
TOC Elevation (feet AMSL*): 525.72

Total Depth (feet): 14

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	4 6 6 65	NR		Silt (GM) Yellowigh-brown silt, little to some gravel, little clay, trace fine-grained sand; dry; medium dense to dense	
	2	NA	21 24 6 5	NR			
5	3	NA	1 2 1 4	NR		Clay (CL) Bluish-grey clay, trace silt, trace gravel; moist; plastic, soft.	
	4	NA	4 2 2 4	NR		Silt (ML) Grey silt; trace clay, some organic material near 5 feet; wet; medium dense	
	5	NA	4 5 9 30	NR			
10	6	NA	7 17 9 11	NR		Weathered Bedrock Dark grey weathered shale; wet; dense	
	7	NA	4 8 30 50	NR			
15						Bottom of Boring at 14 feet	
20							



Geologist(s): E. Michael Riggins

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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703-709-6500

Boring Log: PZ-4

Project: RSR-Middletown
Project No.: 214861
Location: Middletown, NY
Completion Date: August 24, 1999

Surface Elevation (feet AMSL*): 522.92
TOC Elevation (feet AMSL*): 524.74
Total Depth (feet): 14
Borehole Diameter (inches): 8.25
**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	4 7 7 7	NR		Sand (SM) - Fill Material Brown to dark-brown medium-grained sand, trace silt; dry; loose	
	2	NA	3 2 2 3	NR		Clay (CL) Reddish-brown to greenish-grey clay, trace silt, trace gravel; moist; plastic, soft	
5	3	NA	2 2 3 6	NR		Silt (GM) Bluish-grey silt, trace to some fine sand, trace gravel; moist; medium dense.	
	4	NA	5 5 3 6	NR		Wet between 6 and 8 feet.	
	5	NA	7 7 7 12	NR		Weathered Bedrock Dark grey weathered shale; wet, dense	
10	6	NA	6 8 8 13	NR			
	7	NA	9 9 50 -	NR			
15						Bottom of Boring at 14 feet	
20							

Geologist(s): E. Michael Riggins
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Mick Marshall, Rick Navata
Method: Hollow Stem Auger

Environmental Strategies Consulting LLC
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Reston, VA 20190
703-709-6500

Boring Log: PZ-5

Project: RSR-Middletown
Project No.: 214861
Location: Middletown, NY
Completion Date: August 30, 1999

Surface Elevation (feet AMSL*): 523.06
TOC Elevation (feet AMSL*): 522.64
Total Depth (feet): 14
Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	12 11 9 8	50		Silt (GM) - Fill Material Brown silt, some gravel, trace-fine-grained sand; dry; loose to medium dense.	
	2	NA	2 2 1 3	0			
5	3	NA	1 2 2 4	50		Silt (ML) Dark grey to brown silt and clay; moist; loose.	
	4	NA	2 3 5 7	75			
	5	NA	3 3 5 5	50			
10	6	NA	5 5 12 14	75		Sand (SP) Greenish-grey to grey fine-grained sand, some medium-grained sand; wet; loose; faint solvent-like odor between 9.8 and 10 feet.	
	7	NA	18 12 50 -	100		Silt (ML) Dark grey silt, little clay, trace coarse-grained sand; moist; loose to medium dense.	
15						Weathered Bedrock Grey weathered shale; moist to wet; medium dense.	
						Bottom of Boring at 14 feet	
20							

Geologist(s): David P. Bouchard
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Mick Marshall, Rick Navata
Method: Hollow Stem Auger

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Boring Log: PZ-6

Project: RSR-Middletown
Project No.: 214861
Location: Middletown, NY
Completion Date: August 25, 1999

Surface Elevation (feet AMSL*): 522.74
TOC Elevation (feet AMSL*): 524.39
Total Depth (feet): 15
Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	5 7 7 5	83		Silt (GM) - Fill Material Brown to greyish-brown silt, little to some gravel; dry; loose.	
	2	NA	3 4 3 1	75			
5	3	NA	1 1 2 2	50		Silt (ML) Grey silt; moist; loose. Wet between 6.0 and 7.5 feet.	
	4	NA	2 3 3 4	100			
	5	NA	4 6 9 11	25			
10	6	NA	6 9 9 18	25		Weathered Bedrock Dark grey weathered shale; wet; medium dense to dense.	
	7	NA	12 12 11 10	50			
	8	NA	9 14 - -	100			
15						Bottom of Boring at 15 feet	
20							

Geologist(s): David P. Bouchard
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Mick Marshall, Rick Navata
Method: Hollow Stem Auger

Environmental Strategies Consulting LLC
11911 Freedom Drive, Suite 900
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703-709-6500

Boring Log: PZ-7

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 25, 1999

Surface Elevation (feet AMSL*): 519.80

TOC Elevation (feet AMSL*): 521.38

Total Depth (feet): 10

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	9 19 11 7	50		Sand (SP) - Fill Material Brown medium to fine-grained sand, little gravel; dry; loose	
	2	NA	6 7 9 19	100		Silt (ML) Greyish-brown to grey silt, trace to little clay, little gravel; moist; loose to medium dense	
5	3	NA	10 18 17 20	83		Weathered Bedrock Dark grey to brownish-grey weathered shale; moist; medium dense to dense	
	4	NA	9 15 14 14	83		Wet between 5.8 and 10 feet.	
	5	NA	40 45 48 35	25			
10						Bottom of Boring at 10 feet	
15							
20							

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

Environmental Strategies Consulting LLC
11911 Freedom Drive, Suite 900
Reston, VA 20190
703-709-6500

Boring Log: PZ-8

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 25, 1999

Surface Elevation (feet AMSL*): 528.86

TOC Elevation (feet AMSL*): 527.62

Total Depth (feet): 13.4

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	2 4 4 5	83		Silt (ML) Brown to greyish-brown to grey silt, little to no gravel; dry; loose to dense	
	2	NA	9 28 19 20	50			
5	3	NA	24 30 38 28	25			
	4	NA	26 35 43 42	75			
	5	NA	4 11 12 13	50		Weathered Bedrock Brown to greyish-brown weathered shale; moist; medium dense. Wet between 9.8 and 13.4 feet.	
10	6	NA	9 13 11 13	75			
	7	NA	27 51 50 -				
						Bottom of Boring at 13.4 feet	
15							
20							

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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Boring Log: PZ-9

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 31, 1999

Surface Elevation (feet AMSL*): 519.76

TOC Elevation (feet AMSL*): 521.52

Total Depth (feet): 15.2

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silt and Gravel (GM) - Fill Material Brown silt and gravel, little fine to coarse sand; dry; loose	
5	1	NA	4 6 9 11	100		Silt (GM) Brown to greyish-brown silt, little to no gravel, trace fine-grained sand, trace clay; dry; loose to medium dense.	
	2	NA	4 10 10 16	100		Wet between 8.25 and 8.5 feet.	
	3	NA	10 16 22 29	83			
10	4	NA	22 29 50 -	29		Weathered Bedrock Grey to greyish-brown weathered shale; wet; medium dense to dense.	
	5	NA	24 40 12 10	75			
	6	NA	30 49 50 -	50			
15						Bottom of Boring at 15.2 feet	
20							

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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Boring Log: PZ-10

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 25, 1999

Surface Elevation (feet AMSL*): 517.68

TOC Elevation (feet AMSL*): 519.54

Total Depth (feet): 13.1

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	5 17 29 39	50		Silt (ML) Light brown to brown silt, trace to little gravel; dry; loose to medium dense.	
	2	NA	11 14 20 26	75			
5	3	NA	8 4 2 3	75			
	4	NA	2 5 6 12	75		Silt (GM) Brown silt, little to some gravel, little to some fine to medium-grained sand; moist; very loose to medium dense.	
	5	NA	16 16 9 11	50		Sand (SP Brown medium to fine-grained sand; wet; loose.	
10	6	NA	7 8 8 15	50		Silt (GM) Brown to grey silt; some shale gravel, little sand; moist to wet; medium dense to very dense	
	7	NA	17 37 50 -	100			
						Bottom of Boring at 13.1 feet	
15							
20							

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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Boring Log: PZ-11

Project: RSR-Middletown
Project No.: 214861
Location: Middletown, NY
Completion Date: August 31, 1999

Surface Elevation (feet AMSL*): 516.84
TOC Elevation (feet AMSL*): 519.18
Total Depth (feet): 14
Borehole Diameter (inches): 8.25
**AMSL = Above mean sea level*

Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silt and Gravel (GM) - Fill Material Brown silt and gravel, little fine to coarse sand; dry; loose.	
5	1	NA	4 10 12 16	50		Silt (GM) Brown to greyish-brown silt, some medium to fine-grained sand, little to no gravel, trace cobbles; dry; loose to very dense.	
	2	NA	12 21 32 50	50		Wet between 11.5 and 13.5 feet.	
	3	NA	6 8 50 -	33			
10	4	NA	10 21 33 31	50			
	5	NA	12 23 29 31	50			
15						Weathered Bedrock Grey to greyish-brown weathered shale; wet; medium dense to dense	
						Bottom of Boring at 14 feet	
20							

Geologist(s): David P. Bouchard
Subcontractor: Parratt Wolff, Inc.
Driller/Operator: Mick Marshall, Rick Navata
Method: Hollow Stem Auger

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Boring Log: PZ-12

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: August 30, 1999

Surface Elevation (feet AMSL*): 512.72

TOC Elevation (feet AMSL*): 514.80

Total Depth (feet): 14

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	3 4 3 5	50		Silt (GM) Brown to greyish-brown silt, some gravel, little to some fine-grained sand; dry; loose to medium dense.	
	2	NA	4 6 5 10	50		Wet between 8 and 10 feet.	
5	3	NA	36 23 46 42	50			
	4	NA	46 45 50 -	25			
	5	NA	12 35 43 25	50			
10	6	NA	5 16 36 31	50		Weathered Bedrock Grey to greyish-brown weathered shale; wet; medium dense to dense.	
	7	NA	25 19 21 50	50			
15						Bottom of Boring at 14 feet	
20							

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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Boring Log: PZ-13

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: September 1, 1999

Surface Elevation (feet AMSL*): 514.17

TOC Elevation (feet AMSL*): 514.86

Total Depth (feet): 30

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
						Silt and Gravel (GM) - Fill Material Brown silt and gravel, little fine to coarse sand; dry; loose.	
5	1	NA	7 18 7 12	50			
	2		7 7 6 6	0			
	3		4 2 2 5	25		Silt (GM) Greyish-brown to greyish-black silt, some to little gravel, trace to no fine to medium-grained sand, trace cobbles; dry to moise; loose to medium dense.	
10	4		2 3 4 5	50		Wet between 11.5 and 13.5 feet	
	5		3 3 3 4	50			
	6		15 50 - -	0			
15	7		13 19 23 27	50			
	8		28 50 - -	0			
20	9		19 50 -	0			
	10		15 29 20 32	75			

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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Boring Log: PZ-13

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: September 1, 1999

Surface Elevation (feet AMSL*): 514.17

TOC Elevation (feet AMSL*): 514.86

Total Depth (feet): 30

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
25	11		16 26 21 26	75		Sand (SP) Greyish-brown medium to fine-grained sand, some gravel, little silt; moist; medium dense to dense. *(continued)*	
	12		25 27 20 33	75			
	13		22 13 22 50	100		Silt and Gravel (GM) Greyish-brown silt and gravel, trace fine sand; wet; medium dense to dense.	
30						Weathered Bedrock Grey to greyish-brown weathered shale; moist; medium dense to dense Bottom of Boring at 30 feet	
35							
40							
45							

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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Boring Log: PZ-14

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: September 2, 1999

Surface Elevation (feet AMSL*): 506.81

TOC Elevation (feet AMSL*): 508.77

Total Depth (feet): 24

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA	4 5 4 4	50		Silt (GM) Greyish-brown to brown silt, some to little gravel, trace to no fine to medium-grained sand, trace cobbles; dry to moist; loose to dense. Wet between 21 to 23.5, moist between 23.5 and 24	
	2		1 2 3 5	25			
5	3		5 6 5 5	50			
	4		4 3 3 4	25			
	5		4 7 6 6	75			
10	6		10 12 12 10	25			
	7		16 23 18 26	50			
15	8		23 54 30 20	25			
	9		47 50 - -	100			
	10		14 17 32 44	75			
20	11		15 20 32 32	75			
	12		11 23 40 31	75			
25						Bottom of Boring at 24 feet	

Geologist(s): David P. Bouchard

Subcontractor: Parratt Wolff, Inc.

Driller/Operator: Mick Marshall, Rick Navata

Method: Hollow Stem Auger

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Boring Log: PZ-15

Project: RSR-Middletown
Project No.: 214861
Location: Middletown, NY
Completion Date: September 19, 2011

Surface Elevation (feet AMSL*):
TOC Elevation (feet AMSL*):
Total Depth (feet): 8
Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
5	1	NA		50		***Lean Clay with Gravel (CL)*** Logged from cuttings: interbedded gravelly clay and weathered shale gravel.	
10						Bottom of Boring at 10 feet	
15							
20							

Geologist(s): Steven Dawson
Subcontractor: Aquifer Drilling & Testing, Inc.
Driller/Operator: Shawn Miller
Method: Hollow Stem Auger

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Boring Log: PZ-16

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: September 19, 2011

Surface Elevation (feet AMSL*):

TOC Elevation (feet AMSL*):

Total Depth (feet): 13

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA		50		***Lean Clay (CL)*** Brown sandy lean clay (CL) ; stiff; trace gravel from 0 to 0.5 feet bgs; organic from 0 to 0.5 feet bgs; grading to silty clay from 0.5 to 4 feet bgs; moist.	
	2	NA		50			
5	3	NA		20		***Well-Graded Gravel (GW)*** Weathered shale; angular broken gravel.	
						Lean Clay with Gravel (CL) Light brown gravely clay (CL); few sand; grading to weathered shale.	
	4	NA		50			
10	5	NA		50			
	6	NA		100			
						Bottom of Boring at 13 feet	
15							
20							

Geologist(s): Steven Dawson

Subcontractor: Aquifer Drilling & Testing, Inc.

Driller/Operator: Shawn Miller

Method: Hollow Stem Auger

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Boring Log: PZ-17

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: September 19, 2011

Surface Elevation (feet AMSL*):

TOC Elevation (feet AMSL*):

Total Depth (feet): 13

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA		10		***Well-Graded Gravel with Clay (GW-GC)*** Gray gravel; trace clay; unconsolidated; moist.	
	2	NA		0			
5	3	NA		20			
	4	NA		100		***Lean Clay (CL)*** Brown silty clay; trace sand; stiff; trace gravel from 6 to 7 feet bgs; moist.	
10	5	NA		100		***Well-Graded Gravel (GW)*** Sandy gravel; weathered shale; moist. (logged cuttings from 8 to 13 feet bgs: weathered shale with some clay sediment)	
15						Bottom of Boring at 14.65 feet	
20							

Geologist(s): Steven Dawson

Subcontractor: Aquifer Drilling & Testing, Inc.

Driller/Operator: Shawn Miller

Method: Hollow Stem Auger

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Boring Log: PZ-18

Project: RSR-Middletown

Project No.: 214861

Location: Middletown, NY

Completion Date: September 19, 2011

Surface Elevation (feet AMSL*):

TOC Elevation (feet AMSL*):

Total Depth (feet): 13

Borehole Diameter (inches): 8.25

**AMSL = Above mean sea level*

Sample Data					Subsurface Profile		
Depth	Sample/Interval	PID/OVM (ppm)	Blow Count	% Recovery	Lithology	Description	Well Details
						Ground Surface	
	1	NA		50		***Gravelly Lean Clay (CL)*** Dark brown organic silt (GM); some clay; trace gravel; soft; moist.	
	2	NA		50		***Lean Clay (CL)*** Dark brown gravelly clay (CL); some silt; trace sand; hard; moist.	
5	3	NA		10		***Silty Gravel (GM)*** Grayish brown silt (GM); some highly weathered gravel; moist.	
	4	NA		20		***Lean Clay (CL)*** Dark brown gravelly clay (CL); little sand; stiff; moist; becoming wet from 10 to 12 feet bgs.	
	5	NA		50			
10	6	NA		20			
						Well-Graded Gravel with Clay (GW-GC) Dark brown weathered shale; some unconsolidated clay sediment; wet.	
						Bottom of Boring at 13 feet	
15							
20							

Geologist(s): Steven Dawson

Subcontractor: Aquifer Drilling & Testing, Inc.

Driller/Operator: Shawn Miller

Method: Hollow Stem Auger

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Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-14R**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/16/2018	**Drill End Date:** 8/16/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 26	**Bore Diameter:** 6	**Ground Surface:** 505.79 ft
Coordinates (X/Y): 530535.1406/956551.0873	**Well Permit Number:**		**Top-of-Casing:** 509.14 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	14 to 24	**Filter Pack:** US SIlica #1	13 to 24
Riser: Schedule 40 PVC Riser	2	-3.3 to 14	**Seal:** Hydrated Bentonite Chips	10 to 13
Other:			**Other:** Cement-Bentonite Grout	1 to 10

Depth (ft)	Elevation (ft)	Type	Lab Sample	Recovery (%)	Graphic Log	Notes: / Physical Description	Well
						Ground Surface	
2	504			80		***Poorly-Graded Gravel with Sand (gp)*** Gray; gravel fill.	
4	502						4.5
6	500			65		***Clay*** Red; stiff.	
8	498						8
10	496			70		***Clayey Silt with Gravel (ml)*** Brown; soft; some fine-grained sand.	
12	494						
14	492						
16	490			80			
18	488						

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Project Name: Revere Smelting & Refining	Client: RSR	Location: Middletown, NY	Boring Log: PZ-14R

Notes:

Depth (ft)	Elevation (ft)	Type	Lab Sample	Recovery (%)	Graphic Log	Physical Description	Well
22	484			80		***Clayey Silt with Gravel (ml)*** Brown; soft; some fine-grained sand. *(continued)*	
24	482						
				100			25
26	480					***Siltstone*** Dark gray.	
						Bottom of Boring at 26 feet. All soil classification based on visual descriptions made during the installation of the boring, unless noted otherwise.	
28	478						
30	476						
32	474						
34	472						
36	470						
38	468						
40	466						
42	464						
44	462						

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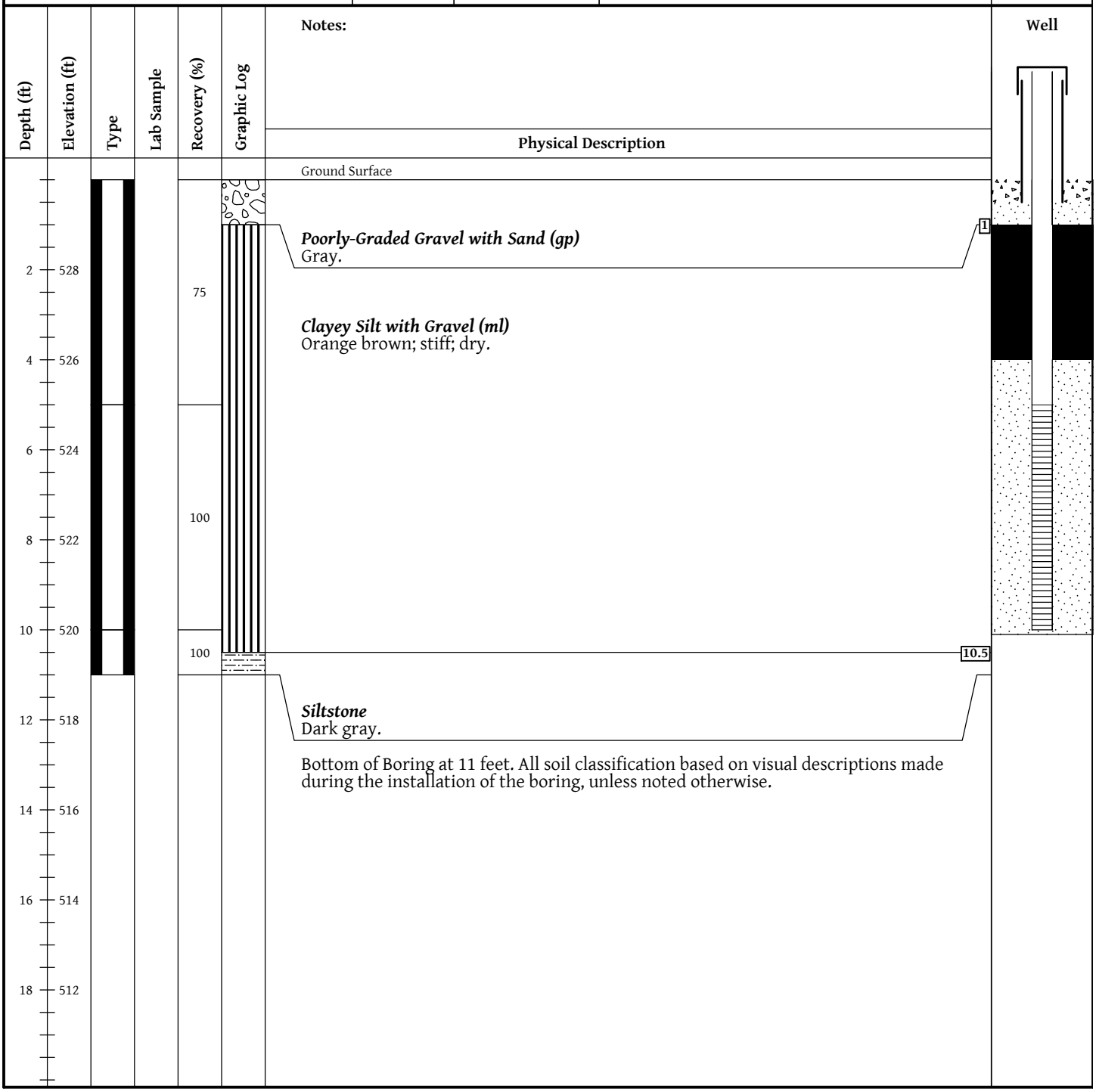
Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-19**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/15/2018	**Drill End Date:** 8/15/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 11	**Bore Diameter:** 6	**Ground Surface:** 529.55 ft
Coordinates (X/Y): 530920.7086/957625.1958	**Well Permit Number:**		**Top-of-Casing:** 532.19 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	5 to 10	**Filter Pack:** US SIlica #1	4 to 10
Riser: Schedule 40 PVC Riser	2	-2.6 to 5	**Seal:** Hydrated Bentonite Chips	1 to 4
Other:			**Other:**	



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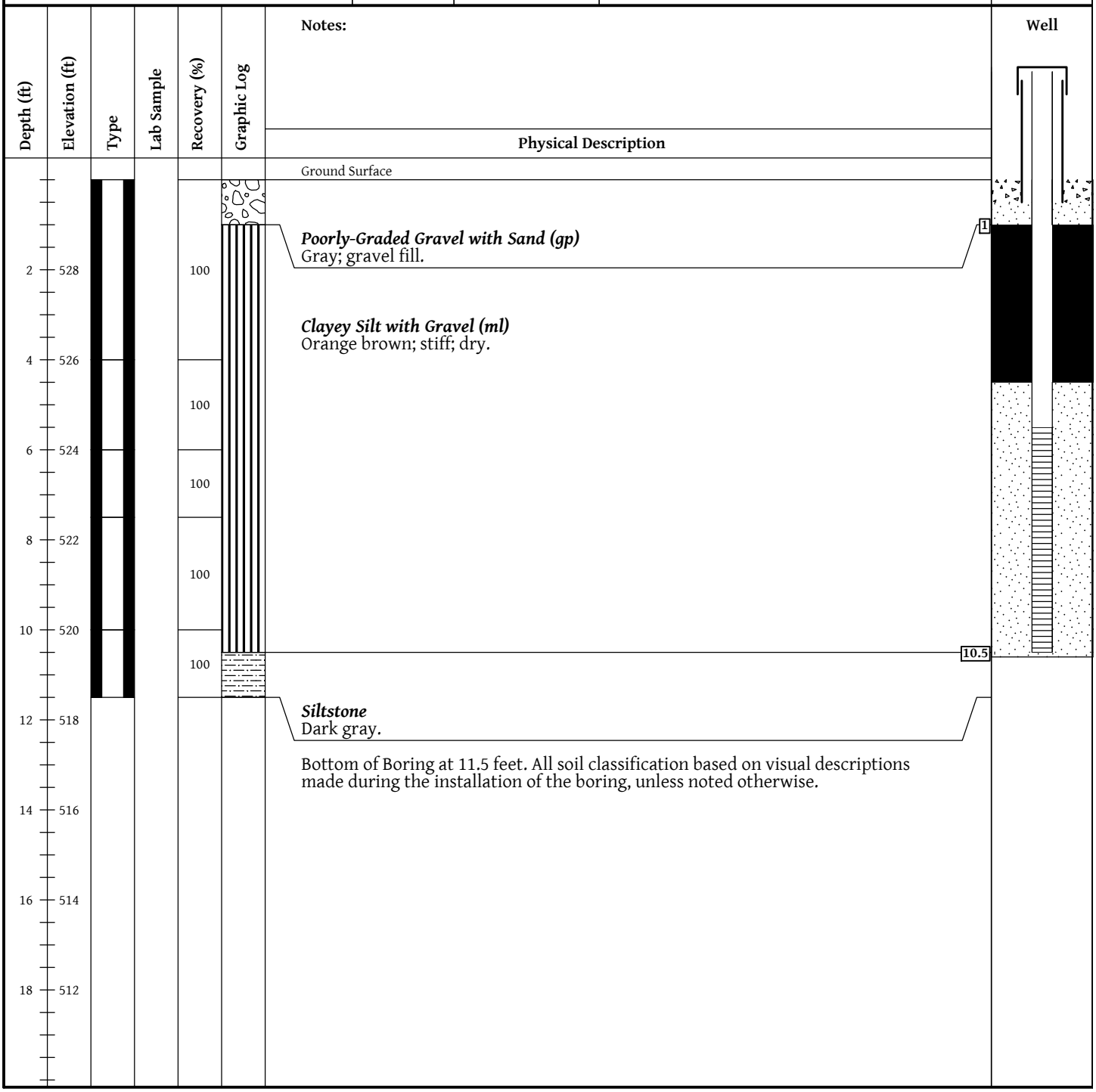
Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-20**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/13/2018	**Drill End Date:** 8/14/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 11.5	**Bore Diameter:** 6	**Ground Surface:** 530.09 ft
Coordinates (X/Y): 530928.9991/957659.8253	**Well Permit Number:**		**Top-of-Casing:** 533.06 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	5.5 to 10.5	**Filter Pack:** US SIlica #1	4.5 to 10.5
Riser: Schedule 40 PVC Riser	2	-3 to 5.5	**Seal:** Hydrated Bentonite Chips	1 to 4.5
Other:			**Other:**	to



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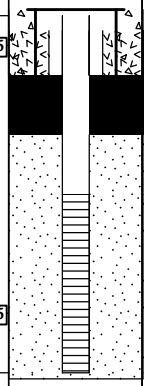
Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-21**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/15/2018	**Drill End Date:** 8/15/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 6	**Bore Diameter:** 6	**Ground Surface:** 518.74 ft
Coordinates (X/Y): 530960.6726/957341.7299	**Well Permit Number:**		**Top-of-Casing:** 518.39 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	3 to 6	**Filter Pack:** US SIlica #1	2 to 6
Riser: Schedule 40 PVC Riser	2	0.35 to 3	**Seal:** Hydrated Bentonite Chips	0.5 to 2
Other:			**Other:**	to

Notes:

Depth (ft)	Elevation (ft)	Type	Lab Sample	Recovery (%)	Graphic Log	Physical Description
0	518					Ground Surface
				92		***Poorly-Graded Gravel with Sand (gp)*** Gray; gravel fill.
2	517					
				100		***Clayey Silt with Gravel (ml)*** Orange brown; stiff; dry.
4	515					
				100		
6	513					***Siltstone*** Dark gray.
8	511					Bottom of Boring at 6 feet. All soil classification based on visual descriptions made during the installation of the boring, unless noted otherwise.
10	509					
12	507					
14	505					
16	503					
18	501					

Well



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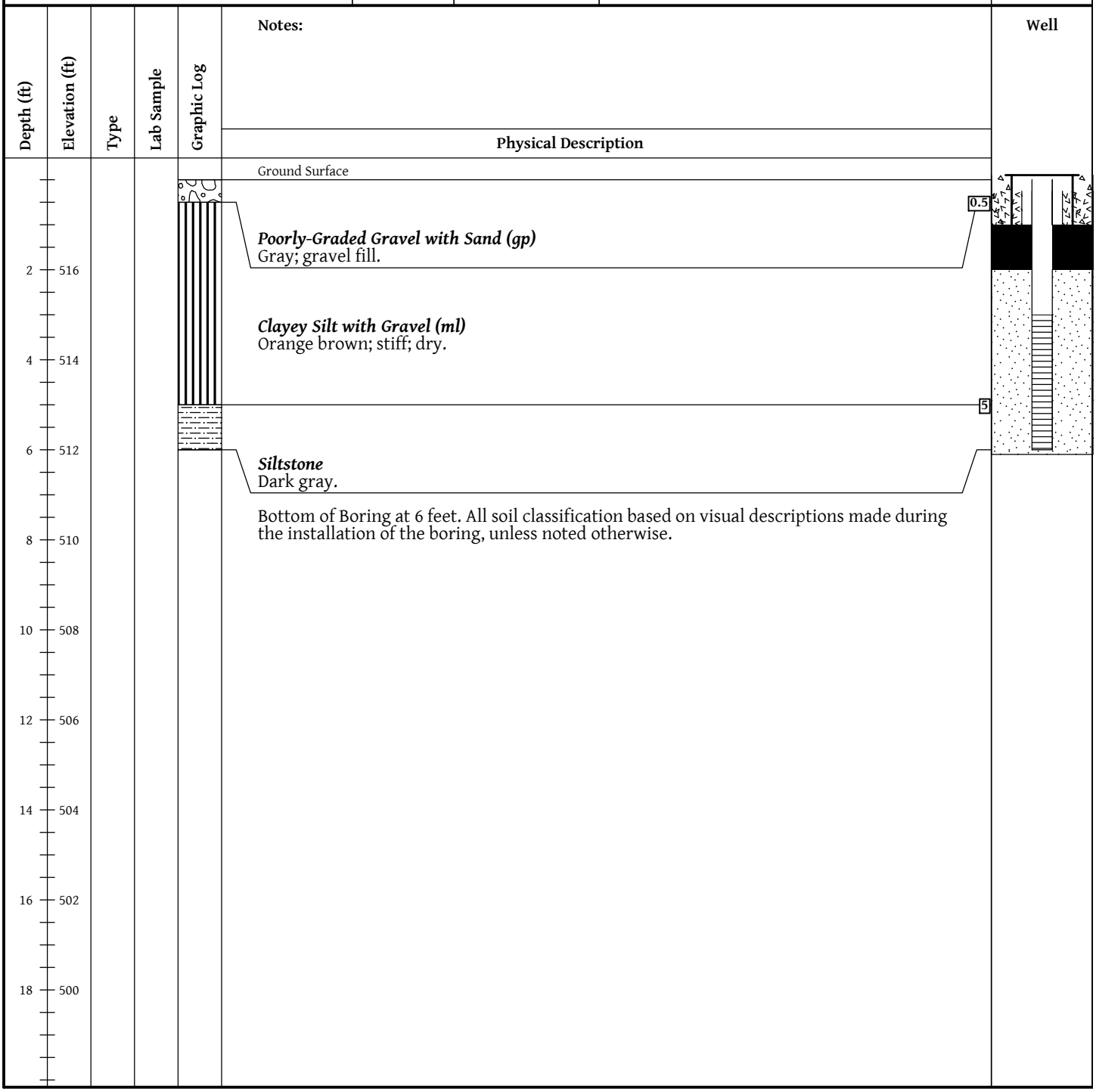
Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-22**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/15/2018	**Drill End Date:** 8/15/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 6	**Bore Diameter:** 6	**Ground Surface:** 517.63 ft
Coordinates (X/Y): 530974.9407/957338.2745	**Well Permit Number:**		**Top-of-Casing:** 517.09 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	3 to 6	**Filter Pack:** US SIlica #1	2 to 6
Riser: Schedule 40 PVC Riser	2	0.5 to 3	**Seal:** Hydrated Bentonite Chips	1 to 2
Other:			**Other:**	to



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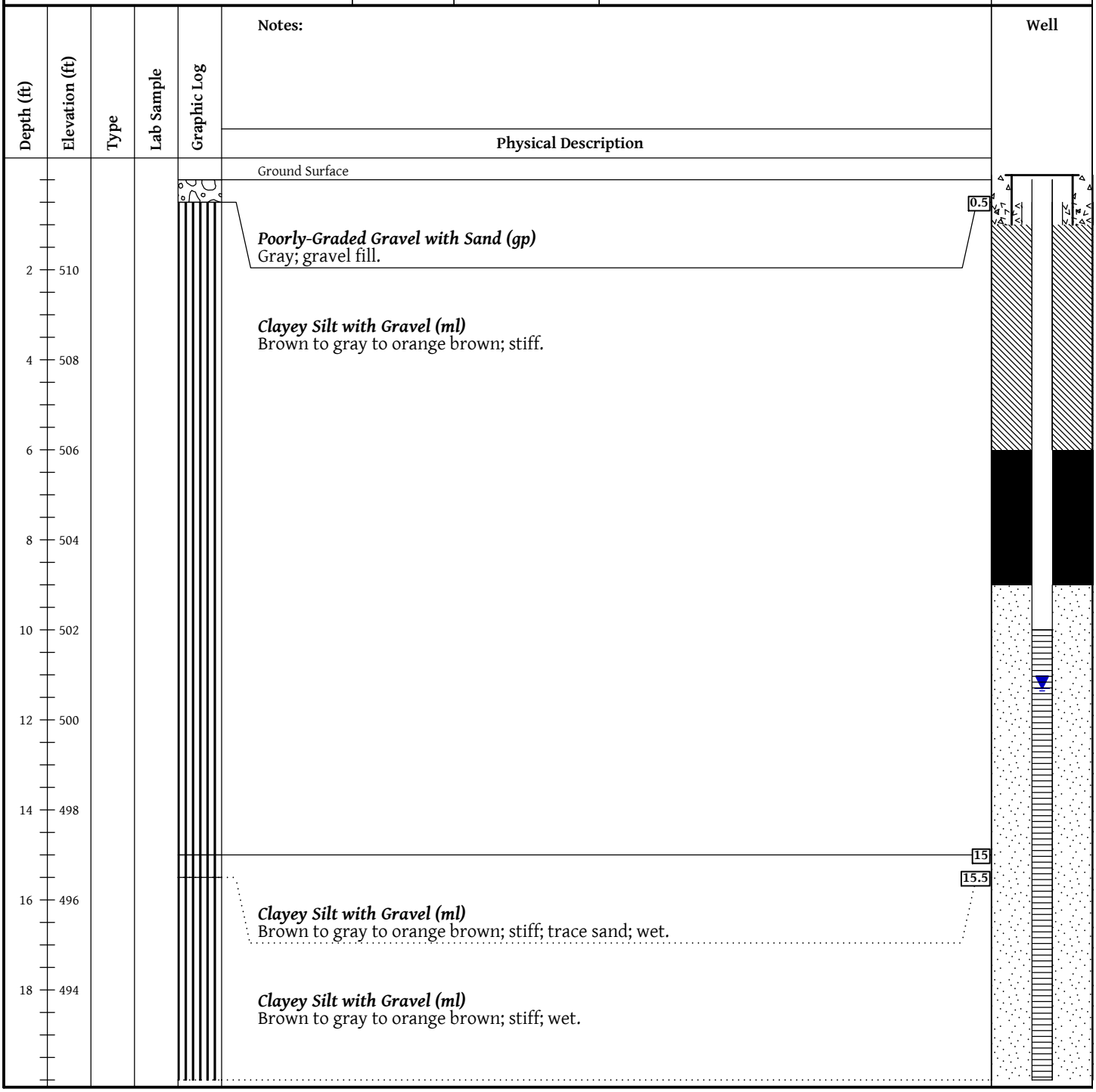
Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-23**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/15/2018	**Drill End Date:** 8/15/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 21	**Bore Diameter:** 6	**Ground Surface:** 512.38 ft
Coordinates (X/Y): 530781.7573/956954.8978	**Well Permit Number:**		**Top-of-Casing:** 511.96 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	10 to 20	**Filter Pack:** US SIlica #1	9 to 20
Riser: Schedule 40 PVC Riser	2	0.4 to 10	**Seal:** Hydrated Bentonite Chips	6 to 9
Other:			**Other:** Cement-Bentonite Grout	1 to 6



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Project Name: Revere Smelting & Refining	Client: RSR	Location: Middletown, NY	Boring Log: PZ-23

Notes:

Well

20

Depth (ft)	Elevation (ft)	Type	Lab Sample	Graphic Log	Physical Description
22	490				***Siltstone*** Dark gray.
24	488				
26	486				
28	484				
30	482				
32	480				
34	478				
36	476				
38	474				
40	472				
42	470				
44	468				

Bottom of Boring at 21 feet. All soil classification based on visual descriptions made during the installation of the boring, unless noted otherwise.

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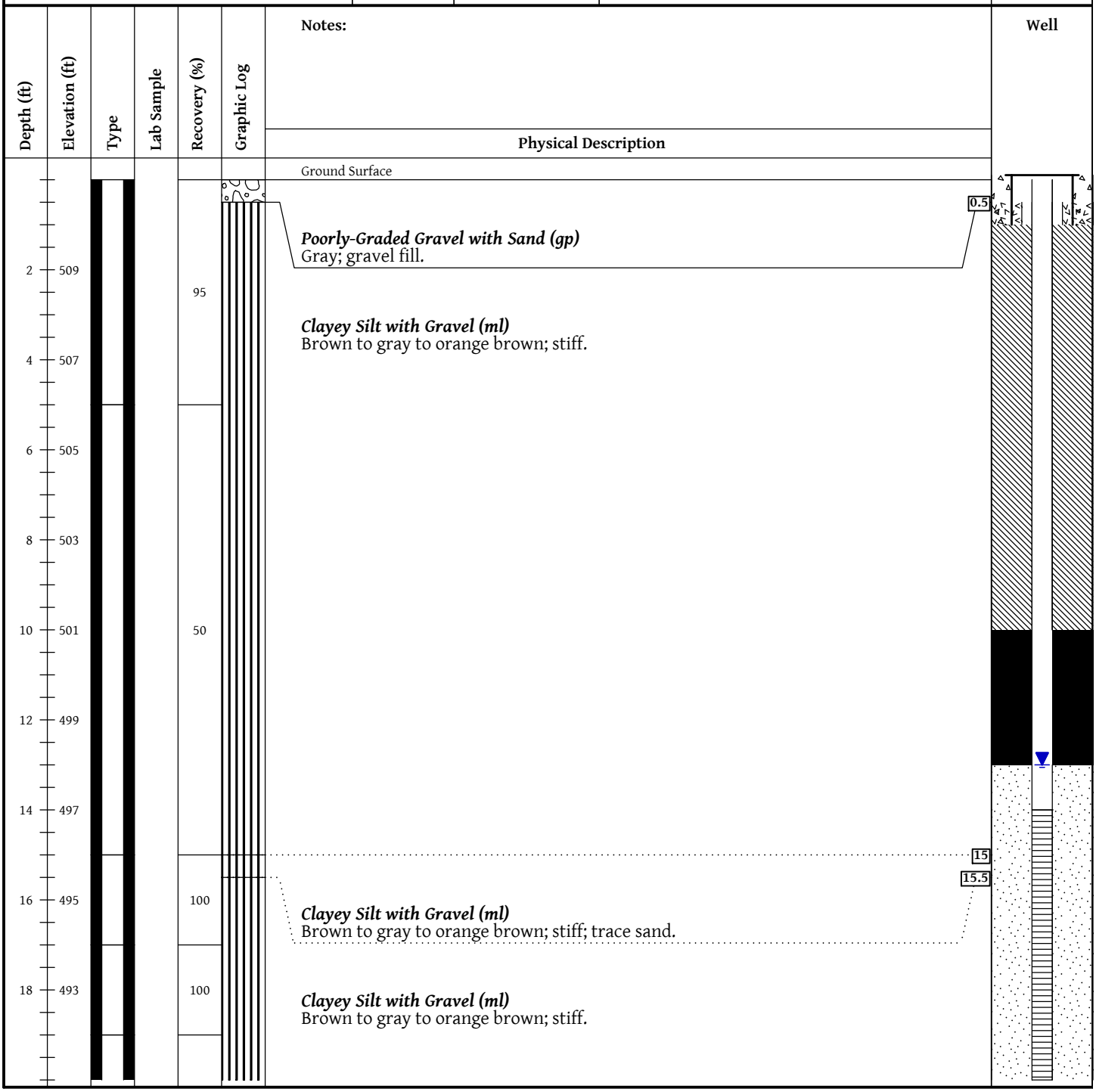
Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-24**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/15/2018	**Drill End Date:** 8/15/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 28	**Bore Diameter:** 6	**Ground Surface:** 511.49 ft
Coordinates (X/Y): 530808.012/956957.043	**Well Permit Number:**		**Top-of-Casing:** 511.20 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	14 to 24	**Filter Pack:** US SIlica #1	13 to 24
Riser: Schedule 40 PVC Riser	2	0.3 to 14	**Seal:** Hydrated Bentonite Chips	10 to 13
Other:			**Other:** Cement-Bentonite Grout	1 to 10



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Project Name: Revere Smelting & Refining	Client: RSR	Location: Middletown, NY	Boring Log: PZ-24

Notes:

Depth (ft)	Elevation (ft)	Type	Lab Sample	Recovery (%)	Graphic Log	Physical Description	Well
22	489			100		***Clayey Silt with Gravel (ml)*** Brown to gray to orange brown; stiff. *(continued)*	
24	487						
						25	
26	485			100		***Siltstone*** Dark gray.	
28	483					Bottom of Boring at 28 feet. All soil classification based on visual descriptions made during the installation of the boring, unless noted otherwise.	
30	481						
32	479						
34	477						
36	475						
38	473						
40	471						
42	469						
44	467						

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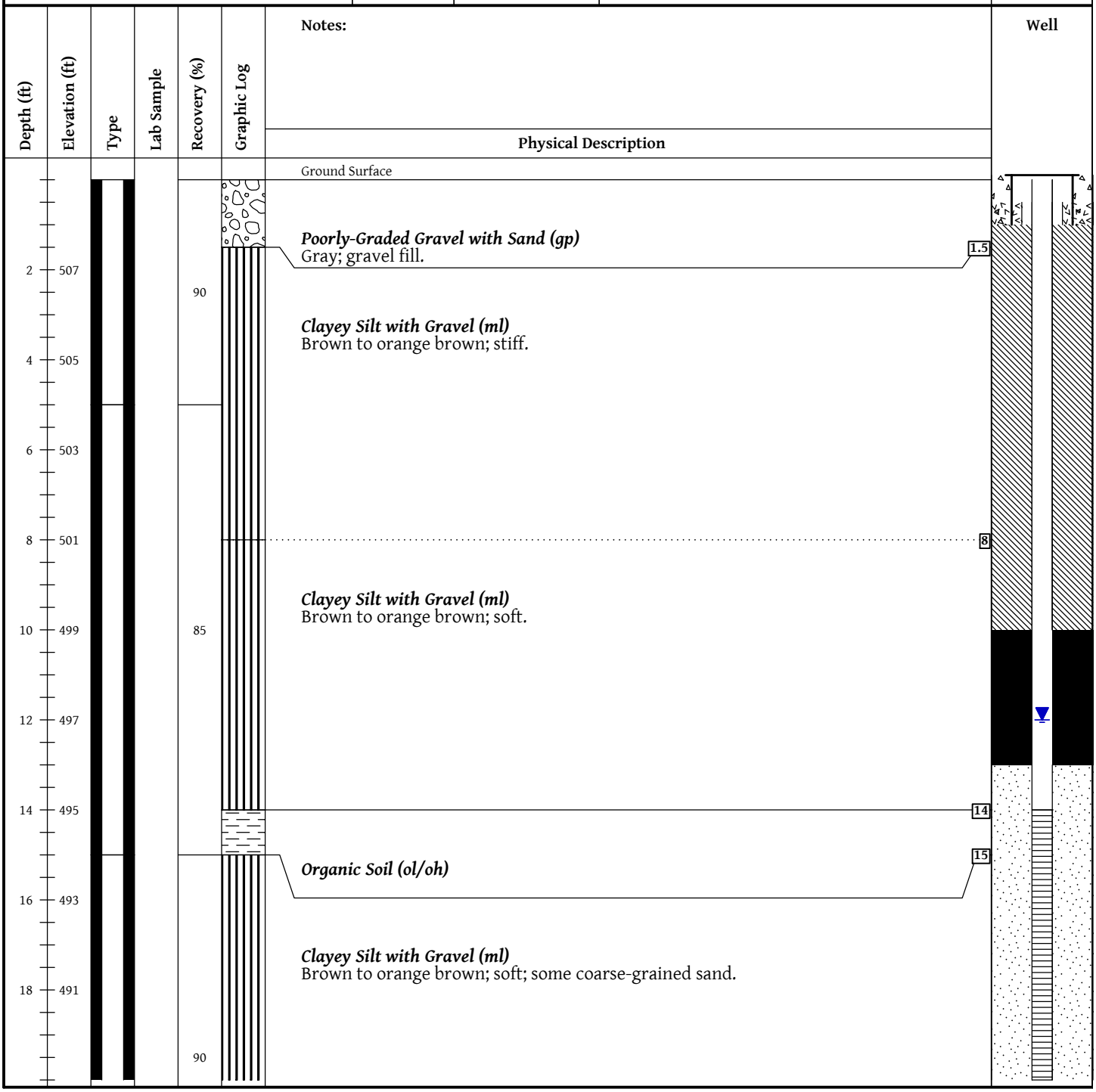
Project Name: Revere Smelting & Refining	**Client:** RSR	**Location:** Middletown, NY	**Boring Log: PZ-25**
Drilled By: Cascade/Jeremy Triepke	**Drill Start Date:** 8/16/2018	**Drill End Date:** 8/16/2018	**Drill Method:** Rotosonic
Logged By: Spiros Zois	**Total Depth:** 24	**Bore Diameter:** 6	**Ground Surface:** 508.85 ft
Coordinates (X/Y): 530586.853/956630.6641	**Well Permit Number:**		**Top-of-Casing:** 508.47 ft

Well Construction			Annulus	
Material	**Diameter (in)**	**Depth (ft)**	**Material**	**Depth (ft)**
Screen: 0.01-inch Schedule 40 PVC Screen	2	14 to 24	**Filter Pack:** US SIlica #1	13 to 24
Riser: Schedule 40 PVC Riser	2	0.4 to 14	**Seal:** Hydrated Bentonite Chips	10 to 13
Other:			**Other:** Cement-Bentonite Grout	1 to 10



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Project Name: Revere Smelting & Refining	Client: RSR	Location: Middletown, NY	Boring Log: PZ-25

Notes:

Well

Depth (ft)	Elevation (ft)	Type	Lab Sample	Recovery (%)	Graphic Log	Physical Description
22	487					***Clayey Silt with Gravel (ml)*** Brown to orange brown; soft; some coarse-grained sand. *(continued)*
						22
24	485					***Clayey Silt with Gravel (ml)*** Brown to orange brown; soft.
						24
26	483					***Siltstone*** Dark gray.
28	481					Bottom of Boring at 24 feet. All soil classification based on visual descriptions made during the installation of the boring, unless noted otherwise.
30	479					
32	477					
34	475					
36	473					
38	471					
40	469					
42	467					
44	465					

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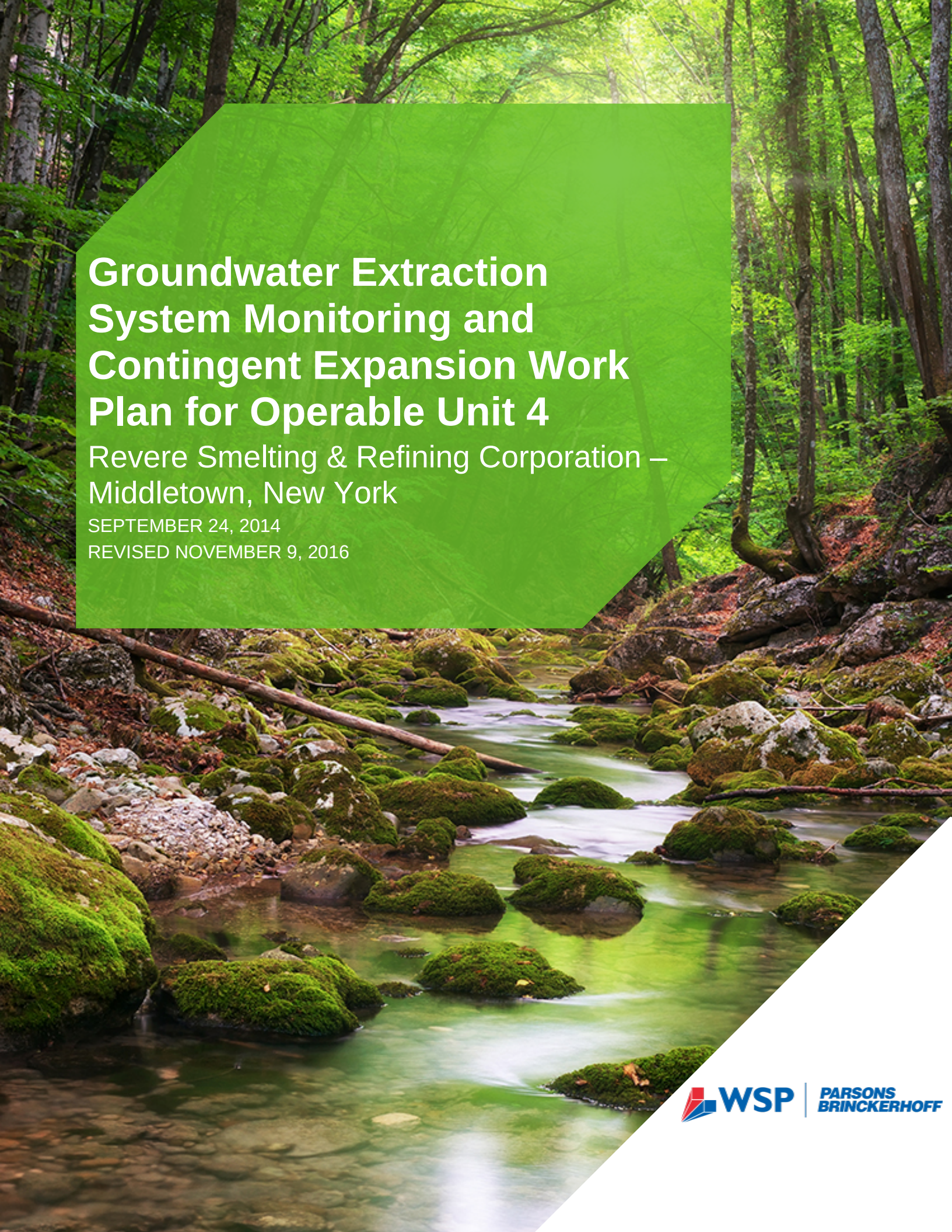

Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4

Revere Smelting & Refining Corporation – Middletown, New York

SEPTEMBER 24, 2014

REVISED NOVEMBER 9, 2016

WSP | PARSONS BRINCKERHOFF

GROUNDWATER EXTRACTION SYSTEM MONITORING AND CONTINGENT EXPANSION WORK PLAN FOR OPERABLE UNIT 4

Revere Smelting & Refining Corporation – Middletown, New York

September 24, 2014
Revised November 9, 2016

Client

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Appendices

Certification

I, James A. Sobieraj, certify that I am currently a New York State-registered professional engineer (License No. 77394) and that this *Groundwater Extraction System Monitoring and Contingent Expansion Work Plan for Operable Unit 4* was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation's *Technical Guidance for Site Investigation and Remediation (DER-10),* dated May 2010.

_____ 11/09/2016

PE No. 77394 Date

1 Introduction

On behalf of Revere Smelting & Refining (Revere), WSP USA Corp. prepared this work plan for monitoring and potentially expanding the existing groundwater extraction system at the Revere facility located in Middletown, New York. Phases I, II, and a portion of the Phase IV barrier wall at the site were completed under the *Corrective Measures Implementation Plan* (CMIP) approved by the New York State Department of Environmental Conservation (NYSDEC) on June 18, 1999, and Consent Order #C3-5528-11-98, which Revere and the NYSDEC executed on May 6, 1999. In 2005, WSP developed a computer model of the groundwater system at the site to optimize the placement and number of extraction wells to lower the water table beneath the containment building and to prevent groundwater within the completed barrier wall from leaving the site (after completion of the then-proposed Phase IV and V barrier walls). This work was summarized in the *Summary Report of Groundwater Modeling and Groundwater Extraction Conceptual Design* that was submitted to the NYSDEC on August 18, 2005. The NYSDEC approved the conceptual design as an Interim Corrective Measure (ICM) in a letter dated January 6, 2006, contingent upon installing the groundwater extraction system in two phases so as to not interfere with the Interim Remedial Measure (IRM) planned for soils located east of the facility (Operable Unit 1 [OU1]).

Phase I of the groundwater extraction system was installed in August and September 2007. Four extractions wells (EW-1 through EW-4)[1] were installed at the locations shown on Sheet 2. Details regarding the installation of the system are included in the *Construction Completion Report (CCR), Phase I Groundwater Extraction System*, dated November 16, 2007.

The 1999 Consent Order has since been superseded by additional Consent Orders between Revere and the NYSDEC. Most recently, Revere and the NYSDEC entered Consent Order #3-20100528-80 on February 1, 2011, which redefined the following OUs on the site as follows:

- OU1 – all environmental media, other than groundwater (OU2), on property currently owned by Eco-Bat New York LLC to the east of Ballard Road in the Town of Wallkill, Orange County, New York (Tax Parcels 41-1-70.21, 41-1-70.22, 41-1-70.23, 41-1-71.22, 41-1-73.1, 41-1-73.22, 41-1-74.82, and 41-1-76), except for the Facility (OU4), and all environmental media, other than groundwater, not owned by Eco-Bat in the Town of Wallkill, Orange County, New York within Tax Parcels 60-1-120 and 41-1-72.2.
- OU2 – all onsite groundwater.
- OU3 – all offsite media impacted by Revere's activities, except environmental media other than groundwater on property not owned by Eco-Bat that is included in OU1.
- OU4 – the facility.

A *Corrective Measures Study (CMS), Revision 2.0*, for OU4 was prepared by ENTACT LLC (ENTACT), on behalf of Revere, and submitted to the NYSDEC on February 7, 2014. The purpose of the CMS was to develop and evaluate corrective measures alternatives that address risks to human health and the environment from exposures to impacted soils and source materials within OU4. Due to the current and expected future operations of the facility, Revere has determined that the implementation of final corrective measures is not practical or feasible and that a phased approach is warranted:

- Phase 1 – ICMs that will be implemented to address risks based on current land use and are consistent with the continued operations of the facility.
- Phase 2 – Final Corrective Measures that are implemented upon cessation of operations at the facility.

The final corrective measure alternatives are discussed in detail in the CMS. Each of the four alternatives involve the use of existing OU4 surface cover (i.e. asphalt surface, concrete surface, building foundation, vegetated soil covers, gravel) and completion of the barrier wall system around the facility as the ICM to address risks based on

[1] With the proposed expansion of the system and the elimination of the previously planned Phase II extraction wells (with proposed labels of EW-2 to EW-7) due to the installation of the Phase III barrier wall, the Phase I extraction wells were renumbered from EW-9, EW-10, EW-8, and EW-1 to EW-1, EW-2, EW-3, and EW-4, respectively.

current land use. As described previously, several phases of the barrier wall system were completed in the late-1990s under a separate CMIP.

In April 2014, WSP submitted an *Interim Corrective Measure Work Plan – Phase III Barrier Wall Installation and Phase I and Phase II Barrier Wall Extensions – Operable Unit 4* (Work Plan) to the NYSDEC, with subsequent addendums submitted on May 5 and August 21, 2014. The NYSDEC approved installation of the Phase III soil-cement-bentonite barrier wall pending further clarifications in a letter dated April 17, 2014, and with further modifications in a letter dated May 12, 2014, and the Phase III wall was completed in July 2014. The August 21, 2014, addendum to the Work Plan, which specified design details for the Phase I and II barrier wall extensions, was approved by the NYSDEC on August 27, 2014. The Phase I and II extensions were completed in October 2014. OU4 is completely encircled with a continuous barrier wall.

The purpose of this work plan is to present a hydraulic containment monitoring program and the contingent design of an expansion to the existing groundwater extraction system to provide additional capacity to contain groundwater within OU4. The expansion to the system would be installed if hydraulic containment monitoring reveals significant increases in groundwater elevation inside the completed barrier wall that would interfere with facility operations. Based on existing data, the expansion would include two additional extraction wells to provide additional spatial coverage on the upgradient side of the Phase II barrier wall in the vicinity of the southern storm water tanks (EW-5 and EW-6; Sheet 3). This work plan was revised to include additional detailed information presented in the CCR regarding construction of the existing wells and revised as-built drawings to reflect the change in the nomenclature for groundwater extraction wells located at the site. This work plan supersedes previous versions.

1.1 Site Description

Revere operates a secondary lead smelting facility located at 65 Ballard Road, approximately 7 miles east of Middletown, in the Town of Wallkill, Orange County, New York (Figure 1). The Revere facility was constructed in 1970 and acquired by Revere in 1973. Revere manufactures lead and lead alloys. The major raw material is used lead acid batteries, such as the typical automotive battery. Other raw materials used in production include battery-manufacturing by-products, lead-bearing baghouse dust from battery manufacturers and smelters, scrap metal from metal salvage yards, and virgin metal from metal brokers. In addition, Revere reclaims polypropylene from battery cases, and in the process, produces sodium sulfate.

The facility consists of several buildings, including the main smelter building, a crystallizer building, a containment building, a wastewater treatment building, six large storm water tanks, and employee and truck parking areas (Sheet 2). In addition, a rail spur from the adjacent Norfolk and Southern Railroad right-of-way services the facility. The operational portion of the site (OU4) encompasses approximately 14 acres. Eco-Bat New York LLC owns the operational property and contiguous undeveloped property to the north and east of the facility and undeveloped property south of the railroad right-of-way. The Eco-Bat properties consist of the eight tax parcels listed in the definition of OU1, which together comprise 154.9 acres. The undeveloped areas are in varying degrees of past disturbance that range from second growth forest, reverting farmlands, maintained lawns, and wetlands.

The facility is located in a combined rural and industrial area of south-central New York, approximately 6,000 feet northwest of the Wallkill River. North of the facility are open, overgrown fields, wetlands, and mature woodlands. North of the woodlands is a Lukoil service station. East of the facility is a combination of open, overgrown fields, wetlands, and mature woodlands. President Container, Inc. operates in a facility located approximately 0.25 mile southeast of the site. Interstate Highway 84 is located approximately 0.6 mile south of the site. A Ball Aluminum can manufacturing facility is located west of the site across Ballard Road, and additional industrial development is located further west and south.

Revere is in the process of design, permitting, and constructing a Wet Electrostatic Precipitator (WESP) emissions control unit that will be located in OU1 in the former Eastern Fill Area (EFA) (Sheet 2). The EFA was recently remediated by Revere, and an onsite containment cell was constructed in OU1 to dispose of lead and arsenic contaminated soils and sediments as part of the Phase I Remedial Design/Remedial Action (RD/RA) for OU1.

1.2 Report Organization

This work plan consists of eight sections (including Section 1.0), as follows:

- Section 2.0 includes details regarding construction of the existing groundwater extraction system.
- Section 3.0 summarizes the previous groundwater modeling effort, associated recent update, and conclusions.
- Section 4.0 presents the hydraulic containment monitoring program.
- Section 5.0 presents the contingent expansion design details.
- Section 6.0 describes system startup procedures.
- Section 7.0 discusses operation and maintenance (O&M) of the system.
- Section 8.0 presents project schedule and reporting.
- Section 9.0 includes a list of references cited in the work plan.

2 Existing Groundwater Extraction System

As described above, the existing groundwater extraction system was originally planned to be completed in two phases; however, due to completion of the Phase III barrier wall (rather than the Phase IV and V barrier walls), Phase II of the groundwater extraction system is no longer necessary and will not be completed. The existing system consists of four extraction wells (EW-1 to EW-4) that transfer water to an existing storm water containment sump located on the southern portion of the property (Sheet 2). Construction details for the existing wells are presented in Table 1.

Water is pneumatically pumped from the extraction wells to the storm water sump and is eventually pumped from the sump to a 335,000-gallon recycle water storage tank. Water from the recycle tank is then pumped through sand filters, utilized in facility operations, treated by the facility's wastewater treatment system, and discharged under permit to the Town of Wallkill sanitary sewer. The following sections provide details regarding the existing groundwater extraction system wells and equipment. Data collected during startup of the groundwater extraction system and system maintenance procedures are included in the CCR (ESC Engineering 2007b).

2.1 Extraction Well Construction

Four groundwater extraction wells designated EW-1, EW-2, EW-3, and EW-4 (Sheet 1) were installed in August 2007. The initial borings for each extraction well were completed using a truck-mounted drill rig equipped with 3.25-inch inside-diameter (ID) hollow stem augers (HSA). The initial boring at each extraction well was terminated at the bedrock interface based on split-barrel and auger refusal. The boring was then re-drilled using a 6.25-inch HSA to enlarge the annular space and install the extraction well. Boring logs for the wells are included in Appendix A of the CCR (ESC Engineering 2007b).

Each well was constructed with 4-inch-diameter Schedule 5 flush-threaded stainless steel casing fitted with 0.040-inch continuous-wrap stainless steel screen. Final extraction well depths for EW-1, EW-2, EW-3, and EW-4 are 19.5, 19.0, 23.0, and 20.5 feet below ground surface (bgs), respectively. Each extraction well was screened from the bedrock interface to a minimum of 2 feet above the top of the static water level as determined during the initial boring.

After the installation of the casings was completed, a quartz sand filter pack (U.S. Silica # 3) was placed in the annular space between the casing and the surrounding formation in each well. The sand was leveled approximately 1 foot above the top of the screened interval and topped with a minimum of 3 feet of bentonite to form a seal. Once the seal was set, a bentonite-cement grout was installed to fill the remaining annular space. Each wellhead was temporarily completed with a concrete flush-mount cap and locking 4-inch well cap. The casing was later cut to accommodate a permanent traffic-rated vault, which was installed as described in Section 2.3. Typical extraction well as-builts are shown on Sheet 4.

Rybinski Land Surveying, a surveyor licensed in New York State, surveyed the horizontal location and elevations of the top of casing and adjacent ground surface for each well. The surveyed coordinates and elevations are summarized in Table 1. All horizontal and vertical measurements were referenced to the New York State Plan coordinate system (Horizontal to NAD-83; Vertical to NAVD-88). Horizontal measurements were calculated to the nearest 0.1 foot. Vertical elevations were calculated to the nearest 0.01 foot and reported in feet above mean sea level.

Each extraction well was developed a minimum of 24-hours after the well was completed, and baseline samples were collected from the newly installed wells. Baseline groundwater sampling data are included in the CCR (ESC Engineering 2007b).

2.2 Extraction Pumps and Associated Components

Each well is equipped with a 3.5-inch outside-diameter (OD) bottom-inlet, controllerless, and pneumatic (Bottom Inlet AP4 AutoPump®) pump manufactured by QED Environmental Systems. These pumps do not require controllers, timers, or down-well probes to regulate pumping cycles in response to well yield, which will ease operational requirements over the lifetime of the system. Bottom-inlet pumps were selected to maximize drawdown

in the areas surrounding the extraction wells. This style of pneumatic pump is self-regulating and will pump at whatever rate the aquifer will yield (up to the maximum extraction rate of the pump, which is 13.5 gallons per minute [gpm]). The pumps are equipped with stainless steel internals to be compatible with the historically low groundwater pH levels (3.05 to 6.44) measured for samples from nearby monitoring wells (MW-9S and MW-20S[2]). The pumps installed in the four groundwater extraction wells were lowered to an approximate depth of 1.5 feet above the bottom of the well to minimize silt intake (Sheet 4 and Table 1). Each pump is equipped with a check valve on the water discharge line to prevent extracted groundwater from gravity draining back into the pump during off cycles.

The down well tubing at each extraction well consists of the following Nylon tubes: 1.25-inch OD groundwater discharge, 0.5-inch OD air supply, and 0.625-inch OD air exhaust. The air exhaust tube is vented to the atmosphere within the extraction well vault. Prefabricated 4-inch-diameter slip caps are installed on the top of the casings. Quick connect fittings were installed on the water and air supply lines to ease the process of pulling the pumps for cleaning and maintenance.

2.3 Well Vaults

Each extraction wellhead is housed in a pre-fabricated, water tight, lockable well vault manufactured by Global Drilling Suppliers, Inc. (HRB-363629 Heavy Duty Road Box – Double Hinged Door; Sheet 4) The groundwater discharge and compressed air supply lines for EW-1 are installed on a separate and independent header. The groundwater discharge piping and compressed air supply piping are connected to extraction wells EW-2, EW-3, and EW-4 via short segmented laterals connected to a main header (EW-2 header). All piping within each well vault (and from the bottom of the vault to 6 inches below the regional frost line) is heat traced with 240-volt self-regulating heat cable to prevent freezing during the winter months.

The vaults for the wellheads are constructed to withstand H-20 vehicular traffic loads. The pre-fabricated slip caps are outfitted with a 0.75-inch removal plug to facilitate measurement of groundwater levels during system operation. The down-well nylon discharge tubing is connected to the well vault groundwater discharge piping via quick connect fittings to allow easy removal of the pumps. Groundwater discharge piping within each extraction vault consists of 1.25-inch ID stainless steel and transitions to 2-inch ID high-density polyethylene (HDPE; EW-2, EW-3, and EW-4 only) at the bottom of each vault before dropping to 48 inches bgs to connect to header piping. The 1.25-inch ID stainless steel water discharge piping from EW-1 does not transition to HDPE because a majority of the EW-1 header is installed above ground as described in Section 2.4. A gate valve is installed on each groundwater discharge line for flow control and individual extraction well isolation as well as a sample port and pressure gauge.

A pressure regulator/filter and cycle counter are installed on the compressed air supply line at each well head to control air flow to the pumps and monitor individual extraction well flow rates.

In order to maintain the water discharge line (rehabilitate clogged piping), pipe cleanouts are installed on the groundwater discharge piping within every well vault to allow removal of sediment or debris build up within the pipes and fittings.

2.4 Trenching and Conveyance Piping

The horizontal above ground conveyance pipe run from EW-1 consists of 1-inch ID Duratec™ air supply line, 1.25-inch ID type 304 stainless steel water discharge line, and 1.5-inch ID PVC electrical conduit. The vertical above ground piping run from the sump house to EW-1 extends to 48 inches bgs for the short segment between the containment building west wall and the well vault. Two 4-inch protective steel shrouds were installed around the first 12 feet of vertical piping installed along the west wall of the containment building. Conveyance piping for EW-2, EW-3, and EW-4 includes a 1-inch ID Duratec™ air supply line, a 2-inch ID HDPE water line, and a 1.5-inch ID polyvinyl chloride (PVC) electrical conduit. The 2-inch ID HDPE discharge header was butt fused at all joints and connections.

[2] Well names were revised in January 2016 with an S, I, or D designation to indicate overburden, intermediate, or bedrock wells.

Trenches for pipe installation were excavated to depths above the seasonal high water table and below the expected frost line (42 inches) for the region as shown on Sheet 3. Material removed during the trench excavation was tested with an XRF to determine the material's lead concentration. Composite XRF readings of the excavated soil were collected every 10 feet from the floor and sidewall along the conveyance piping run and are included in the CCR. Excavated soil was used as backfill material for the groundwater and compressed air conveyance lines.

A segment of the EW-2 header was installed beneath the railroad spur (Sheets 2 and 3). A pneumatic mole boring tool was used to install two schedule-40, 4-inch-diameter steel pipes underneath the railroad. One of the 4-inch-diameter pipes houses the 1-inch-diameter air supply header and the 1.5-inch-diameter PVC electrical conduit header, and the other houses the 2-inch-diameter HDPE water header.

All conveyance lines were trenched with the exception of the pipe run from EW-1 to the sump house. The EW-1 lateral and header piping run aboveground along the containment building's west and south sidewalls and connect with the main groundwater header in the sump house. All aboveground piping runs are insulated with Duratec insulation (Part No. #SST15810 and #SST13810) and heat traced (240-volt Wintergard Wet™ heat cable) to prevent freezing during winter months. Pipe supports were installed along the containment building sidewalls every 8 feet with Unistrut mounting plates, toggle bolts, and Unistrut mounting clamps (Sheet 3). All aboveground piping was painted with latex paint for weatherproofing and labels were placed on the pipes every 50 feet with a sticker indicating non-potable water (groundwater discharge), compressed air line, or 240 volts.

Concrete and sub-base material at EW-1 was saw-cut prior to removal and setting of the extraction well vault. Replacement concrete was of the type and thickness of existing concrete. New concrete was installed flush with existing concrete and utilized rebar and waterstop to minimize swelling and shrinking of the concrete.

2.5 Connection to Revere's Recycled Process Water System

Extracted water pumped from the groundwater extraction system is discharged into Revere's storm water sump located south of the scrubber building on the southern portion of the facility. The sump receives storm water runoff from the roofs and paved areas of the facility. The sump has a capacity of 5,131 gallons and is equipped with three transfer pumps, with a total flow capacity of 500 gpm. Water is pumped from the sump to a 335,000-gallon recycle water storage tank. Water from the recycle tank is then pumped through sand filters, utilized in facility operations, treated by the facility's wastewater treatment system, and discharged under permit to the Town of Wallkill sanitary sewer.

The extracted groundwater from the EW-1 and EW-2 headers are combined within the sump house and routed through a flow totalizing meter before being discharged. The flow meter has an analog counter that measures total flow in 10-gallon increments and a dial from which the discharge flow rate can be calculated. Groundwater discharge piping within the sump house consists of 1.25-inch ID stainless steel that is insulated and heat traced to prevent freezing. A 1.25-inch ID stainless steel tee with a removable plug was installed on both the EW-1 and EW-2 headers within the sump house to allow for future pressure testing of each segment.

2.6 Connection to Revere's Compressed Air Supply

The groundwater extraction system pneumatic pumps obtain compressed air from existing compressors that service Revere's operations. Revere runs two air compressors with a capacity of 2,108 cubic feet per minute at 100 pounds per square inch (psi) located east of the guard shack. The compressed air supply headers to EW-1 and EW-2 each utilize separate shut off and control valves. A solenoid valve is hard wired to a float switch that is mounted at a depth just below the storm water inlet bridge. The positioning of the solenoid valve allows for the cut-off of supplied air to all extraction wells when the float switch is engaged due to high sump levels.

2.7 Electrical Power Supply for Heat Tracing

The breaker panel for the electrical circuits that supply power to the heat trace in each well vault is also mounted inside the sump house. The heat trace in each extraction vault is powered on an individual circuit. The heat trace for the above ground piping run between the discharge sump and EW-1 and the heat trace installed inside the discharge sump house are both on individual circuits.

The heat trace installed throughout the system is a self-regulating heat cable that automatically adjusts heat output along the pipe with no need for thermostats. The 240-volt Wintergard Wet™ heat cable contains an outer jacket making the cable both waterproof and abrasion resistant.

3 Groundwater Model Summary

As described above, the Phase I, II, and a portion of the Phase IV barrier walls were completed in accordance with the approved CMIP in the late 1990s. The barrier wall construction was discontinued in August 1999 until 2014, when the Phase III wall and Phase I and II barrier wall extensions were installed. In 2005, WSP developed a computer model of the complex groundwater system at the site to optimize the placement and number of extraction wells required to lower the groundwater table beneath the Containment Building and prevent groundwater within the completed portions of the barrier wall from leaving the site. The groundwater flow model was developed using Visual MODFLOW Version 3.0 and the summary was provided in WSP's 2005 *Summary Report of Groundwater Modeling and Groundwater Extraction Conceptual Design* (ESC Engineering 2005). Based on this model, the Phase I and II groundwater extraction system design included nine groundwater extraction wells pumping at 0.25 gpm each (2.25 gpm total), resulting in a predicted radius of influence of approximately 75 to 100 feet for each well. Because the barrier wall was not completed at the time, only four extraction wells were installed (EW-1 to EW-4). Based on flow totalizer readings since system startup in 2007, these wells have historically pumped at an average rate of 0.26 gpm per well; in very close agreement with the 2005 model predictions.

To evaluate groundwater conditions following construction of the proposed WESP building and completion of the Phase III barrier wall and the remaining sections of the Phase I and II barrier walls, WSP updated the 2005 model, using the existing conceptual site model and incorporating historical data collected since operation of the groundwater system began, the new proposed site topography following the construction of the WESP, and completion of the barrier wall around OU4. An updated groundwater flow model was developed using Schlumberger Water Services' Visual MODFLOW software (Version 4.3).

The updated model was first calibrated to pre-2014 conditions, and then predictive steady-state simulations were performed to model the modified ground surface in the area of the WESP, completion of the Phase III barrier wall, and completion of the Phase I and II extensions (Figure A-1). Under natural groundwater conditions, it would be expected that once the barrier walls completely encircled the facility, groundwater elevations would increase until the hydrostatic pressures force the groundwater through an outlet before resuming the regional flow direction. The predictive model simulations indicate groundwater mounding behind the barrier walls (Figures A-17 and A-18 in Appendix A). A zone budget analysis comparing the groundwater volume entering and exiting the glacial till within the area inside the pre-2014 and proposed final barrier walls resulted in a predicted flow discrepancy of only 0.1 gpm. The existing extraction wells (EW-1 through EW-4) have considerable excess capacity to manage this additional flow rate. The pneumatic pumps are capable of automatically self-adjusting to changes in the amount of available groundwater for extraction and are designed to pump up to 9 gpm of water at the design system pressure. Therefore, no additional capacity is necessary within the capture zones of the existing extraction wells, which each have a radius of influence of about 75 to 100 feet.

A hydraulic containment monitoring program will be implemented to evaluate the effects of completion of the barrier walls on localized groundwater elevations in OU4. Should hydraulic containment monitoring indicate that the groundwater elevation within the completed barrier wall is increasing at a rate that cannot be adequately controlled with operation of the existing groundwater extraction system, two additional extraction wells (EW-5 and EW-6) will be installed west of the existing wells to provide additional spatial coverage along the upgradient side of the completed barrier wall. In addition to spatial coverage, these extraction wells would also provide redundant capacity to control groundwater and limit mounding on the upgradient side of the barrier wall during periods of increased infiltration.

4 Hydraulic Containment Monitoring

Three shallow monitoring wells and three piezometers are located in the vicinity of the existing groundwater extraction system on the interior side of the barrier wall: monitoring wells MW-9S, MW-19S, and MW-20S, and piezometers PZ-9, PZ-11, and PZ-13. Water levels are currently collected from these monitoring wells and piezometers on a quarterly basis as part of the routine groundwater monitoring program at the site.

The Phase I and II barrier wall extensions were installed in October 2014; and therefore, the September 2014 site-wide quarterly water level measurements will serve as a baseline for the hydraulic containment monitoring program. Upon completion of the barrier wall extensions, the groundwater elevations in these six monitoring wells and piezometers were collected biweekly for a two month period to identify any significant changes to the water table elevation on the upgradient side of the barrier wall. After the first two months, WSP evaluated the data collected and reduced the frequency of data collection to the quarterly site-wide groundwater monitoring program. WSP will review the quarterly data for a minimum of one year to evaluate seasonal changes.

Should the data indicate a significant increase in the groundwater elevation at any time during the first year, WSP will evaluate site conditions, including precipitation events and operation of the existing system, to determine if factors outside normal parameters may be affecting the groundwater elevation. If deemed necessary to maintain the groundwater elevation at a level that does not affect facility operations, the additional extraction wells proposed in the contingent design will be installed as described in Sections 5 through 7.

5 Groundwater Extraction System Contingent Expansion Design

This section and the following drawings present the groundwater extraction system contingent expansion design and performance-based requirements.

- Sheet 1 – Title Sheet
- Sheet 2 – Existing Conditions
- Sheet 3 – Contingent Groundwater Extraction System Expansion Layout
- Sheet 4 – Site Work Details (As-Built and Contingent Extraction System)
- Sheet 5 – Well Construction Details (As-Built and Contingent Extraction System)
- Sheet 6 – Discharge Sump and Layout and Details (As-Built and Contingent Extraction System)

Final equipment selection will meet or exceed the defined performance-based criteria. Design calculations are included in Tables 3 and 4.

The groundwater extraction system expansion will include the following major components: extraction wells, wellheads and conveyance piping, dedicated air compressor, and discharge sump. The design for each of these components is discussed in detail below, as well as, utility requirements for the system.

5.1 Extraction Wells and Pumps

The design of the proposed extraction wells is based on the existing extraction wells (Table 1), boring logs from historical investigations, and previous remedial actions undertaken by WSP. All of the extraction wells will be completed as detailed on Sheet 5. The extraction wells will be installed using a drill rig equipped with 6.25-inch inside-diameter (ID) hollow stem augers. Each well will be constructed with 4-inch diameter Schedule 5 flush-threaded stainless steel casing fitted with 0.040-inch continuous-wrap stainless steel screen. The extraction wells will be installed to the bedrock interface, which is anticipated to be between 21 and 31 feet bgs. Final extraction well depths will be determined in the field by a WSP hydrogeologist based on soil lithology and auger refusal characteristics. The extraction wells will be screened from the bedrock interface in 5-foot increments to a minimum of 2-feet above the top of the static water level as determined by the WSP hydrogeologist.

Similar to the existing extraction wells, once the casings have been installed a quartz sand filter pack (U.S. Silica #3, or equivalent) will be placed in the annular space between the casing and the surrounding formation in each well. As described in the June 2007 *Groundwater Extraction System Work Plan* (ESC Engineering 2007a), this grade of sand for the existing extraction wells was selected based on the D30 method (Driscoll, 1986) using a distribution for a silty clay (CL-ML) based on existing soil boring data. The sand will be installed to a level approximately 1-foot above the top of the screened interval and topped with a minimum of 2 feet of bentonite to form a seal. Once the seal has set, a bentonite-cement grout will be installed to fill the remaining annular space. Each wellhead will be temporarily completed with a steel protective post and locking 4-inch well cap.

Each well will be developed 24 hours or later after the installation of the well seal. The wells will be developed using a pump or with a dedicated bailer until the development water is relatively free of suspended sediment and the pH, temperature, conductivity, and turbidity have stabilized. Field measurements will be considered stable when two successive readings vary by less than 10 percent. If the water remains turbid, or the *in situ* measurements do not stabilize, the completion of the well development will be determined by the onsite hydrogeologist. If a submersible pump is used for the development activities, the pump will be decontaminated before each use. Decontamination rinsate, development water, and soil cuttings generated during the installation activities will be managed as described in Section 5.7.

Similar to the existing system, bottom-inlet, controllerless, pneumatic pumps will be used in each extraction well to recover groundwater (AP4+B AutoPump® pumps manufactured by QED Environmental Systems; Appendix B). These pumps do not require controllers, timers, or down-well probes to regulate pumping cycles in response to well

yield, which will ease operational requirements over the lifetime of the system. Bottom-inlet pumps were selected to maximize drawdown in the areas surrounding the extraction wells. This style of pneumatic pump is self-regulating and will pump at whatever rate the aquifer will yield depending on the static head in the well (up to the maximum extraction rate of the pump, which is 14 gpm). The pumps will be equipped with stainless steel internals to be compatible with the historically low groundwater pH levels measured for samples from nearby monitoring wells and piezometer PZ-13 (5.15 to 7.33).

The downwell tubing at each extraction well will consist of the Nylon 12 jacketed tubing. The tubing consists of 1.25-inch OD groundwater discharge, 0.5-inch OD air supply, and 0.625-inch OD air exhaust. The air exhaust tube will be vented to the atmosphere within the extraction well vault.

5.2 Well Vaults

Similar to the existing system, each extraction wellhead will be housed in a pre-fabricated, water tight, lockable well vault (Sheet 5) constructed to withstand H-20 vehicular traffic loads. Laterals for extracted groundwater and compressed air will extend through each wellhead vault, and connect to the existing cleanouts for EW-1 (EW-6 header) or EW-2 through EW-4 (EW-5) as described in Sections 5.3 and 5.4.

A sacrificial zinc anode with steel or copper wire leads will be installed within each well vault to protect steel conveyance piping from electrolytic corrosion. All wellheads will be outfitted with a 0.75-inch removal plug to facilitate measurement of groundwater levels during system operation.

The water line tubing in each well vault will be connected to a 1.25-inch stainless steel water discharge header within each vault. A gate valve will be installed on each water line for flow control and individual extraction well isolation. Downwell air supply tubes will also be connected to the compressed air header in a similar manner with a ball valve on the tubing for on/off control. A pressure gauge will be installed on the water discharge line at each extraction wellhead to monitor for pressure buildup indicative of a line obstruction, and a pressure regulator/indicator will control air pressure to each pneumatic pump in accordance with the manufacturer's specifications. A cycle counter will be used to estimate the relative flow rate from each well.

Finally, in order to maintain the water discharge line (rehabilitate clogged piping), pipe cleanouts will be installed on water conveyance headers at every well vault to allow removal of sediment or debris build up within the pipes and fittings.

5.3 Conveyance Piping, Trenching, and Backfilling

For design purposes, the water discharge and compressed air conveyance lines were sized assuming all six pneumatic pumps will operate concurrently. The air supply lines and water discharge lines have been sized to maximize air conveyance while minimizing the total pressure head required to maintain adequate system pressure to actuate the pumps. Tables 3 and 4 present the design calculations for both extracted groundwater and compressed air transfer pipe sizes. Similar to the existing system, the new extracted groundwater headers will be constructed of 1.25-inch ID type 304 stainless steel piping. All new air lines will be constructed of 1-inch diameter Duratec™ compressed air piping.

Piping to and from extraction well EW-5 will be belowground, while the majority of the piping from extraction well EW-6 will be above grade. The trench for the pipe installation to extraction well EW-5 and the short segment from the extraction well vault for EW-6 to the southern storm water tank containment wall will be excavated to a depth above the seasonal high water table and below the expected frost line for the region as shown on Sheet 4. Because this area has been previously remediated, material removed during the trench excavation is assumed to be suitable for reuse as backfill. Excavated material re-used for backfill may be temporarily stored in onsite stockpiles. Stockpiles will be bottom lined and covered with polyethylene sheeting to prevent runoff during temporary storage. Sheets 4 and 5 provide additional information on the trenching and conveyance piping.

The remaining lateral piping for extraction well EW-6 will run aboveground along the southern and eastern sidewalls of the southern storm water tank containment walls and the adjacent block building, and connect with the groundwater and compressed air headers from EW-1 in the sump house as shown on Sheet 6 and described in Sections 5.4 and 5.5. Pipe supports will be installed every 8 feet along the pipe run (Sheet 4).

All above ground piping runs and piping in the well vaults will be insulated and heat traced to prevent freezing during winter months. A 1.5-inch diameter PVC conduit will be installed in the trenches and along the storm water containment walls as appropriate for installation of a 240-volt electrical supply line to the well vaults for the heat tracing equipment. All aboveground piping will be labeled approximately every 50 feet with a sticker indicating non-potable water (groundwater discharge), compressed air line, or 240 volts.

5.4 Connection to Existing Storm Water Sump

Water pumped from the existing groundwater extraction system is discharged into Revere's storm water containment sump located south of the scrubber building on the southern portion of the facility (Sheet 2) as described in Section 2.5.

The existing cleanouts for the EW-1 and the EW-2 through EW-4 headers will be removed and replaced with 1.25-inch stainless steel tees. The water discharge line from EW-6 will connect to the new tee on the former cleanout for EW-1, and the water discharge line from EW-5 will connect to the new tee on the former cleanout for EW-2 through EW-4. A removable stainless steel plug will then be placed in the remaining flow-through outlet of each new tee for later use as new cleanouts if needed as shown on Sheet 6.

5.5 New Dedicated Air Compressor

Currently, the groundwater extraction system pneumatic pumps in wells EW-1 through EW-4 obtain compressed air from existing compressors that service Revere's operations. A recent review of Revere's operations indicate that the existing compressors do not have sufficient capacity to supply the additional required air necessary to operate the proposed extraction wells. Therefore, if the contingent wells are required a new dedicated compressor will be installed to service the entire groundwater extraction system. Calculations to determine pressure losses through the air supply network for sizing of the new compressor based on anticipated and maximum groundwater extraction rates are included in Tables 3 and 4. Based on the groundwater model and historical operations, the anticipated groundwater extraction rate is 0.25 gpm per well (1.5 gpm total). The maximum groundwater extraction rate per well using the existing and proposed AP4 AutoPump® pneumatic pumps at the design well depths is 9 gpm (54 gpm total). Based on these data, a compressor that can supply a minimum of 28 cfm of air at 80 psi will be installed. WSP will coordinate the location and electrical connection of this compressor with Revere personnel.

As currently installed, the compressed air supply headers to EW-1 and EW-2 through EW-4 each utilize separate shut off and control valves. The existing compressors will be disconnected from these air supply headers at the tee that divides the compressed air between the air supply line for facility use and the existing wells, and the tee will be plugged as shown on Sheet 6. The existing and new extraction wells will then be connected to the new compressed air supply system via the following headers: EW-1, EW-2 through EW-4, EW-5, and EW-6. Similar to the existing system, each new air pressure line will be equipped with a 1-inch diameter brass ball valve to control operation and allow for isolation of the air transfer laterals during maintenance activities.

A solenoid valve is hard wired to a float switch that is mounted in the storm water sump at a depth just below the storm water inlet bridge. The positioning of the solenoid valve allows for the shut-off of supplied air to all of the extraction wells when the float switch is engaged due to a high water level in the sump. No changes to the existing telemetry for this solenoid valve are anticipated.

5.6 Electrical Connection

A breaker panel for the electrical circuits that supply power to the heat trace in each well vault is mounted inside the sump house. The heat trace in each existing extraction well vault, the aboveground lines to extraction well EW-1, and the piping inside the sump house are all powered on individual circuits. Similarly, heat tracing to extraction wells EW-5 and EW-6 will be installed on individual circuits. WSP and the selected remedial subcontractor will coordinate with Revere to connect these circuits inside the breaker panel.

5.7 Waste Management

Decontamination rinsate and development water will be contained, potentially filtered at the discretion of Revere personnel, and pumped to Revere's recycled process water system for reuse as process water onsite followed by treatment in the onsite wastewater treatment system and eventual discharge (under permit) to the sanitary sewer.

The area in the vicinity of EW-6 was previously remediated by ENTACT during the Phase IIB RD/RA for OU1 in 2014. Therefore, soil cuttings and trench spoils from the installation of EW-6 may be reused for backfill. Any soil cuttings or trench spoils that cannot be reused will placed at a location designated by Revere personnel.

Data collected from soil boring OU4-SB-35, which was located southwest of the storm water sump near the proposed location of EW-5 (Figure 6, WSP Engineering 2012), indicated lead is present in the surficial soil from 0 to 2 inches bgs at concentrations exceeding the industrial use soil cleanup objectives and hazardous waste characteristic concentrations. Therefore, soil cuttings and trench spoils from this area will be managed in accordance with the 2015 Material and Groundwater Management Plan (MGMP; WSP 2015).

The anticipated volume of soil to be removed in this area from installation of the well and the trench to EW-5 is less than 10 cubic yards. Therefore, WSP will notify the NYSDEC a minimum of 24 hours in advance of the groundwater extraction well installation. One composite sample will be collected from the excavated material and drilling cuttings and analyzed for Target Analyte List (TAL) Metals using Environmental Protection Agency (EPA) Method 6010B and for lead using the Toxicity Characteristic Leaching Procedure (TCLP). Based on the analytical results, the soil will be disposed of in accordance with the MGMP and all local, state, and federal regulations. To document materials left in place, one post-excavation sample will be collected from the floor of the trench and one sample per 30 linear feet of sidewall will be collected and analyzed for TAL Metals and TCLP-Lead. WSP will provide the NYSDEC with the analytical data at the completion of the project.

5.8 Additional Piezometers

Groundwater piezometer pairs are located on the upgradient and downgradient sides of the Phase I and II barrier walls as shown on Sheet 2. In general the piezometers are located approximately every 300 feet along the barrier wall alignment. Irrespective of whether or not the contingent extraction wells are installed, additional piezometer pairs will be installed along the Phase III alignment at a similar interval after completion of the WESP. In addition, piezometer PZ-14 was abandoned in April 2014 as part of the Phase IIB RD/RA and will be replaced after completion of the Phase II extension and construction of the WESP. Data collected from these piezometers will be used for long-term monitoring of the groundwater extraction system. It is estimated that up to five new piezometer pairs will be installed; selected piezometer locations and construction details will be provided in a future addendum to this report after the WESP is completed.

5.9 Breaching of the Phase IV Barrier Wall

During the Phase IIB RD/RA, soil was excavated adjacent to the upgradient side of the Phase IV barrier wall. At that time, sections of the upper portion of the Phase IV barrier wall were removed to prevent future mounding of groundwater behind the wall. Details regarding the locations and depths of the removed sections will be provided in the Phase IIB RD/RA completion report to be prepared by ENTACT.

6 System Startup

After the new groundwater extraction wells have been installed and connected to the existing system, each system component will be inspected and tested to ensure proper performance. Specific inspection and testing procedures are described below.

6.1 Extraction Wells

Each extraction well will be developed 24 hours after installation to remove fine sediment and repair the subsurface formation damage caused by drilling. The extraction wells will be surveyed by a surveyor licensed in the state of New York and the elevation measuring point will be permanently marked. All horizontal and vertical measurements will be referenced to the New York State Plan coordinate system (Horizontal to NAD-83; Vertical to NAVD-88). Horizontal measurements will be calculated to the nearest 0.1 foot. Vertical elevations will be calculated to the nearest 0.01 foot and reported in feet above mean sea level. Groundwater elevation data will be collected from each well before the system is started.

6.2 Conveyance Piping

Before backfilling the trenches, the air and water lines will be pneumatically pressure-tested by pressurizing each line with compressed air to 100 psi. If a pressure drop of more than 2 psi is observed over a period of 1 hour, each header segment will be isolated and pressurized to identify the location of the leak, and the leak will be repaired. The repaired section of pipe will then be retested to ensure compliance with the specifications.

6.3 Extraction Well Pumps and Components

After pressure testing the compressed air lines, the pneumatic pumps will be pressurized. The pressure regulator within each vault will be set to provide pressure to each pump according to the manufacturers' specifications (approximately 80 psi). The downwell tubing will then be connected to the air and water laterals and the flow valves will be opened to allow pump cycling and water conveyance. Pressure indicators within each line will be monitored continuously for several minutes to ensure proper air delivery and water discharge. The groundwater extraction rate for each well will be quantified by using the manufacturer provided pump stroke displacement data and by observing the air line's cycle flow counter (each pump cycle is roughly equivalent to 0.7 gallons).

Following individual pump testing, the entire extraction well network will be pressurized. Sufficient pressure to actuate each pump simultaneously will be verified by observing the air pressure at each well head. The field data, including information from the cycle counters, will then be compared to the predicted groundwater extraction rates to endure adequate system performance. The total groundwater extraction rate will be measured within the storm water sump by the flow indicator totalizer.

6.4 Groundwater Elevation Measurements

Before the system is restarted, static groundwater elevation measurements will be collected in nearby piezometers PZ-9, PZ-11, and PZ-13, and monitoring wells MW-9S, MW-19S, and MW-20S. The groundwater elevation in these piezometers and wells will be collected weekly thereafter for the first month of operation to determine if there are any significant changes to the water table elevation on the upgradient side of the barrier wall. After the first month of operation, WSP will evaluate the data collected and anticipates reducing the frequency of data collection to quarterly to coincide with the existing groundwater monitoring program at the site.

7 Groundwater Extraction System Operation and Maintenance

Revere facility personnel are responsible for the daily O&M of the existing groundwater extraction system. All maintenance activities are recorded on log sheets that are kept in a secure and waterproof location at the facility. The following sections describe the routine maintenance activities completed on the existing system. A modified log sheet including the new extraction wells is included in Appendix C.

7.1 Extraction Wells

Biweekly inspection tasks to be conducted at the extraction wells include, but are not limited to, the following:

- Inspect all hoses and connections in the well vaults for damages. Make sure that the hoses and pipes are not split or cracked, and listen for leaks during pump cycles.
- Check the air filter and filter bowl drains on the air regulator/filter for saturation and operation.
- Drain the air filter on the air hose to the pumps of collected particles, water and oil. Draining prevents the filter from clogging up or being otherwise damaged.
- Check the air pressure gauge to ensure the pressure setting has not drifted appreciably from 80 psi.

7.2 Cycle Counters

As described above, the cycle counters are air pulse detecting units that require no external power source. A readout displays the number of times a pump cycles, which in turn can be used to calculate the individual flow total from each well. Each pump cycle is approximately equivalent to 0.7 gallons. The pump cycle counter O&M manual was previously provided in the CCR (ESC Engineering 2007b).

Biweekly inspection tasks to be conducted on the cycle counters include, but are not limited to, the following:

- Verify that the counter is cycling correctly during routine inspections. The cycle counter should advance one digit ever time the pump goes through an audible on/off cycle.
- If the cycle counter is not working properly, an attempt should be made to re-adjust the display reading. The compressed air supply to the pump should be shut off by closing the ball valve on the compressed air line in the well vault (Sheet 5). The two air supply quick connect fittings should be disconnected to isolate and depressurize the air regulator/filter assembly, and the cycle counter cleaned as described in the O&M manual.

7.3 Water Discharge Meter

When the existing groundwater extraction system was constructed, a positive displacement water discharge meter was installed in the sump house to measure the combined flow of the four groundwater extraction wells. The meter has a 1-inch ID inlet and 0.75-inch ID outlet. The flow meter has an analog counter that measures total flow in 10-gallon increments and a dial from which the discharge flow rate can be calculated. Manufacturer supplied specification sheets were provided in the CCR (ESC Engineering 2007b).

During the biweekly inspections, Revere should routinely inspect the flow meter to ensure that the flow meter dial turns during discharge cycles. The flow meter may become clogged and stop working if an excessive amount of sediment and/or air is entrained in the water discharge piping. The following general procedures should be followed to remove sediment from the internal components of the flow meter:

- Shut off the compressed air supply to all of the extraction wells by closing the main air supply shut-off valve.
- Close the main water discharge on/off valve on the EW-1, EW-2 through EW-4, EW-5, and EW-6 water discharge lines.

- Disconnect the flow meter by loosening the unions installed on each side of the meter.
- Run clean water through the flow meter in the reverse direction (i.e. opposite the direction of normal flow as indicated by an arrow on the meter).
- Re-connect the meter to the water discharge line.
- Open the main water discharge on/off valves 50-percent to allow water to slowly gravity feed into the meter for 2 minutes.
- Open the main water discharge on/off valves fully and open the main air supply shut-off valve to resume normal operation.

8 Project Schedule and Reporting

The August 21, 2014, addendum to the Phase I and II barrier wall extension work plan was approved by the NYSDEC on August 27, 2014. The barrier walls around the site were completed in October 2014. Baseline groundwater elevation measurements were collected in September 2014 as part of the routine groundwater monitoring program. Collection of biweekly groundwater elevation measurements for the selected wells and piezometers included in the hydraulic containment monitoring program commenced after the Phase I and II barrier wall extensions were completed and continued for a minimum of two months. Based on an evaluation of the data, the measurement frequency has been reduced to quarterly to coincide with the routine groundwater sampling events. WSP will review the quarterly elevation data for a minimum of one year to evaluate seasonal changes. After one year, if WSP and Revere conclude that expansion of the existing groundwater extraction system is unwarranted, WSP will submit a report to the NYSDEC presenting the groundwater elevation data and technical rationale for this conclusion.

At any time during the first year, if WSP and Revere conclude that installation of the contingent extraction wells is warranted, WSP will notify the NYSDEC a minimum of 10 days before construction of the system expansion begins. The expansion field work is anticipated to take approximately 3 weeks to complete. Within 60 days of system restart, WSP will submit to the NYSDEC a completion report that will include as-built construction drawings, manufacturer specification sheets for all installed equipment, performance measurements, and groundwater elevation data.

9 References

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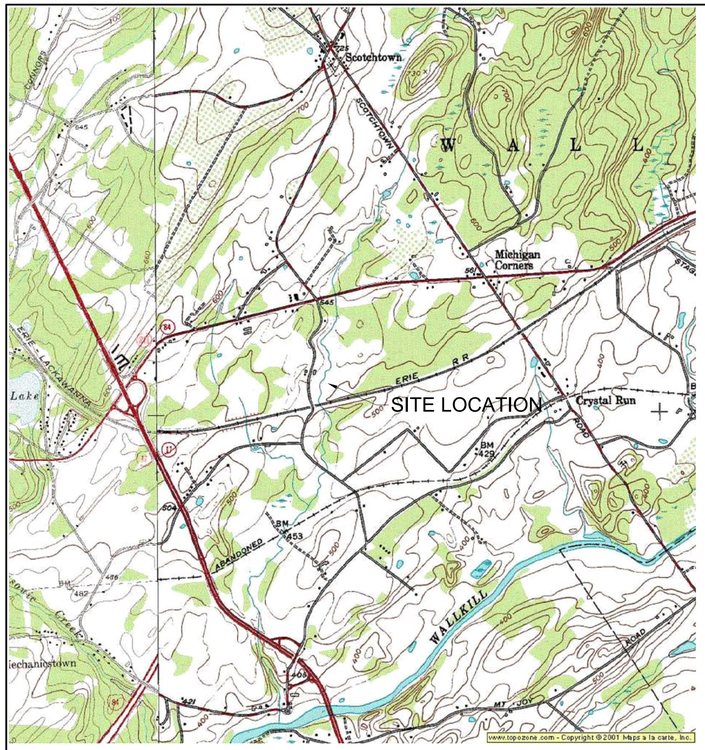
WSP. 2016. Material and Groundwater Management Plan, Revere Smelting & Refining Facility, Middletown, New York. January 31, 2011; Revised January 21.

Sheets



SITE LOCATION
NOT TO SCALE

INDEX OF DRAWINGS

DRAWING NUMBER	SHEET NUMBER	DESCRIPTION
00020422-040	1	TITLE SHEET
00020422-040	2	EXISTING CONDITIONS
00020422-041	3	CONTINGENT GROUNDWATER EXTRACTION SYSTEM EXPANSION LAYOUT
00020422-042	4	SITE WORKS DETAILS
00020422-042	5	WELL CONSTRUCTION DETAILS
00020422-042	6	DISCHARGE SUMP LAYOUT AND DETAILS

GROUNDWATER EXTRACTION SYSTEM
(AS-BUILT AND CONTINGENT EXPANSION CONSTRUCTION DRAWING PACKAGE)

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

PREPARED FOR

RSR CORPORATION
DALLAS, TEXAS

D

REVISIONS

REV	DESCRIPTION	Drwn:	Appr:
1	Revised		
2	Revised		
3	Revised		

SEAL

DATE

DRAWN BY: EGC
CHECKED: AMB 11/8/2016
APPROVED: 11/8/2016

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TITLE SHEET

AS-BUILT AND CONTINGENT EXPANSION CONSTRUCTION DRAWING PACKAGE
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SHEET 1

Drawing Number
00020422–040

LEGEND

- MW-18S — SHALLOW MONITORING WELL
- ABANDONED MONITORING WELL
- MW-18D — BEDROCK MONITORING WELL
- PZ-1 — PIEZOMETER
- ABANDONED PIEZOMETER
- EW-9 — EXTRACTION WELL
- EXISTING BARRIER WALL
- OU BOUNDARY LINE
- GROUNDWATER EXTRACTION SYSTEM PIPING
- EDGE OF WATER

NOTE:

1. EXTRACTION WELLS EW-9, EW-10, EW-8, AND EW-1 WERE RENUMBERED IN JULY 2014 TO EW-1 THROUGH EW-4, RESPECTIVELY.
2. THE INSTALLATION OF THE PHASE III BARRIER WALL RENDERED THE EXISTING PHASE IV BARRIER WALL FROM STATION 400 +34 TO 405+00, THE EXISTING PHASE I HDPE BARRIER WALL NORTHEAST LEG, AND THE EXISTING PHASE I HDPE NORTHWEST LEG (0+00 TO 1+00) UNNECESSARY. SECTIONS OF THE PHASE I AND PHASE IV BARRIER WALLS HAVE BEEN OR MAY BE BREACHED.
3. THE OU LIMITS ARE DEFINED IN CONSENT ORDER #3-20100528-80 DATED FEBRUARY 1, 2011. THE BOUNDARY IS PROPOSED TO BE MODIFIED TO INCLUDE THE WESP IN OU4.
4. WELL NAMES WERE REVISED IN JANUARY 2016 WITH AN S, I, OR D DESIGNATION TO INDICATE OVERBURDEN, INTERMEDIATE, OR BEDROCK WELLS.
5. WELL MW-16S WAS DAMAGED IN 2015 AND REPAIRED AND RESURVEYED IN JANUARY 2016.

EASTERN STREAM
POND
POND STREAM
COMBINED STREAM
WESTERN STREAM
BALLARD ROAD
WESP ACCESS ROAD
CONTAINMENT CELL
EMPLOYEE PARKING AREA
TRUCK PARKING AREA
CRYSTALLIZER BUILDING
SMELTER BUILDING
BAG HOUSE
STACK
CONTAINMENT BUILDING
SUMP HOUSE
BLOCK BUILDING
STORM TANK
WET ELECTROSTATIC PRECIPITATOR
RECOVERY WELL

OU-1
OU-4

EXISTING PHASE I HDPE BARRIER WALL–NORTHWEST LEG (0+00–2+65)
EXISTING PHASE I HDPE BARRIER WALL–NORTHEAST LEG (100+00–104+57)
EXISTING PHASE I CEMENT–BENTONITE BARRIER WALL (2+65–8+90)
EXISTING PHASE I SOIL–CEMENT–BENTONITE BARRIER WALL EXTENSION (8+82–9+11.74)
EXISTING PHASE I CEMENT–BENTONITE BARRIER WALL (199+26–203+50)
EXISTING PHASE II SOIL–BENTONITE BARRIER WALL (203+50–210+25)
EXISTING PHASE II SOIL–CEMENT–BENTONITE BARRIER WALL EXTENSION (210+16–210+61.36)
EXISTING PHASE III SOIL–CEMENT–BENTONITE BARRIER WALL (300+00–316+03)
EXISTING PHASE IV SOIL–BENTONITE BARRIER WALL (400+34–405+00; SEE NOTE 2)
EXISTING PHASE IV SOIL–BENTONITE BARRIER WALL (400+00–400+34; SEE NOTE 2)

MW-29I, MW-29D, MW-29S, MW-30D, MW-30S, MW-31D, MW-31S, MW-32S, MW-32D, MW-33S, MW-6S, MW-28D, MW-28S, MW-7S, MW-18S, MW-18D, MW-8, MW-8S-R, MW-11, MW-12S, MW-26S, MW-26S-R, MW-9S, MW-1S, MW-1S-R, MW-4S, MW-4S-R, MW-23S-R, MW-23D-R, MW-10S, MW-21D, MW-20S, MW-23S, MW-23D-R, MW-24S, MW-17S, MW-15S, MW-15D, MW-16S, MW-13D, MW-13S, MW-27D, MW-27S, MW-25S, MW-14D, MW-14S, PZ-1, PZ-2, PZ-3, PZ-4, PZ-5, PZ-6, PZ-7, PZ-8, PZ-9, PZ-10, PZ-11, PZ-12, PZ-13, PZ-14, EW-1, EW-2, EW-3, EW-4

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SCALE IN FEET

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REVISIONS

REV	DESCRIPTION	Chkd:	Appr.:
1	Revised:		
2	Revised:		
3	Revised:		

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DATE

DRAWN BY	EGC	11/8/2016
CHECKED		11/8/2016
APPROVED		

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MIDDLETOWN, NEW YORK

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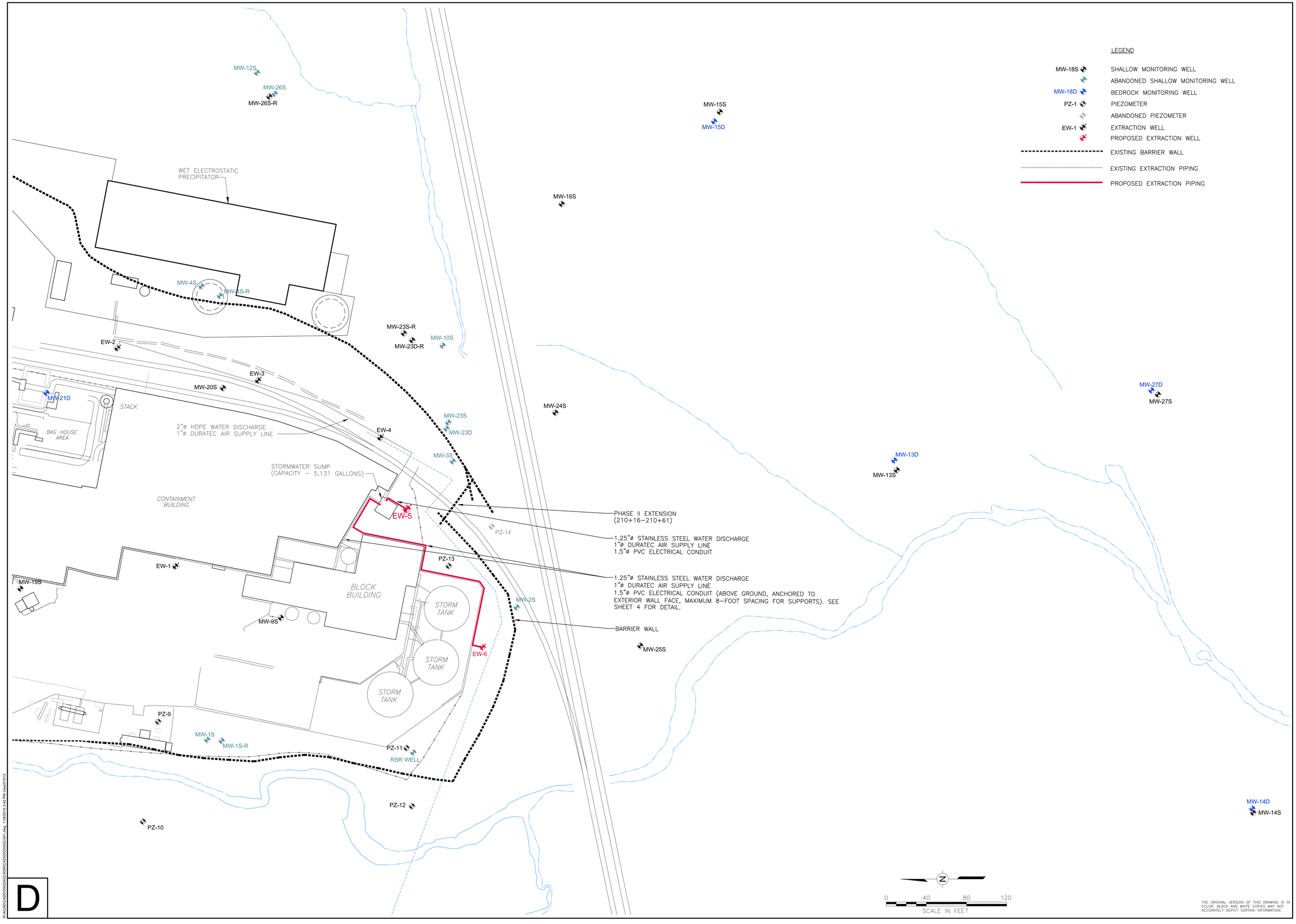
SHEET 2

Drawing Number
00020422–040



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REVISIONS

REV	DESCRIPTION		
1	Revised:	Chkd:	Appr.:
2	Revised:	Chkd:	Appr.:
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CONTINGENT GROUNDWATER EXTRACTION SYSTEM EXPANSION LAYOUT

AS–BUILT AND CONTINGENT EXPANSION CONSTRUCTION DRAWING PACKAGE

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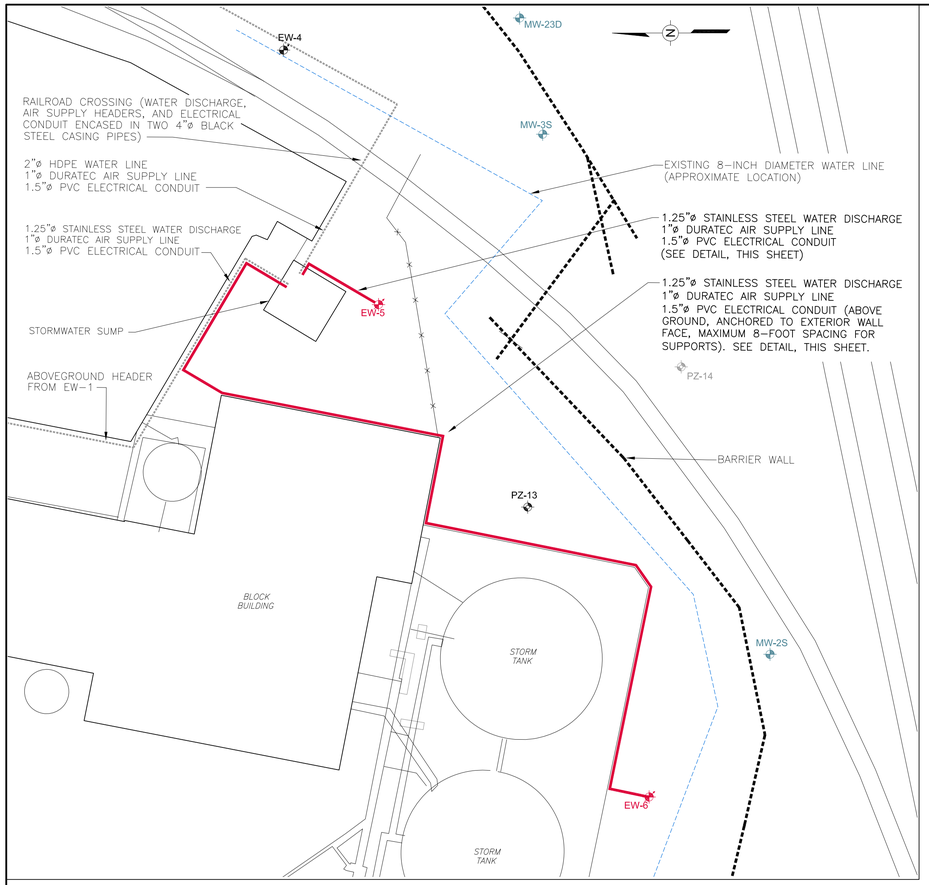
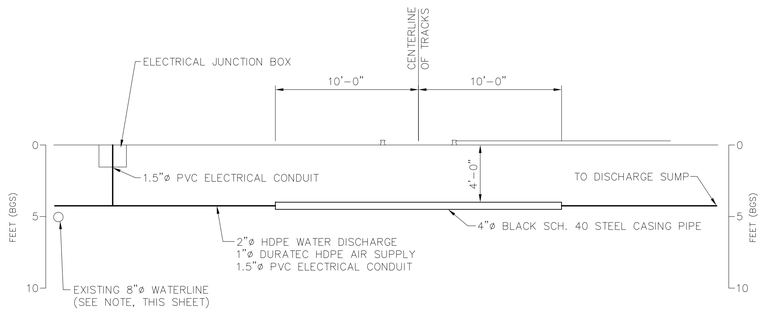
SHEET 3

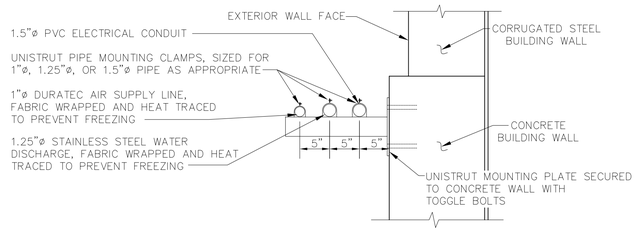
Drawing Number
00020422–041



SYSTEM EXPANSION PLAN VIEW
SCALE: 1"=20'

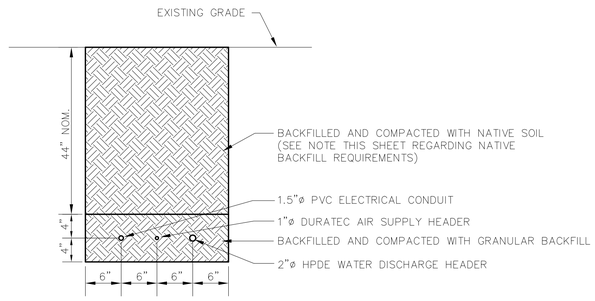


RAILROAD CROSSING SECTION
SCALE: 1"=5'



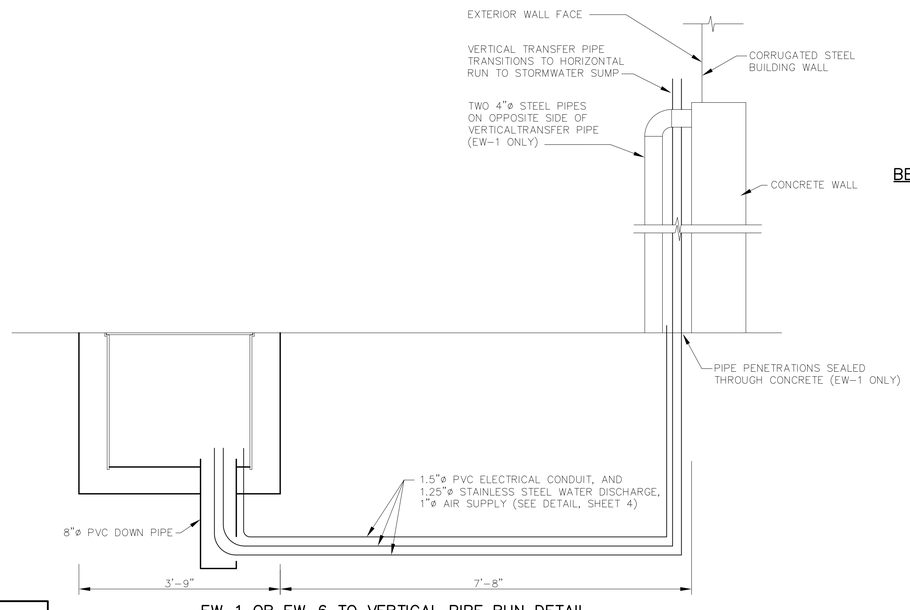
EXTERIOR PIPE SUPPORT DETAIL (TYPICAL)
(EW-1 OR EW-6 HEADER TO DISCHARGE SUMP)
NO SCALE

NOTES: 1. WATER AND AIR SUPPLY LINES COATED WITH WHITE LATEX PAINT FOR WEATHERPROOFING.
2. "NON-POTABLE WATER", "COMPRESSED AIR", AND "240 VOLT" LABELS AFFIXED TO ALL ABOVEGROUND PIPING EVERY 50 FEET.

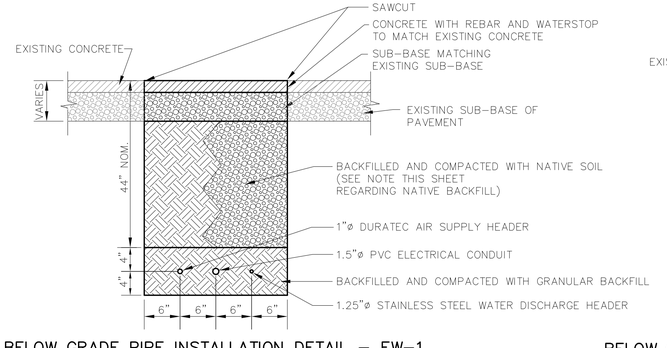


BELOW GRADE PIPE INSTALLATION DETAIL – EW-2, EW-3, AND EW-4
SCALE: 1"=1'-0"

(WATER DISCHARGE, AIR SUPPLY HEADER, AND PVC ELECTRICAL CONDUIT INSTALLATION CROSS-SECTION)



EW-1 OR EW-6 TO VERTICAL PIPE RUN DETAIL
SCALE: 3/4" = 1'-0"



BELOW GRADE PIPE INSTALLATION DETAIL – EW-1
SCALE: 1"=1'-0"

(WATER DISCHARGE, AIR SUPPLY HEADER, AND PVC ELECTRICAL CONDUIT INSTALLATION CROSS-SECTION)

NOTES:

GENERAL:
1. NOTES BELOW DESCRIBE THE AS-BUILT CONDITIONS FOR EXISTING WELLS EW-1 TO EW-4, AND ALSO APPLY TO FUTURE CONTINGENT WELLS EW-5 AND EW-6 IF INSTALLED.
2. REVERE MAY ELECT TO REPLACE DURATEC AIR SUPPLY LINES WITH OTHER MATERIAL COMPATIBLE FOR COMPRESSED AIR (SUCH AS STAINLESS STEEL).

TRENCHING:
1. TRENCHES FOR UNDERGROUND PIPING WERE EXCAVATED TO THE DEPTHS INDICATED ON THIS SHEET. EXCAVATED TRENCH MATERIAL WAS TESTED AND DOCUMENTED FOR LEAD CONCENTRATION BY WSP EVERY 10-FEET ALONG THE EXCAVATION WITH THE X-RAY FLUORESCENCE METER. EXCAVATED TRENCH MATERIAL WAS USED AS BACKFILL. EXCESS TRENCH SPOILS WERE STOCKPILED IN CAMU 3 FOR TREATMENT BY OTHERS.

2. 4-INCHES OF PIPE BEDDING MATERIAL WAS PLACED BELOW AND ABOVE THE WATER DISCHARGE, AIR SUPPLY, AND ELECTRICAL CONDUIT AS SHOWN ON THIS SHEET.

3. BACKFILL WAS COMPACTED USING A VIBRATORY PLATE COMPACTOR IN MAXIMUM 6-INCH LIFTS. NATIVE SOILS WERE PLACED AND GRADED FLUSH WITH SURFACE ELEVATION OF THE EXISTING NATIVE SOIL SURROUNDING THE TRENCH.

4. ALL CONCRETE REMOVED FOR EXCAVATION OF PIPE TRENCHES WAS SAW CUT. ALL DEMOLISHED CONCRETE DEBRIS WAS STOCKPILED IN CAMU 4 FOR LATER TREATMENT/DISPOSAL BY OTHERS.

5. ALL CONCRETE AND SUB-BASE MATERIAL REMOVED FOR EXCAVATION OF PIPE TRENCHES WAS REPLACED IN-KIND. REPLACEMENT CONCRETE MATCHED THE TYPE AND THICKNESS OF THE EXISTING CONCRETE SURROUNDING THE CUT. BASE COURSE OR SUB-BASE MATERIAL FOR THE REPLACEMENT CONCRETE MATCHED THE TYPE AND DEPTH OF THE EXISTING MATERIAL SURROUNDING THE CUT. THE SURFACE OF THE REPLACEMENT CONCRETE WAS FINISHED FLUSH WITH THE SURFACE GRADE OF THE SURROUNDING CONCRETE AND WAS INSTALLED WITH REBAR AND WATERSTOP.

PIPE INSTALLATION:
1. WATER DISCHARGE PIPING IN TRENCHES IS 2-INCH HIGH DENSITY POLYETHYLENE (HDPE) INSTALLED TO THE DEPTHS SPECIFIED ON THIS SHEET. HDPE DISCHARGE HEADER PIPING HAS A MINIMUM PRESSURE RATING OF 160 POUNDS PER SQUARE INCH (PSI) (DR 11 HDPE). ALL HDPE JOINTS AND CONNECTIONS WERE BUTT FUSED. AIR SUPPLY PIPING IS 1-INCH DURATEC ALUMINUM COMPOSITE WITH MANUFACTURER'S RECOMMENDED FITTINGS. ELECTRICAL CONDUIT TO EXTRACTION WELLS EW-1 TO EW-4 IS 1.5-INCH POLYVINYL CHLORIDE (PVC).

2. ALL PIPE FITTINGS AND COUPLINGS WERE SEALED WITH INDUSTRIAL GRADE THREAD SEALANT.

3. PIPING ROUTES ARE APPROXIMATE AS DEPICTED IN THE GROUNDWATER EXTRACTION SYSTEM LAYOUT AS SHOWN ON SHEETS 2 AND 3.

4. THE VERTICAL ABOVEGROUND PIPE RUN FROM EW-1 EXTENDS 48-INCHES BELOW GRADE AND TRANSITIONS TO THE SHORT LATERAL SECTION AS SHOWN ON THIS SHEET. ALL ABOVE GROUND WATER DISCHARGE PIPING IS 1.25-INCH ID TYPE 304 STAINLESS STEEL. ALL ABOVE GROUND AIR SUPPLY IS 1-INCH ID DURATEC.

5. TWO 4-INCH STEEL PROTECTIVE SHROUDS ARE INSTALLED AROUND THE FIRST 12-FEET OF VERTICAL PIPE RUN FROM EW-1 PIPE PENETRATION THROUGH CONCRETE TO HORIZONTAL RUN ALONG BUILDING EXTERIOR.

6. ABOVE GROUND HORIZONTAL PIPING RUNNING ALONG BUILDING EXTERIOR IS SECURED EVERY 8-FEET ALONG THE BUILDING WALL.

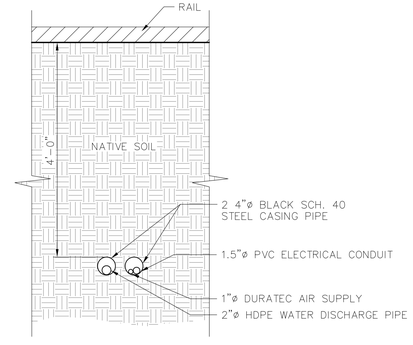
7. ALL ABOVE GROUND WATER DISCHARGE AND AIR SUPPLY SECTIONS ARE WRAPPED WITH 240-VOLT WINTERGARD HEAT CABLE AND WITH ARMAFLEX INSULATION TO PREVENT FREEZING. HEAT CABLES FOR THE ABOVE GROUND PIPING TERMINATE IN THE DISCHARGE SUMP. ALL WIRING WAS TERMINATED BY A REVERE FACILITY ELECTRICIAN .

8. THE PIPE TRENCH AND INDIVIDUAL SEGMENTS OF THE BELOW GROUND AND ABOVE GROUND PIPE SYSTEM WERE PNEUMATICALLY PRESSURE TESTED FOR LEAKS AT THE COMPLETION OF INSTALLATION. PRESSURE TESTING CONSISTED OF APPLYING A MAXIMUM OF 100 PSI PNEUMATIC PRESSURE FOR A MINIMUM OF ONE HOUR TO EACH SEGMENT. PIPE WAS CONSIDERED ACCEPTABLE FOR USE IF THE PRESSURE DROP IN THE ISOLATED SEGMENT DID NOT EXCEED 2-PSI. DURING TESTING, ALL JOINTS AND CONNECTIONS WERE LEAK TESTED USING A SOAP-WATER SOLUTION. ALL PNEUMATIC TESTING WAS PERFORMED UNDER DIRECT SUPERVISION OF WSP.

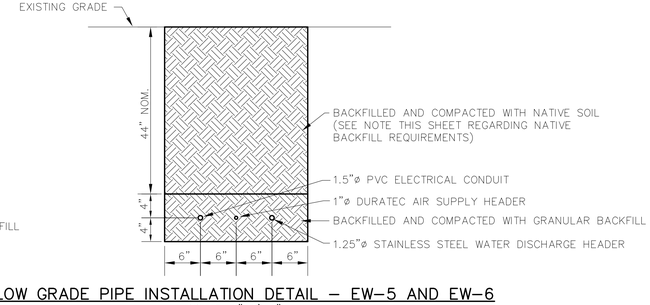
RAILROAD CROSSING:
1. THE WATER DISCHARGE, AIR SUPPLY, AND ELECTRICAL CONDUIT PIPING WERE INSTALLED UNDERNEATH THE ONSITE RAILROAD SPUR AT THE LOCATION SHOWN ON THIS SHEET. THE UNDERGROUND PIPING RUN BENEATH THE RAILROAD TRACK WAS INSTALLED UTILIZING A PNEUMATIC MOLE BORE.

2. TWO 4-INCH ID BLACK SCHEDULE 40 STEEL CASING PIPES WERE INSTALLED BENEATH THE RAILROAD SPUR AS SHOWN ON THIS SHEET. CASING PIPES WERE INSTALLED TO A HORIZONTAL DISTANCE OF 10-FEET ON EITHER SIDE OF THE CENTERLINE OF THE RAILROAD TRACK. CASING PIPE AND JOINTS ARE OF LEAK PROOF CONSTRUCTION.

3. THE EXISTING 8-INCH HYDRANT LINE WAS UNCOVERED BY HAND BEFORE BORING UNDERNEATH THE RAILROAD TRACKS.



RAILROAD CROSSING DETAIL
SCALE: 1"=1'-0"



BELOW GRADE PIPE INSTALLATION DETAIL – EW-5 AND EW-6
SCALE: 1"=1'-0"

(WATER DISCHARGE, AIR SUPPLY HEADER, AND PVC ELECTRICAL CONDUIT INSTALLATION CROSS-SECTION)

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1	Revised: Date: Appr.:			
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SITE WORK DETAILS
AS-BUILT AND CONTINGENT EXPANSION CONSTRUCTION DRAWING PACKAGE
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MIDDLETOWN, NEW YORK
PREPARED FOR
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SHEET 4

Drawing Number
00020422-042

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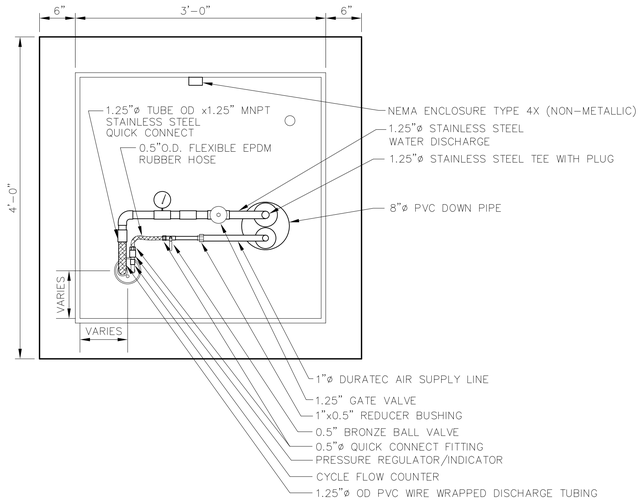
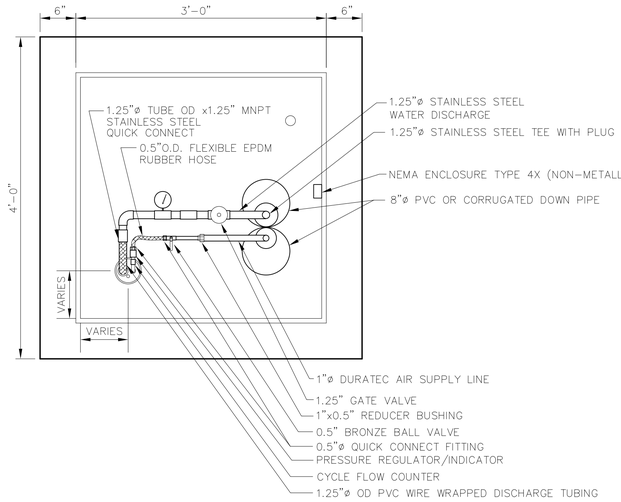
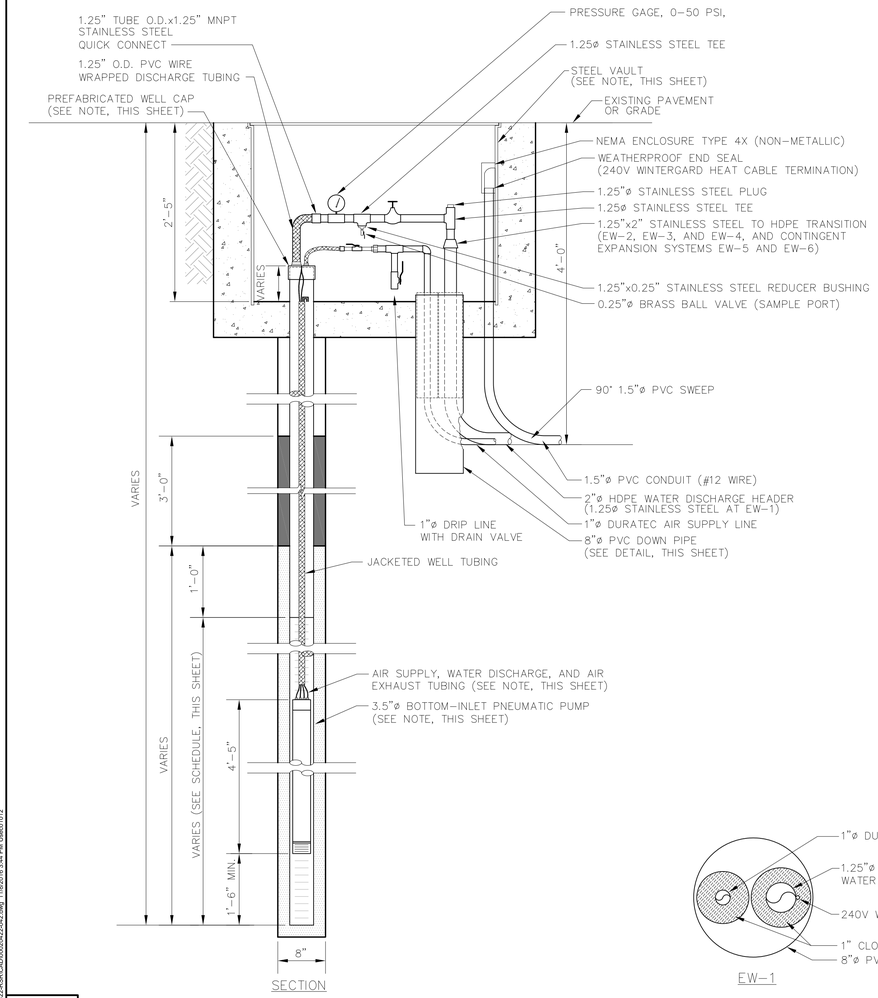


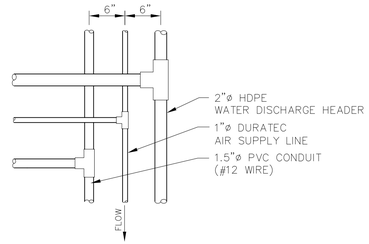
AS-BUILT WELL VAULT DETAIL EW-1



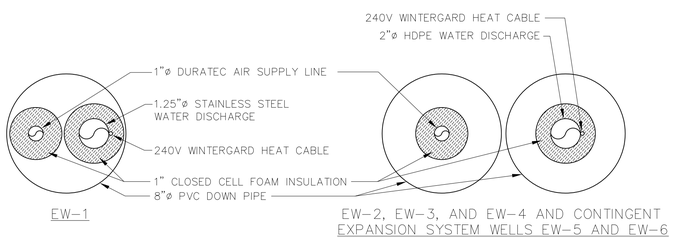
AS-BUILT WELL VAULT DETAIL EW-2, EW-3, AND EW-4
CONTINGENT WELL VAULT DETAIL EW-5 AND EW-6



WELL VAULT COMPLETION WITH HEADER
SCALE: 1"=1'-0"



LATERAL CONNECTIONS EW-2, EW-3, AND EW-4,
AND CONTINGENT EXPANSION SYSTEMS EW-5 AND EW-6
NOT TO SCALE



PVC DOWN PIPE
NOT TO SCALE

NOTES:

GENERAL:
1. NOTES BELOW DESCRIBE THE AS-BUILT CONDITIONS FOR EXISTING WELLS EW-1 TO EW-4, AND ALSO APPLY TO FUTURE CONTINGENT WELLS EW-5 AND EW-6 IF INSTALLED.
2. REVERE MAY ELECT TO REPLACE DURATEC AIR SUPPLY LINES WITH OTHER MATERIAL COMPATIBLE FOR COMPRESSED AIR (SUCH AS STAINLESS STEEL).

PUMP AND PUMP EQUIPMENT INSTALLATION:
1. EXTRACTION WELL PUMPS ARE 3.5-INCH DIAMETER CONTROLLERLESS BOTTOM-INLET PNEUMATIC AUTO PUMP (AP-4 AUTOPUMP) MANUFACTURED BY QED ENVIRONMENTAL SYSTEMS. PUMPS WERE INSTALLED IN ACCORDANCE WITH THE DETAIL ON THIS SHEET AND THE MANUFACTURER'S SPECIFICATIONS.

2. CONNECTION TUBING WAS INSTALLED AND FITTED IN ACCORDANCE WITH THE DETAIL ON THIS SHEET AND THE MANUFACTURERS INSTRUCTIONS. CONNECTION TUBING IS NYLON 12 PUMP JACKETED TUBING MANUFACTURED BY QED ENVIRONMENTAL SYSTEM (PART NO. 38884). TUBING CONSISTS OF 0.5-INCH OUTSIDE DIAMETER (OD) AIR SUPPLY, 0.625-INCH OD AIR EXHAUST, AND 1.25-INCH OD WATER DISCHARGE.

3. WELL CAPS FOR THE EXTRACTION WELLS ARE PREFABRICATED 4-INCH DIAMETER SLIP CAPS (MODEL NO. S4S) MANUFACTURED BY QED ENVIRONMENTAL SYSTEMS. WELL CAPS WERE INSTALLED AND FITTED BY CONTRACTOR IN ACCORDANCE WITH THE DETAIL ON THIS SHEET AND THE MANUFACTURER'S INSTRUCTIONS.

4. WELL HEAD PIPING AND VALVES ARE INSTALLED IN ACCORDANCE WITH THE DETAIL ON THIS SHEET. THE AIR SUPPLY LINES ARE EQUIPPED WITH PRESSURE REGULATORS/INDICATORS (QED ENVIRONMENTAL SYSTEMS PART NO. 39580) AND CYCLE FLOW COUNTERS (QED ENVIRONMENTAL SYSTEMS PART NO. 39196).

5. ALL PUMPS AND PUMP EQUIPMENT WERE PERFORMANCE TESTED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. WELL HEAD PIPING AND FITTINGS WERE TESTED FOR LEAKS UNDER THE ANTICIPATED OPERATING PRESSURES. ALL PERFORMANCE TESTING AND LEAK TESTING WAS PERFORMED UNDER THE DIRECT SUPERVISION OF WSP.

WELL HEAD PIPING AND VAULT COMPLETION

1. ALL VAULTS ARE CONSTRUCTED OF STEEL, COATED FOR CORROSION PROTECTION, AND AASHTO RATED TO SUPPORT H-20 SURFACE LOADING FROM VEHICULAR TRAFFIC. EXTRACTION WELL VAULTS ARE GLOBAL DRILLING SUPPLY PART NO. HRB-363629 WITH INSIDE DIMENSIONS OF 36-INCHES BY 36-INCHES BY 24-INCHES (WXLXD).

2. CONTRACTOR INSTALLED AN ELECTRICAL PULL BOX VAULT FOR ELECTRICAL WIRING TO EXTRACTION WELLS EW-2, EW-3, AND EW-4. ELECTRICAL PULL BOX VAULT WAS GLOBAL DRILLING SUPPLY PART NO. HRB-181818 H-20 ECONO WITH INSIDE USEABLE DIMENSIONS OF 18-INCHES BY 18-INCHES BY 14-INCHES (WXLXD).

3. IN-VAULT WATER DISCHARGE PIPING AT EXTRACTION WELLS EW-1, EW-2, EW-3 AND EW-4 IS 1.25-INCH ID TYPE 304 STAINLESS STEEL. FOR EW-2, EW-3, AND EW-4 WATER DISCHARGE PIPING TRANSITIONS FROM 1.25-INCH STAINLESS STEEL TO 2-INCH HDPE VIA PRE-FABRICATED THREADED TRANSITION FITTINGS AS SHOWN ON THIS SHEET.

4. EACH EXTRACTION WELL WAS CONSTRUCTED WITH A WATER DISCHARGE SAMPLING PORT BETWEEN THE PUMP AND THE BRONZE GATE VALVE.

5. IN-VAULT AIR SUPPLY LINE IS 1-INCH DURATEC AS SHOWN ON THIS SHEET AND TRANSITIONS TO 0.5-INCH OD TUBING FOR CONNECTION TO FILTER/REGULATOR ASSEMBLY. ALL AIR SUPPLY CONTROL VALVES AND DRIP LINE VALVES ARE BRASS.

6. ONE 8-INCH PVC DOWN PIPE WAS INSTALLED THROUGH THE BOTTOM OF THE VAULT AT EW-1 AND TWO 8-INCH PVC OR CONGRUGATED PLASTIC DOWN PIPES AT THE BOTTOM OF EW-2, EW-3, AND EW-4 VAULTS TO A DEPTH OF 48-INCHES BELOW GROUND SURFACE (BGS).

7. ALL RIGID IN-VAULT WATER DISCHARGE AND AIR SUPPLY PIPING WAS HEAT TRACED WITH 240-VOLT WITNERGARD HEAT CABLE. ALL SUBSURFACE PIPING DOWN TO 48-INCHES BGS IS INSULATED WITH ARMAFLEX INSULATION (PART NO, #SST15810 AND #SST13810) AND HEAT TRACE CABLE.

8. A NEMA TYPE 4X FIBERGLASS ENCLOSURE WAS INSTALLED IN EACH EXTRACTION VAULT FOR HEAT CABLE TERMINATIONS. REVERE FACILITY ELECTRICIANS WERE RESPONSIBLE FOR TERMINATING ALL WIRING AT EXTRACTION WELL VAULTS.

9. ALL PIPE PENETRATIONS THROUGH VAULTS WERE SEALED FOR WATER-TIGHTNESS USING A WATERPROOF, NON-SHRINKING SEALANT SUITABLE FOR UNDERGROUND USE.

10. EXTRACTION WELLS WERE CONSTRUCTED USING TYPE 304 STAINLESS STEEL WELL CASING AND SCREEN. WELL CASINGS ARE 4-INCH DIAMETER STAINLESS STEEL WITH ASTM FLUSH THREADS. WELL SCREENS ARE 4-INCH DIAMETER STAINLESS STEEL, CONTINUOUS WRAP SCREEN IN 0.040-INCH SLOT SIZE AND ASTM FLUSH THREADS.

11. THE HORIZONTAL LOCATION AND VERTICAL ELEVATION FROM THE TOP OF EACH 4-INCH ID STAINLESS STEEL CASING WAS SURVEYED BY A NEW YORK STATE-LICENSED SURVEYOR TO AN ACCURACY OF 0.1-FEET AND 0.01-FEET RESPECTIVELY.

12. ALL EXTRACTION WELLS WERE SEALED TO THE CONCRETE VAULT USING A HYDRATED BENTONITE PELLET SEAL FOLLOWED BY A PORTLAND CEMENT GROUT. BENTONITE AND GROUT SEALS WERE PLACED TO THE DIMENSIONS INDICATED ON THIS SHEET.

WELL CONSTRUCTION SCHEDULE

Well ID	Ground Surface Elevation (feet amsl)	Well Casing Elevation (feet bgs)	Shale Bedrock Interface (feet amsl)	Total Depth (feet amsl)	Filter Pack Interval (feet amsl)	Bentonite Plug Interval (feet amsl)	Grout Interval (feet amsl)	Screen Interval (feet amsl)
EW-1	518.63	0.92	498.63	498.63	509.93 - 498.63	513.63 - 509.93	518.63 - 513.63	508.63 - 498.63
EW-2	513.65	0.85	494.65	494.65	506.65 - 494.65	508.65 - 506.65	513.65 - 508.65	504.65 - 494.65
EW-3	511.12	0.85	488.12	488.12	504.12 - 488.12	507.12 - 504.12	511.12 - 507.12	503.12 - 488.12
EW-4	509.41	1.12	488.91	489.91	500.61 - 489.61	503.91 - 500.61	509.41 - 503.91	499.61 - 489.61

Well ID	Ground Surface Elevation (feet amsl)	State Plane Coordinates (NAD-83)		Top of Casing Elevation (feet amsl)	Bottom of Pump (feet amsl)	Static Groundwater Level (feet amsl) (a)	Minimum Pump Actuation Level (feet amsl)	Water Column (feet)
		Easting	Northing					
EW-1	518.63	530436.1536	956840.1405	517.71	500.13	513.50	503.13	14.87
EW-2	513.65	530653.4490	956898.0010	512.80	496.15	501.30	499.15	6.65
EW-3	511.12	530621.3155	956757.8777	510.27	489.62	495.61	492.62	7.49
EW-4	509.41	530564.2753	956636.2649	508.29	491.41	494.38	494.41	4.47

a/ Static groundwater levels are from baseline groundwater sampling conducted prior to full system operation.

REVISIONS

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WELL CONSTRUCTION DETAILS

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SHEET 5

Drawing Number
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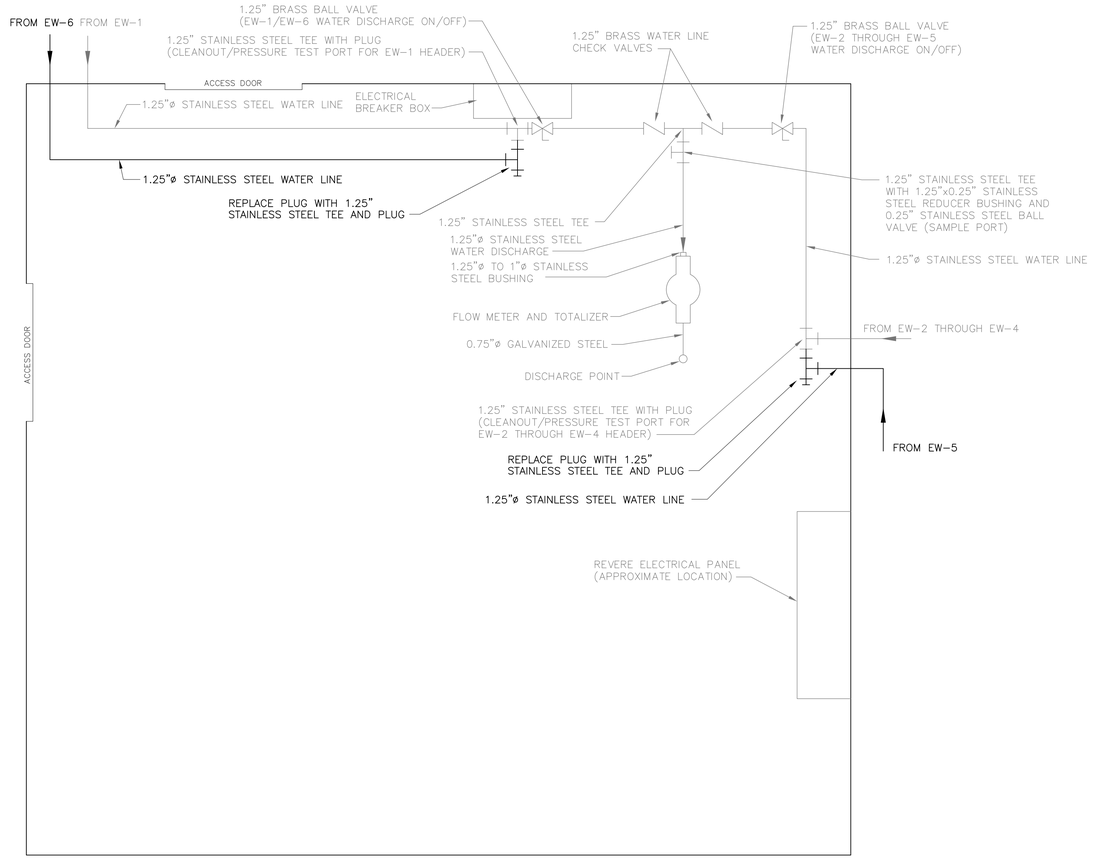
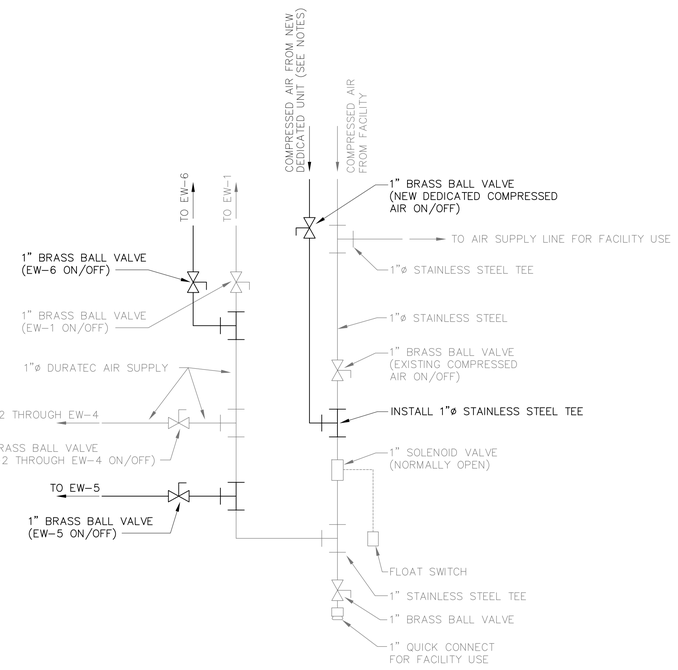


SUMP HOUSE LAYOUT AND WATER DISCHARGE PIPING
SCALE 3/4"=1'-0"



PLAN VIEW
SUMP HOUSE COMPRESSED AIR PIPING
NOT TO SCALE

NOTES:

GENERAL:
1. EXISTING CONDITIONS SHOWN IN GRAYSCALE AND EXPANSION DETAILS FOR EW-5 AND EW-6 (IF INSTALLED) SHOWN IN BLACK LINETYPE AND FONT.

2. REVERE MAY ELECT TO REPLACE DURATEC AIR SUPPLY LINES WITH OTHER MATERIAL COMPATIBLE FOR COMPRESSED AIR (SUCH AS STAINLESS STEEL).

DISCHARGE SUMP COMPLETION AND ELECTRICAL COMPONENTS:
1. THE EXTRACTED GROUNDWATER TOTAL DISCHARGE IS MONITORED USING AN IN-LINE FLOW METER (C700 POSITIVE DISPLACMENET METER) MANUFACTURED BY AMCO WATER METERING SYSTEMS INC.

2. TEES, FITTINGS, AND VALVES SHALL BE INSTALLED AS SHOWN ON THIS SHEET TO ALLOW WSP TO PRESSURE TEST DISCHARGE LINES IN THE FUTURE.

COMPRESSED AIR SUPPLY COMPONENTS:
1. IF EW-5 AND EW-6 ARE INSTALLED AND THE FACILITY'S EXISTING COMPRESSORS CANNOT MEET THE ADDED DEMAND, A DEDICATED COMPRESSOR CAPABLE OF SUPPLYING 28 SCFM OF AIR AT 80 PSI SHALL BE INSTALLED. WSP WILL COORDINATE THE LOCATION OF THE COMPRESSOR AND ELECTRICAL CONNECTIONS WITH REVERE PERSONNEL.

REVISIONS

REV	DESCRIPTION		
1	Revised:	Chkd:	Appr.:
2	Revised:	Chkd:	Appr.:
3	Revised:	Chkd:	Appr.:

SEAL

DATE

DRAWN BY: ECC
CHECKED: DJH 11/8/2016
APPROVED: 11/8/2016

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DISCHARGE SUMP LAYOUT AND DETAILS

AS-BUILT AND CONTINGENT EXPANSION CONSTRUCTION DRAWING PACKAGE

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

PREPARED FOR
RSR CORPORATION
DALLAS, TEXAS

PARSONS BRINCKERHOFF
WSP
WSP USA Corp.
75 Arlington Street, 4th Floor
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SHEET 6

Drawing Number
00020422-042

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Tables

Table 1

Extraction Well Construction Details
Revere Smelting & Refining Facility
Middletown, New York

Well ID	State Plane Coordinates (NAD-83) Easting	Northing	Ground Surface Elevation (feet amsl)	Well Casing Elevation (feet bgs)	Top of Casing Elevation (feet amsl)	Total Depth (feet bgs)	(feet amsl)	Filter Pack Interval (feet amsl)	Bentonite Plug Interval (feet amsl)	Grout Interval (feet amsl)	Grout Interval (feet bgs)	Bentonite Plug Interval (feet bgs)	Filter Pack Interval (feet bgs)	Screen Interval (feet bgs)	Screen Interval (feet amsl)	Bottom of Pump (feet amsl)	Minimum Pump Actuation Level (feet amsl)
Existing Wells																	
EW-1	530436.1536	956840.1405	518.63	0.92	517.71	20.0	498.63	509.93 - 498.63	513.63 - 509.93	518.63 - 513.63	0 - 5	5 - 8.7	8.7 - 20.0	10 - 20.0	508.63 - 498.63	500.13	503.13
EW-2	530653.4490	956898.0010	513.65	0.85	512.80	19.0	494.65	506.65 - 494.65	508.65 - 506.65	513.65 - 508.65	0 - 5	5 - 7	7 - 19.0	9 - 19.0	504.65 - 494.65	496.15	499.15
EW-3	530621.3155	956757.8777	511.12	0.85	510.27	23.0	488.12	504.12 - 488.12	507.12 - 504.12	511.12 - 507.12	0 - 4	4 - 7	7 - 23.0	8 - 23.0	503.12 - 488.12	489.62	492.62
EW-4	530564.2753	956636.2649	509.41	1.12	508.29	19.5	489.91	500.61 - 489.61	503.91 - 500.61	509.41 - 503.91	0 - 5.5	5.5 - 8.8	8.8 - 19.8	9.8 - 19.8	499.61 - 489.61	491.41	494.41
Proposed Wells																	
EW-5	TBD	TBD	TBD	TBD	TBD	31.5	TBD	TBD - TBD	TBD - TBD	TBD - TBD	0 - 5	5 - 7	7 - 31.5	11.5 - 31.5	TBD - TBD	TBD	TBD
EW-6	TBD	TBD	TBD	TBD	TBD	21.0	TBD	TBD - TBD	TBD - TBD	TBD - TBD	0 - 5	5 - 7	7 - 21.0	11.0 - 21.0	TBD - TBD	TBD	TBD

a/ amsl = above mean sea level; bgs = below ground surface; TBD = To be determined.
b/ Wells EW-9, EW-10, EW-8, and EW-1 were renamed EW-1 through EW-4, respectively, in July 2014.

Table 2

Groundwater Extraction System Flow Rates
Revere Smelting & Refining
Middletown, New York

Date	Time Between Readings (Minutes)	Sump House Reading (Gallons)	Data Since Previous Reading		
			Total Volume (Gallons)	Total Flow (gpm)	Flow Rate Per Well (gpm)
09/19/07	NA	6,330	NA	NA	NA
09/28/07	13,028	6,440	110	0.01	0.00
10/04/07	8,319	21,630	15,190	1.83	0.46
10/10/07	8,705	36,510	14,880	1.71	0.43
10/17/07	10,075	53,760	17,250	1.71	0.43
10/23/07	8,590	66,750	12,990	1.51	0.38
10/30/07	10,223	69,370	2,620	0.26	0.06
11/07/07	11,322	73,540	4,170	0.37	0.09
11/14/07	10,115	90,370	16,830	1.66	0.42
11/21/07	10,078	107,100	16,730	1.66	0.42
11/28/07	10,032	126,190	19,090	1.90	0.48
12/05/07	10,260	138,830	12,640	1.23	0.31
12/12/07	9,992	138,880	50	0.01	0.00
12/19/07	10,063	143,570	4,690	0.47	0.12
12/28/07	12,993	155,060	11,490	0.88	0.22
01/04/08	10,017	155,090	30	0.00	0.00
01/10/08	8,659	155,460	370	0.04	0.01
01/17/08	10,121	155,460	0	0.00	0.00
01/22/08	7,230	155,510	50	0.01	0.00
01/31/08	12,992	155,940	430	0.03	0.01
02/07/08	10,078	190,300	34,360	3.41	0.85
02/14/08	10,110	206,960	16,660	1.65	0.41
02/28/08	20,130	243,580	36,620	1.82	0.45
03/06/08	9,990	263,980	20,400	2.04	0.51
03/13/08	10,086	282,190	18,210	1.81	0.45
03/25/08	17,259	311,020	28,830	1.67	0.42
04/03/08	13,140	331,230	20,210	1.54	0.38
04/10/08	9,870	348,720	17,490	1.77	0.44
04/24/08	20,195	382,170	33,450	1.66	0.41
05/01/08	10,100	398,010	15,840	1.57	0.39
05/08/08	10,064	413,960	15,950	1.58	0.40
05/28/08	28,806	439,420	25,460	0.88	0.22
06/05/08	11,550	439,420	24,382	2.11	0.53
06/12/08	10,061	449,590	10,170	1.01	0.25
06/19/08	10,129	460,950	11,360	1.12	0.28
06/26/08	10,012	470,370	9,420	0.94	0.24
07/03/08	10,038	485,060	14,690	1.46	0.37
07/10/08	10,190	494,040	8,980	0.88	0.22
07/31/08	30,300	516,330	22,290	0.74	0.18
08/14/08	19,995	545,710	29,380	1.47	0.37
08/21/08	10,080	560,758	15,048	1.49	0.37
08/28/08	10,115	574,180	13,422	1.33	0.33
09/04/08	10,131	586,870	12,690	1.25	0.31
09/11/08	10,035	602,890	16,020	1.60	0.40
09/18/08	10,094	618,890	16,000	1.59	0.40
09/24/08	8,699	630,880	11,990	1.38	0.34

Table 2

Groundwater Extraction System Flow Rates
Revere Smelting & Refining
Middletown, New York

Date	Time Between Readings (Minutes)	Sump House Reading (Gallons)	Data Since Previous Reading		
			Total Volume (Gallons)	Total Flow (gpm)	Flow Rate Per Well (gpm)
10/01/08	10,064	649,200	18,320	1.82	0.46
10/08/08	10,002	661,760	12,560	1.26	0.31
10/15/08	10,120	675,670	13,910	1.37	0.34
10/22/08	10,124	688,630	12,960	1.28	0.32
10/30/08	11,507	708,350	19,720	1.71	0.43
11/05/08	8,569	722,020	13,670	1.60	0.40
11/12/08	10,200	738,120	16,100	1.58	0.39
11/19/08	10,015	755,320	17,200	1.72	0.43
11/25/08	8,550	770,430	15,110	1.77	0.44
12/03/08	11,565	785,830	15,400	1.33	0.33
12/10/08	10,083	800,080	14,250	1.41	0.35
12/17/08	10,092	821,760	21,680	2.15	0.54
12/24/08	10,130	833,440	11,680	1.15	0.29
01/02/09	12,981	861,910	28,470	2.19	0.55
01/09/09	9,984	872,940	11,030	1.10	0.28
01/14/09	7,213	876,450	3,510	0.49	0.12
01/21/09	10,152	879,660	3,210	0.32	0.08
01/26/09	7,132	882,230	2,570	0.36	0.09
02/04/09	12,985	885,720	3,490	0.27	0.07
02/11/09	10,099	890,720	5,000	0.50	0.12
02/19/09	10,944	896,910	6,190	0.57	0.14
02/25/09	8,640	899,760	2,850	0.33	0.08
03/04/09	10,080	902,870	3,110	0.31	0.08
03/10/09	8,640	905,640	2,770	0.32	0.08
03/18/09	11,520	909,580	3,940	0.34	0.09
03/31/09	18,720	921,150	11,570	0.62	0.15
04/17/09	24,480	961,070	39,920	1.63	0.41
04/22/09	7,200	972,620	11,550	1.60	0.40
05/01/09	12,960	992,670	20,050	1.55	0.39
05/06/09	7,200	1,003,050	10,380	1.44	0.36
05/13/09	10,080	1,019,170	16,120	1.60	0.40
05/19/09	8,640	1,036,500	17,330	2.01	0.50
07/16/09	83,520	1,057,030	20,530	0.25	0.06
07/22/09	8,640	1,074,620	17,590	2.04	0.51
07/30/09	11,520	1,093,580	18,960	1.65	0.41
08/06/09	10,080	1,113,090	19,510	1.94	0.48
08/13/09	10,080	1,133,530	20,440	2.03	0.51
08/19/09	8,640	1,148,940	15,410	1.78	0.45
08/26/09	10,080	1,165,960	17,020	1.69	0.42
09/02/09	10,080	1,184,510	18,550	1.84	0.46
09/09/09	10,080	1,198,900	14,390	1.43	0.36
09/16/09	10,080	1,213,280	14,380	1.43	0.36
09/23/09	10,080	1,228,270	14,990	1.49	0.37
09/29/09	8,640	1,244,180	15,910	1.84	0.46
10/06/09	10,080	1,259,560	15,380	1.53	0.38
10/13/09	10,080	1,275,840	16,280	1.62	0.40

Table 2

Groundwater Extraction System Flow Rates
Revere Smelting & Refining
Middletown, New York

Date	Time Between Readings (Minutes)	Sump House Reading (Gallons)	Data Since Previous Reading		
			Total Volume (Gallons)	Total Flow (gpm)	Flow Rate Per Well (gpm)
10/20/09	10,080	1,290,350	14,510	1.44	0.36
10/28/09	11,520	1,312,820	22,470	1.95	0.49
11/03/09	8,640	1,330,900	18,080	2.09	0.52
11/10/09	10,080	1,344,920	14,020	1.39	0.35
11/17/09	10,080	1,358,960	14,040	1.39	0.35
11/24/09	10,080	1,374,340	15,380	1.53	0.38
12/02/09	11,520	1,390,800	16,460	1.43	0.36
12/08/09	8,640	1,393,580	2,780	0.32	0.08
12/21/09	18,720	1,406,320	12,740	0.68	0.17
12/31/09	14,400	1,434,720	28,400	1.97	0.49
01/05/10	7,200	1,446,860	12,140	1.69	0.42
01/14/10	12,960	1,466,630	19,770	1.53	0.38
01/19/10	7,200	1,477,650	11,020	1.53	0.38
01/28/10	12,960	1,500,890	23,240	1.79	0.45
02/03/10	8,640	1,515,890	15,000	1.74	0.43
02/09/10	8,640	1,524,560	8,670	1.00	0.25
02/18/10	12,960	1,538,400	13,840	1.07	0.27
03/02/10	17,280	1,564,940	26,540	1.54	0.38
03/09/10	10,080	1,580,840	15,900	1.58	0.39
03/16/10	10,080	1,590,180	9,340	0.93	0.23
03/23/10	10,080	1,603,886	13,706	1.36	0.34
03/31/10	11,520	1,620,880	16,994	1.48	0.37
04/06/10	8,640	1,631,960	11,080	1.28	0.32
04/14/10	11,520	1,645,510	13,550	1.18	0.29
04/21/10	10,080	1,657,060	11,550	1.15	0.29
04/29/10	11,520	1,668,570	11,510	1.00	0.25
05/05/10	8,640	1,677,310	8,740	1.01	0.25
05/11/10	8,640	1,685,850	8,540	0.99	0.25
05/20/10	12,960	1,698,740	12,890	0.99	0.25
05/25/10	7,200	1,705,950	7,210	1.00	0.25
06/02/10	11,520	1,716,140	10,190	0.88	0.22
06/16/10	20,160	1,726,720	10,580	0.52	0.13
06/22/10	8,640	1,735,010	8,290	0.96	0.24
06/30/10	11,520	1,746,090	11,080	0.96	0.24
07/08/10	11,520	1,758,450	12,360	1.07	0.27
07/13/10	7,200	1,766,560	8,110	1.13	0.28
07/31/10	25,920	1,791,260	24,700	0.95	0.24
08/04/10	5,760	1,797,940	6,680	1.16	0.29
08/11/10	10,080	1,803,960	6,020	0.60	0.15
08/17/10	8,640	1,809,820	5,860	0.68	0.17
08/25/10	11,520	1,815,200	5,380	0.47	0.12
08/31/10	8,640	1,823,880	8,680	1.00	0.25
09/08/10	11,520	1,836,450	12,570	1.09	0.27
09/14/10	8,640	1,845,290	8,840	1.02	0.26
09/24/10	14,400	1,858,200	12,910	0.90	0.22
10/06/10	17,280	1,885,260	27,060	1.57	0.39

Table 2

Groundwater Extraction System Flow Rates
Revere Smelting & Refining
Middletown, New York

Date	Time Between Readings (Minutes)	Sump House Reading (Gallons)	Data Since Previous Reading		
			Total Volume (Gallons)	Total Flow (gpm)	Flow Rate Per Well (gpm)
10/13/10	10,080	1,898,190	12,930	1.28	0.32
10/20/10	10,080	1,911,310	13,120	1.30	0.33
10/27/10	10,080	1,921,820	10,510	1.04	0.26
11/04/10	11,520	1,937,180	15,360	1.33	0.33
11/09/10	7,200	1,947,690	10,510	1.46	0.36
11/17/10	11,520	1,959,430	11,740	1.02	0.25
11/23/10	8,640	1,959,430	0	0.00	0.00
11/30/10	10,080	1,962,620	3,190	0.32	0.08
12/08/10	11,520	1,980,860	18,240	1.58	0.40
12/14/10	8,640	1,992,680	11,820	1.37	0.34
12/21/10	10,080	2,001,850	9,170	0.91	0.23
12/29/10	11,520	2,007,980	6,130	0.53	0.13
01/04/11	8,640	2,009,260	1,280	0.15	0.04
01/13/11	12,960	2,009,260	0	0.00	0.00
01/20/11	10,080	2,013,680	4,420	0.44	0.11
02/21/11	46,080	2,036,420	22,740	0.49	0.12
03/08/11	21,600	2,044,850	8,430	0.39	0.10
03/15/11	10,080	2,056,420	11,570	1.15	0.29
03/22/11	10,080	2,063,740	7,320	0.73	0.18
03/29/11	10,080	2,108,550	44,810	4.45	1.11
04/05/11	10,080	2,113,880	5,330	0.53	0.13
04/14/11	12,960	2,146,350	32,470	2.51	0.63
04/26/11	17,280	2,229,930	83,580	4.84	1.21
05/03/11	10,080	2,249,230	19,300	1.91	0.48
05/10/11	10,080	2,264,390	15,160	1.50	0.38
05/17/11	10,080	2,277,380	12,990	1.29	0.32
05/25/11	11,520	2,301,960	24,580	2.13	0.53
05/31/11	8,640	2,312,980	11,020	1.28	0.32
06/07/11	10,080	2,323,550	10,570	1.05	0.26
06/15/11	11,520	2,336,730	13,180	1.14	0.29
06/30/11	21,600	2,374,190	37,460	1.73	0.43
07/06/11	8,640	2,388,980	14,790	1.71	0.43
06/25/12	511,200	2,922,650	533,670	1.04	0.26
07/27/12	46,080	3,016,230	93,580	2.03	0.51
08/31/12	50,400	3,044,530	28,300	0.56	0.14
10/01/12	44,640	3,081,220	36,690	0.82	0.21
10/26/12	36,000	3,119,160	37,940	1.05	0.26
11/19/12	34,560	3,153,060	33,900	0.98	0.25
12/19/12	43,200	3,193,630	40,570	0.94	0.23
01/23/13	50,400	3,265,700	72,070	1.43	0.36
02/22/13	43,200	3,319,270	53,570	1.24	0.31
03/20/13	37,440	3,363,530	44,260	1.18	0.30
04/18/13	41,760	3,387,100	23,570	0.56	0.14
05/16/13	40,320	3,403,010	15,910	0.39	0.10
06/20/13	50,400	3,429,470	26,460	0.53	0.13
07/23/13	47,520	3,471,790	42,320	0.89	0.22

Table 2

Groundwater Extraction System Flow Rates
Revere Smelting & Refining
Middletown, New York

Date	Time Between Readings (Minutes)	Sump House Reading (Gallons)	Data Since Previous Reading		
			Total Volume (Gallons)	Total Flow (gpm)	Flow Rate Per Well (gpm)
08/19/13	38,880	3,498,020	26,230	0.67	0.17
09/19/13	44,640	3,537,220	39,200	0.88	0.22
10/18/13	41,760	3,560,900	23,680	0.57	0.14
11/25/13	54,720	3,569,370	8,470	0.15	0.04
12/30/13	50,400	3,596,560	27,190	0.54	0.13
01/29/14	43,200	3,596,690	130	0.00	0.00
03/20/14	72,000	3,627,580	30,890	0.43	0.11
04/28/14	56,160	3,656,840	29,260	0.52	0.13
05/21/14	33,120	3,665,590	8,750	0.26	0.07
06/26/14	51,840	3,691,560	25,970	0.50	0.13
07/17/14	30,240	3,709,600	18,040	0.60	0.15
Total:	**3,589,142**		**3,727,652**	**1.04**	**0.26**

Notes:

a/ gpm = gallons per minute

b/ Extractions rates are based on flow totalizer readings. If the meter was not working properly, total flow rates are estimated based on individual cycle counter readings at the wellheads.

Table 3

Friction Loss Calculations for Water Conveyance Piping
Groundwater Extraction System Expansion
Revere Smelting & Refining
Middletown, New York

Scenario 1: 2-inch Diameter Header, Anticipated Water Flow Rate

	Static Head	Frictional Head Loss in Discharge Piping (a)											Velocity Head	Minor Losses in Discharge Piping (b)											Dynamic Head
		Diameter		Flow Rate		Total Flow Rate		Velocity	Total Velocity	H-W Discharge	Pipe Length	hf		Pipe Entrance		90 Deg. Elbow		Valves (c)		Tee, Standard		Pipe Exit		h_m	
Section of Pipe	H_{STAT} (ft)	(in)	(ft)	(gpm)	(ft^3/sec)	(gpm)	(ft^3/sec)	(ft/sec)	(ft/sec)	Coefficient, C	(ft)	(ft)	$V^2/2g$ (ft)	No.	K	No.	K	No.	K	No.	K	No.	K	(ft)	(ft)
EW-2 to EW-3	19.0	2	0.17	0.26	5.8E-04	0.26	5.8E-04	0.027	0.027	130	150	5.5E-04	1.1E-05	1	0.5	4	0.9	1	0.19	1	1.8	0	1.0	6.7E-05	19.0
EW-3 to EW-4	0.0	2	0.17	0.26	5.8E-04	0.52	1.2E-03	0.027	0.053	130	135	1.8E-03	4.4E-05	0	0.5	0	0.9	0	0.19	1	1.8	0	1.0	7.9E-05	0.0
EW-4 to EW-2/EW-4 Tee	0.0	2	0.17	0.26	5.8E-04	0.78	1.7E-03	0.027	0.080	130	90	2.5E-03	9.9E-05	0	0.5	2	0.9	0	0.19	2	1.8	0	1.0	5.3E-04	0.0
EW-2/EW-4 Tee to Sump	0.0	2	0.17	0.52	1.2E-03	1.30	2.9E-03	0.053	0.133	130	10	7.1E-04	2.7E-04	0	0.5	2	0.9	2	2.3	2	1.8	1	1.0	3.0E-03	0.0

TOTAL DYNAMIC HEAD REQUIRED (FT): 19
SYSTEM DESIGN DYNAMIC HEAD (TDH * 1.5 FS) (FT): 29

Scenario 2: 2-inch Diameter Header, Maximum Water Flow Rate

	Static Head	Frictional Head Loss in Discharge Piping (a)											Velocity Head	Minor Losses in Discharge Piping (b)											Dynamic Head
		Diameter		Flow Rate		Total Flow Rate		Velocity	Total Velocity	H-W Discharge	Pipe Length	hf		Pipe Entrance		90 Deg. Elbow		Valves (c)		Tee, Standard		Pipe Exit		h_m	
Section of Pipe	H_{STAT} (ft)	(in)	(ft)	(gpm)	(ft^3/sec)	(gpm)	(ft^3/sec)	(ft/sec)	(ft/sec)	Coefficient, C	(ft)	(ft)	$V^2/2g$ (ft)	No.	K	No.	K	No.	K	No.	K	No.	K	(ft)	(ft)
EW-2 to EW-3	19.0	2	0.17	9	0.020	9	0.020	0.92	0.92	130	150	0.38	0.013	1	0.5	4	0.9	1	0.19	1	1.8	0	1.0	0.080	19.5
EW-3 to EW-4	0.0	2	0.17	9	0.020	18	0.040	0.92	1.8	130	135	1.2	0.052	0	0.5	0	0.9	0	0.19	1	1.8	0	1.0	0.094	1.3
EW-4 to EW-2/EW-4 Tee	0.0	2	0.17	9	0.020	27	0.060	0.92	2.8	130	90	1.8	0.12	0	0.5	2	0.9	0	0.19	2	1.8	0	1.0	0.64	2.4
EW-2/EW-4 Tee to Sump	0.0	2	0.17	18	0.040	45	0.10	1.8	4.6	130	10	0.50	0.33	0	0.5	2	0.9	2	2.3	2	1.8	1	1.0	3.6	4.1

TOTAL DYNAMIC HEAD REQUIRED (FT): 27
SYSTEM DESIGN DYNAMIC HEAD (TDH * 1.5 FS) (FT): 41

(b) K values from *Civil Engineering Reference Manual: 8th Edition.* By Michael R. Lindeburg, P.E., Table 17.4.
(c) Gate valve located in the well vault; check valve located in the sump building.

Table 4

Friction Loss Calculations for Compressed Air Piping
Groundwater Extraction System Expansion
Revere Smelting & Refining
Middletown, New York

Scenario 1: 1-inch Diameter Header, Anticipated Water Flow Rate

Air Flow Rate per GPM (80 psi at 29 feet TDH): 0.45 scfm
Total Air Flow Rate (6 wells; 80 psi at 29 feet TDH): 1.4 scfm
Anticipated Flow Rate Per Extraction Well: 0.26 gpm
Water Flow Rate Factor of Safety: 2

Pipe Section	Diameter of Pipe (inches)	Length of Pipe (feet)	Total Flow Rate (gpm)	Total Flow Rate (scfm)	Total Velocity (sfpm)	Estimated Head Loss in Pipe (a) (in. H2O/ft pipe)	Equivalent Length of Pipe															Total Equivalent Length of Pipe (feet)	Loss in Pipe (in. of H_2O)
							90 Deg. Elbow (b)			45 Deg. Elbow (b)			Ball Valve (c)			Flow Through Tee (b)			Side Outlet Tee (b)				
							No.	E.L.	Total E.L.	No.	E.L.	Total E.L.	No.	E.L.	Total E.L.	No.	E.L.	Total E.L.	No.	E.L	Total E.L.		
Compressor to EW-5 Tee	1.0	50	3.1	1.40	257	0.014	1	5.2	5.2	0	1.3	0.0	2	29	58	2	3.2	6.4	1	6.6	6.6	126	1.8
EW-5 Tee to EW-2/EW-4 Tee	1.0	5	2.6	1.17	215	0.014	0	5.2	0.0	0	1.3	0.0	0	29	0	1	3.2	3.2	0	6.6	0.0	8	0.1
EW-2/E-4 Tee to EW-4	1.0	90	1.6	0.70	129	0.014	1	5.2	5.2	0	1.3	0.0	0	29	0	1	3.2	3.2	0	6.6	0.0	98	1.4
EW-4 to EW-3	1.0	135	1.0	0.47	86	0.014	0	5.2	0.0	0	1.3	0.0	0	29	0	1	3.2	3.2	0	6.6	0.0	138	1.9
EW-3 to EW-2	1.0	150	0.5	0.23	43	0.014	4	5.2	20.8	0	1.3	0.0	1	29	29	1	3.2	3.2	1	6.6	6.6	210	2.9

Total Head Loss: 8 in of H_2O
0.3 psi

Scenario 2: 1-inch Diameter Header, Maximum Water Flow Rate

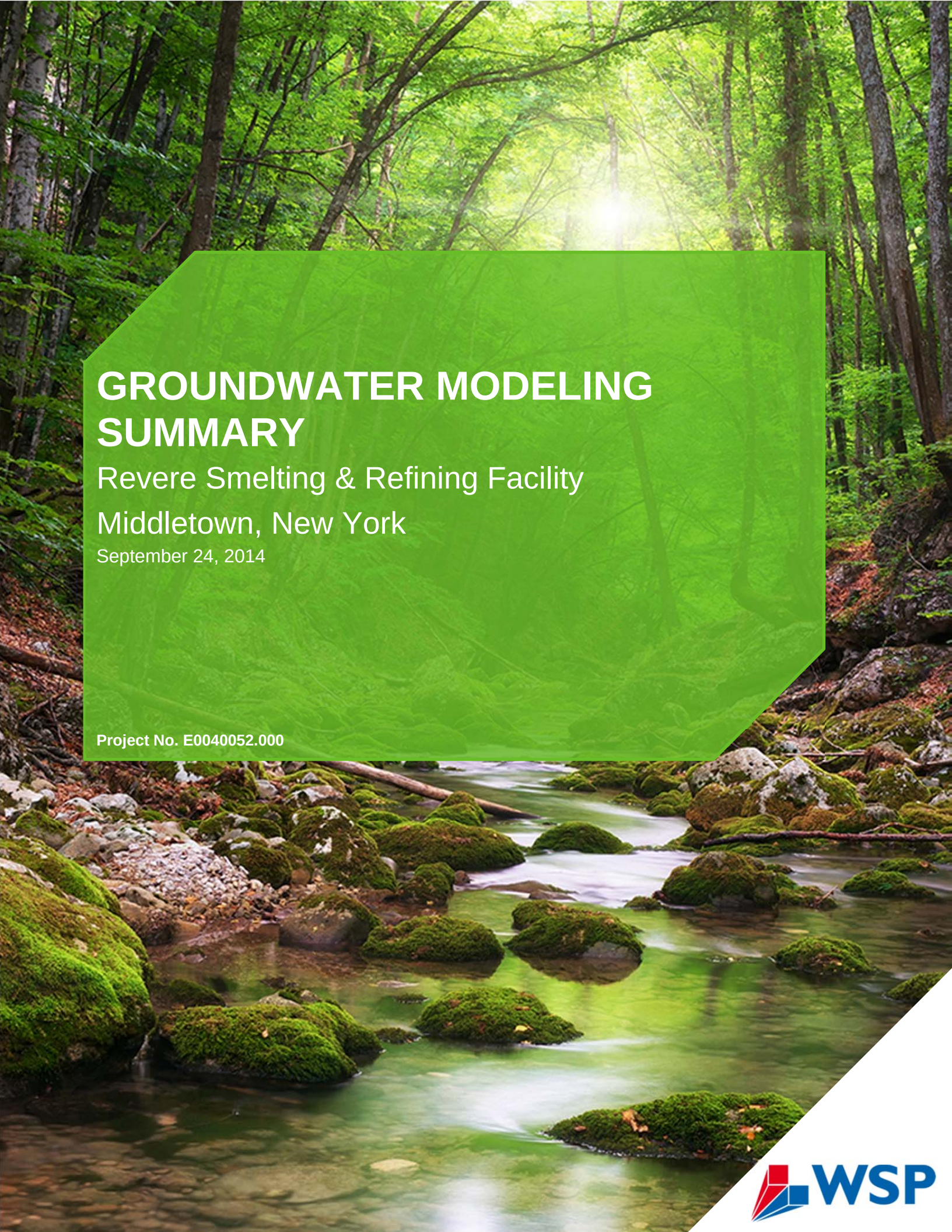
Air Flow Rate per GPM (80 psi at 41 feet TDH): 0.525 scfm
Total Air Flow Rate (6 wells; 80 psi at 41 feet TDH): 28 scfm
Anticipated Max. Flow Rate Per Extraction Well: 9 gpm
Water Flow Rate Factor of Safety: 1

Pipe Section	Diameter of Pipe (inches)	Length of Pipe (feet)	Total Flow Rate (gpm)	Total Flow Rate (scfm)	Total Velocity (sfpm)	Estimated Head Loss in Pipe (a) (in. H2O/ft pipe)	Equivalent Length of Pipe															Total Equivalent Length of Pipe (feet)	Loss in Pipe (in. of H_2O)
							90 Deg. Elbow (b)			90 Deg. Elbow (b)			Ball Valve (c)			Flow Through Tee (b)			Side Outlet Tee (b)				
							No.	E.L.	Total E.L.	No.	E.L.	Total E.L.	No.	E.L.	Total E.L.	No.	E.L.	Total E.L.	No.	E.L	Total E.L.		
Compressor to EW-5 Tee	1.0	50	54	28.4	5,198	0.475	1	5.2	5.2	0	1.3	0.0	2	29	58	2	3.2	6.4	1	6.6	6.6	126	59.9
EW-5 Tee to EW-2/EW-4 Tee	1.0	5	45	23.6	4,332	0.345	0	5.2	0.0	0	1.3	0.0	0	29	0	1	3.2	3.2	0	6.6	0.0	8	2.8
EW-2/E-4 Tee to EW-4	1.0	90	27	14.2	2,599	0.125	1	5.2	5.2	0	1.3	0.0	0	29	0	1	3.2	3.2	0	6.6	0.0	98	12.3
EW-4 to EW-3	1.0	135	18	9.5	1,733	0.054	0	5.2	0.0	0	1.3	0.0	0	29	0	1	3.2	3.2	0	6.6	0.0	138	7.5
EW-3 to EW-2	1.0	150	9	4.7	866	0.014	4	5.2	20.8	0	1.3	0.0	1	29	29	1	3.2	3.2	1	6.6	6.6	210	2.9

Total Head Loss: 85 in of H_2O
3.1 psi

(a) From "Friction Loss per Foot Tubing" Nomograph, Section I: Application Engineering Basics, *A Complete Product Specification Guide.* EG&G Rotron Industrial Division, pg I-8.
All loss in pipe for each new pipe section assumed to be equal to that of the compressor to EW-6. Actual pipe loss is negligible based on air consumption.
(b) From "Appendix L: Equivalent Length of Straight Pipe for Various Fittings", *Civil Engineering Reference Manual: Sixth Edition.* By Michael R. Lindeburg, P.E., pg 3-53.
(c) Equivalent Length estimated as a globe valve because the value for a ball valve was not available. Taken from reference (b).
(d) Anticipated groundwater flow rate based on 2005 groundwater flow model and historical operation of existing wells. Maximum flow rate based on pump curve operating at 80 psi, pump head 6 inches below surface.

Appendix A – Groundwater Model Summary Report



GROUNDWATER MODELING SUMMARY

Revere Smelting & Refining Facility

Middletown, New York

September 24, 2014

Project No. E0040052.000

WSP

GROUNDWATER MODELING SUMMARY

Revere Smelting & Refining Facility
Middletown, New York

September 24, 2014

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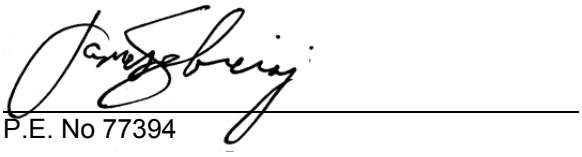
Certification

I, James A. Sobieraj, certify that I am currently a New York State-registered professional engineer (License No. 77394) and that this *Groundwater Modeling Summary* was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation's *Technical Guidance for Site Investigation and Remediation (DER-10),* dated May 2010.



P.E. No 77394

09/24/2014

1 Introduction

On behalf of Revere Smelting & Refining Corporation (Revere), WSP USA Corp. has prepared this summary report of groundwater modeling for the Revere facility located in Middletown, New York (Site). WSP developed a computer model of the complex groundwater system at the Site to evaluate the groundwater conditions following construction of the proposed wet electrostatic precipitator (WESP) building and completion of the Phase I, II, and III barrier walls.

In 1998 and 1999, WSP (formerly Environmental Strategies Corporation and ESC Engineering of New York, P.C.) oversaw the construction of several phases of barrier walls at the Site. The barrier wall construction was discontinued in August 1999 until this year. As described in the *Interim Corrective Measure Work Plan – Phase III Barrier Wall Installation and Phase I and II Barrier Wall Extensions – Operable Unit 4* (Work Plan; WSP 2014a) and the *Response to Conditional Approval Comments and Work Plan Addendum* (WSP 2014b), Revere will be constructing the proposed WESP building to the east of the Containment building. The pre-construction activities include installation of the following barrier wall segments and grading the WESP area (Figure A-1):

- Phase I extension soil-cement-bentonite barrier wall (stations 8+85 to 8+98)
- Phase II extension soil-cement-bentonite barrier wall (stations 210+16 to 210+58)
- Phase III soil-cement-bentonite barrier wall (stations 300+00 to 315+78)

The specific objectives for this modeling effort are consistent with those presented in the Work Plan and include the following:

- Evaluation of the expected groundwater flow system following the construction of the Phase I and Phase II extensions and Phase III barrier wall.
- Evaluation of potential effects of removing sections of the Phase IV barrier wall (Figure A-1) to reduce the potential of groundwater mounding in the new WESP building area.
- Evaluation of the existing groundwater extraction network to determine if there is sufficient groundwater elevation control on the Site.

In 2005, WSP developed a computer model of the complex groundwater system at the Site to optimize the placement and number of extraction wells required to lower the groundwater table beneath the Containment Building and prevent groundwater within the completed portions of the barrier wall from leaving the Site. The groundwater flow model was developed using Visual MODFLOW Version 3.0 and the summary was provided in WSP's 2005 *Summary Report of Groundwater Modeling and Groundwater Extraction Conceptual Design* (ESC Engineering of New York 2005). The conceptual model developed during the 2005 modeling effort was used as the base for this modeling effort.

A calibrated groundwater flow model was developed using Schlumberger Water Services' Visual MODFLOW software (Version 4.3) to allow for the estimation of the groundwater flow system following the construction activities.

2 Conceptual Model of Hydrogeologic System

The conceptual hydrogeologic model incorporates the important properties and conditions of the actual groundwater flow system into a framework that can be solved using mathematical techniques. Based on the available information, assumptions are carefully made to take into consideration data uncertainties and complex hydrogeologic conditions. Additionally, boundary conditions are selected to depict physical site conditions or arbitrarily determined to facilitate mathematical treatment by the program. The resulting conceptual model contains the relevant hydrogeologic parameters and conditions for the flow system, and is used as a guide in the calibration process.

2.1 Groundwater Flow System

The Revere facility lies within the Great Valley physiographic region of southeastern New York State. The Great Valley region is part of the Appalachian Valley and Ridge province which lies northwest of the Hudson Highlands. The regional hydrogeologic system underlying the facility consists of Pleistocene-age glacial till deposits which overlie Ordovician aged bedrock consisting primarily of shale, siltstone, and greywacke horizons. The glacial tills are in general poorly sorted, and primarily consist of a silt- or clay- sized particle matrix with minor sand and gravel horizons. Beneath the developed portions of the facility, much of the till has been reworked and some areas include several feet of fill, reportedly derived from the same native till. The thickness of the till deposits in the Walkill area may exceed 30 feet in thickness.

The glacial till overlies shale bedrock that has been folded and faulted during several tectonic episodes. Bedrock underlying the Revere facility is encountered at a minimum of 4 feet below ground surface (bgs) at the northern portion of the facility to greater than 29 feet bgs south and east of the operations area. The sedimentary bedrock strikes northeast-southwest and dips moderately towards the northwest. The shale, while predominantly competent, is slightly weathered in the upper few feet, and contains some vertical fractures.

Two water-bearing horizons underlie the Revere facility, although only one results in any appreciable flow of groundwater. The uppermost, unconfined horizon is associated with the glacially deposited till and/or reworked till materials. This water-bearing zone extends to the top of the underlying bedrock surface. The glacial and reworked till deposits are hydraulically connected based on historical groundwater elevation data. The glacial till is generally poorly sorted with low porosity and permeability, whereas the anthropogenic and reworked materials are generally coarser in nature, and are assumed to be slightly more permeable and porous. The surficial water-bearing unit is believed to behave as a porous media and, as such, can be modeled mathematically.

The bedrock also contains groundwater, although to a much smaller degree than the surficial unit. Fractures, jointing, and secondary openings are the primary source of groundwater from these sedimentary bedrock units. Based on observations of recharge rates following monitoring well purging, the degree of interconnectivity of these fractures is believed to be low. As a result, little flow is expected to occur through the bedrock water-bearing unit. In addition, since any flow within the bedrock is controlled by fractures, the application of mathematically based groundwater modeling techniques requires representing this unit as an equivalent porous medium.

2.2 Hydrologic Boundaries

Based upon information from historical water level measurements, there are no identified groundwater divides present within the surficial flow system. Based upon visual observations of surface water flow, the stream, which traverses the western property line, is a net gaining stream. The majority of the influx of groundwater into the stream is assumed to be from the hydraulically higher western side. As such, the stream was defined as a constant head boundary. The other surface water body of consequence, a pond located southeast of the facility operations, acts as a limited hydrologic boundary and represents a local discharge point for groundwater. Prior to 2014, approximately 3,000 linear feet of vertical barrier wall have been installed around the perimeter of the Site (Figure A-1).

The significant hydraulic properties for the surficial groundwater unit were characterized as follows:

1. Groundwater in the till deposits flows across the site under groundwater table conditions toward the south-southeast.
2. Limited leakage occurs from the uppermost water-bearing zone to the bedrock unit.
3. Hydraulic properties for the glacial till have been determined from completion of falling- and rising-head slug tests in onsite monitoring wells. The results of the slug tests indicate an average hydraulic conductivity in the native soils of 1.24 feet per day (ft/day), while in the reworked till it was 3.69 ft/day (ESC Engineering of New York 2005).
4. Site-specific values of porosity, specific yield and specific storage have not been determined for the till; therefore, estimated values were used based upon previous modeling efforts that are within typical ranges reported in the literature for similar deposits.

2.3 Sources and Sinks

There are no known offsite pumping or injection wells in the vicinity of the Revere facility that would impact the surficial groundwater flow system. Four onsite groundwater extraction wells have been installed and operate at the Site (EW-1 through EW-4; Figure A-1[1]).

Infiltration due to recharge to the uppermost water-bearing zone was assumed to be uniformly distributed over the model domain. The mean annual precipitation in this area of New York is 41 inches, and surface runoff and evapotranspiration average 14 and 21 inches, respectively, which results in a net recharge to the regional groundwater system of 6 inches per year (in/year; National Oceanographic and Atmospheric Association data for Albany, New York, 1997). The values for precipitation and evapotranspiration were varied in the model during the calibration process, and are discussed in Section 4.2.

Boundary conditions were incorporated into the model to simulate measured flow conditions. Based on information concerning groundwater flow, constant head boundaries were defined for the western creek, the pond, and the northern and southern boundaries (Section 3.3). Groundwater elevations along these boundaries were estimated in the model from the extrapolation of hydraulic gradients obtained from the contouring of average of quarterly groundwater elevation data obtained from onsite monitoring wells in 2010 (Table 1). The average groundwater elevation values measured in 2010 were selected for the model based on their comprehensive distribution.

[1] Extraction wells EW-9, EW-10, EW-8, and EW-1 were renamed to EW-1 through EW-4, respectively, in July 2014.

3 Numerical Groundwater Flow Model

The conceptual model was developed from a detailed review of the regional and site-specific data and the 2005 modeling effort (ESC Engineering of New York 2005), and forms the hydrogeologic framework for the input parameters to the mathematical model. The conceptual model is used to guide the calibration of the flow model and assist in the interpretation of the model results. Calibration of the flow model for the Site involved adjusting selected parameters for the groundwater system, within reasonable limits, to obtain a satisfactory match between observed water levels and simulated values calculated by the model. The model calibration was performed using iterative techniques.

3.1 Code Selection

The modular three-dimensional groundwater flow model (MODFLOW) was used to simulate groundwater movement at the Site. MODFLOW is a non-proprietary computer program developed by the U.S. Geological Survey (McDonald and Harbaugh 1988, Harbaugh and McDonald 1996) that simulates three-dimensional groundwater flow under steady-state and transient conditions in both confined and unconfined aquifers. This flow code is capable of incorporating a range of boundary conditions and includes options for recharge to one or more layers, aquifer-stream interaction, evapotranspiration, and various groundwater sources and sinks. The groundwater flow equation is approximated using the method of finite differences, and is solved by one of four matrix solution techniques:

- strongly implicit procedure
- slice-successive overrelaxation
- preconditioned conjugate-gradient (PCG) method
- WHS Solver for Visual MODFLOW (WHSSolv)

The WHSSolv technique was selected for this model because it is an efficient matrix solution method that incorporates the PCG solver and allows for variability between neighboring cells. The groundwater flow model was developed using Schlumberger Water Services' Visual MODFLOW software (Version 4.3).

3.2 Model Layers and Discretization

A finite-difference grid consisting of 134 rows and 138 columns was constructed over the Site and immediately surrounding offsite areas (Figure A-2). Variable grid dimensions were specified within the model domain. Finer grid spacing was designated over the portions of the Site containing barrier walls and groundwater extraction wells. This discretization of the model area was performed to achieve more detail with respect to groundwater flow conditions.

The uppermost water-bearing zone consisting of the glacial till and/or reworked till represents the upper two layers in the model (Layers 1 and 2); a third layer of nominal thickness represents the bedrock zone (Layer 3). The ground surface elevation of Layer 1 was obtained from the site survey base map and input into the model through automated digitization techniques (Figure A-3). Layer 2 was assigned in the model to create a vertical discretization for the Phase III barrier wall near the WESP. The vertical elevation of the boundary separating Layer 1 from Layer 2 was set at a uniform elevation of 507 feet above mean sea level (feet amsl) near the Containment Building, and a minimum elevation of 1 foot was assigned in areas beyond the WESP area (Figure A-4). The base of Layer 2 mirrors the ground surface topography, and Layer 2 was assigned a minimum thickness of 1 foot. The model base (465 feet amsl) was assigned a uniform value and is assumed to be a no-flow boundary (Figure A-4). The average thickness of Layer 3 is approximately 6 feet.

3.3 Boundary Conditions

Based on the orientation of the model domain, the hydrogeologic boundaries consisted of constant hydraulic head and no-flow conditions. Constant head boundaries were assigned to portions of the western creek and the northern boundary, the pond, and the southern boundary (Figures A-5 and A-6). Groundwater elevations along these boundaries were initially estimated in the model from the contouring of the average of groundwater elevation data obtained from onsite monitoring wells in 2010 (Figure A-7), and the final values were determined using iterative techniques during model calibration. The constant head boundaries were defined in the appropriate layer for the specified elevation; the groundwater elevations for cells designated as constant head in the model are summarized below:

- Northern Boundary: 527 feet amsl
- Western Creek Area: 504 to 518 feet amsl (from the south moving north, linearly)
- Pond Boundary: 494 feet amsl
- Southern Boundary: 472.5 feet amsl

Overall, the specified boundary conditions allow for the flow of groundwater from the northwest to the south and east across the model area.

Based on the information generated during the construction of the existing barrier walls, the pre-2014 barrier walls were simulated at a three-foot thickness at the following conductivity values:

- Stations 0+00 to 203+50 and 100+00 to 104+57: 1×10^{-6} centimeters per second (cm/sec)
- Stations 203+50 to 210+25: 3.2×10^{-8} cm/sec
- Stations 400+00 to 405+00: 4.5×10^{-8} cm/sec

The conductivity values are the average permeabilities for the Phase I cement-bentonite wall and the Phase II and Phase IV soil-bentonite walls, respectively, based on quality assurance/quality control (QA/QC) testing completed at the time of installation.

The barrier walls were assigned to the overburden materials in Layers 1 and 2 (Figure A-8).

3.4 Aquifer Properties

Based on evaluation of site hydrogeologic data, the model layers occur within an unconfined water-bearing unit. The transmissivity of the layers were calculated by MODFLOW using the hydraulic conductivity of the aquifer material and the saturated thickness of the layer. The model layers represent an unconfined zone of variable saturated thickness. The hydraulic conductivity was specified within the model domain based on the results of the aquifer tests performed at the Site (Section 2.2). A horizontally isotropic hydraulic conductivity of 1.24 ft/day was initially assigned over all layers of the model domain. This value is representative of silt and fine sand sediments (Domenico and Schwartz 1990). The hydraulic conductivity was assumed to be horizontally isotropic, with the ratio of K_x and K_y being 1 to 1. The conductivity values for the aquifer material were assumed to be vertically anisotropic, with the ratio of K_X to K_Z being 10 to 1.

Values of specific storage (0.003 1/feet), specific yield (0.015 dimensionless), effective porosity (25%), and total porosity (41.9%) used in the 2005 modeling effort were applied to all layers in the model domain.

3.5 Groundwater Sources and Sinks

Sources of water to the unconfined aquifer consist of groundwater recharge through infiltration of precipitation and the pond. The water that infiltrates into the surficial soil is called recharge water and is a function of the rate of precipitation and evapotranspiration. As described in Section 3.3, the pond was simulated as a constant head

boundary. Groundwater withdrawals were limited to groundwater extraction at four extraction wells located on the Site (Figure A-1). No other significant groundwater sources or sinks were known to exist within the model domain at the time the water level measurements used for calibration were collected at the Site.

3.5.1 Recharge

As stated in Section 2.3, the net recharge to the regional groundwater system is approximately 6 inches per year. This initial infiltration rate was used to determine the recharge flux for the model domain. For the land area covered by the containment cell northeast of the Site (Figure A-1), the recharge flux to the groundwater surface was assumed to be 0 in/year (Figure A-9). Recharge was applied to the uppermost active cell in the model domain. The recharge flux was varied during the flow model calibration process, and is further discussed in Section 4.2.

3.5.2 Extraction Wells

Four active groundwater extraction wells (EW-1 through EW-4) are located within the model domain (Figure A-1). Construction information (depth and screen interval) is provided in Table 2. Using operational data collected from cycle counters and the flow totalizer meter since startup in September 2007 through March 2014, the average pumping rates for each extraction well were calculated and assigned in the model (Table 2). The flow totalizer meter data provide the total volume of groundwater extracted over time for the four wells combined, which were used to calculate an average total extraction rate of 1.04 gpm for the system. This observed flow rate very closely matches the extraction rate predicted by the 2005 groundwater model. The data from the cycle counters provide a semi-quantitative extraction rate for each individual well[2]. WSP utilized the cycle counter data to estimate the ratio of relative extraction rates for each of the four wells as shown in Table 2. WSP then applied these relative extraction ratios to the total extraction rate for the entire system based on the flow totalizer (1.04 gpm) to calculate the following average extraction rate for each existing well:

- EW-1: 0.54 gpm
- EW-2: 0.09 gpm
- EW-3: 0.12 gpm
- EW-4: 0.29 gpm

[2] Comparatively, the flow totalizer meter provides a more accurate flow measurement compared to the cycle counters.

4 Model Calibration and Pre-Construction Flow Simulation

The conceptual hydrogeologic model presented in Section 3 was developed from a detailed review of the regional and site-specific data, and forms the framework for the input parameters to the numerical groundwater flow model. The conceptual hydrogeologic model is used to guide the calibration process and assist in the interpretation of the model results. Calibration of the flow model for the Site involved adjusting selected input parameters for the groundwater system, within reasonable limits, to obtain a satisfactory match between observed water levels and model-simulated head values. The model calibration was performed using an iterative (trial and error) approach.

4.1 Calibration Targets

The calibration of the numerical groundwater flow model involves minimization of the difference, or residual, between the observed and simulated heads at various points within each model layer. The water level measurements used to check the model calibration are termed calibration targets. Based on a review of the Site hydrogeologic data, the average of the 2010 quarterly water level measurements were selected as calibration targets for the flow model because of their spatial completeness.

A total of 24 calibration targets were used for the groundwater flow model, with the location of each target shown in Figure A-10. Based on the screen measuring point elevations, 13 of the calibration targets occur in model Layer 1, 10 calibration targets occur in Layer 2, and 1 calibration target is present in model Layer 3.

4.2 Model Calibration

The groundwater flow model was calibrated under steady-state conditions using the hydraulic parameters and boundary conditions specified above. The input parameters that were varied during the calibration process were hydraulic conductivity and several boundary conditions. Boundary conditions adjusted during model calibration consisted of:

- Recharge to Layer 1
- Constant head along the western creek
- Constant head along the upgradient (northern) boundary
- Constant head along the downgradient (southern) boundary

As previously discussed, a uniform isotropic hydraulic conductivity of 1.24 ft/day was assigned to all layers; this hydraulic conductivity value was verified during calibration. Variances in the hydraulic conductivity for the bedrock layer (Layer 3) did not result in improvements in calibration; therefore, the calibrated hydraulic conductivity in Layer 3 was not modified.

The calibrated recharge rate was 4.5 in/year, which is slightly lower than the estimated regional recharge rate of 6 in/year. This is reasonable given the nature of the soils, hydrology, and hydrogeology at the Site, including the collection of storm water in a large portion of the operational areas. The containment cell recharge was held at 0 in/yr during calibration (Figure A-9).

The overall quality of the steady-state flow simulation for each model run was evaluated using the following measures:

- difference between the observed head (h_o) and simulated head (h_s), termed head residual
- mean and root-mean-square (RMS) of the residuals
- groundwater mass flow balance within the model domain

Evaluation of the numerical accuracy of the model was based on an examination of the solution convergence criteria for each run. Numerical iterations during each model run continued until the solution converged; i.e., until the difference between the simulated heads from two successive iterations at a particular model cell was less than a pre-set value, termed the convergence criteria. The WHSSolv matrix solution was able to achieve the specified convergence criterion of 0.01 feet for the total head change and a residual head change of 0.001 feet.

After completion of the model calibration, diagnostic checking was performed to evaluate the accuracy of the model results. This step included an assessment of the numerical accuracy of the model and an analysis of the model residuals. The residuals for the flow model are defined as the observed head minus the simulated head.

4.2.1 Simulated Hydraulic Heads

The simulated hydraulic heads for the calibrated flow model compare favorably with the average 2010 groundwater elevations for the Site. The distribution of head residuals is illustrated in Figure A-11. Ideally, all points should plot along the theoretical straight line that represents equal calculated and observed groundwater elevations for the model layer. The high correlation coefficient (r^2 = 0.972) of the residuals with respect to the theoretical line indicates a very good match between the simulated and observed heads. The plot also illustrates the majority of the head residuals for both layers lie within the 95% confidence interval with respect to the theoretical line.

Summary statistics for the simulated heads in both model layers (n = number of calibration targets = 24) are provided below.

- Normalized RMS: 9.26%
- Mean of residuals: 1.62 feet
- RMS of residuals: 4.14 feet

The normalized mean is defined as the root mean square (sum of the residuals [h_o minus h_s] divided by the number of calibration targets) divided by the maximum head minus the minimum head; the target value of the normalized mean for a calibrated model is less than 10%. Using this criterion, the pre-remediation steady-state flow simulation achieves this normal calibration standard.

The mean of residuals (1.62 feet) indicates a slightly positive bias, or skewness, to the simulated heads in the model.

The RMS of residuals (4.14 feet) is small in comparison to the 50-foot range in head values between the upgradient and downgradient boundaries in the model. Generally, the RMS of residuals for a calibrated groundwater flow model should be less than 10 percent of the change in the observed heads or 5 feet. Using this criterion, the pre-remediation steady-state flow simulation achieves this normal calibration standard.

Therefore, the model was calibrated within normal limits. Additional variance of net recharge to the modeled area might marginally improve the calibration; however, the calibration values achieved are consistent with the use of the model as a preliminary engineering design tool.

4.2.2 Simulated Groundwater Flow

Contour maps of the model-generated pre-2014 construction steady-state hydraulic heads in Layers 1 and 2 beneath the Site are shown in Figures A-12 and A-13. The groundwater elevations are highest along the northern model boundary and decrease to the southern boundary of the model area and are consistent with the potentiometric surface map based on the average 2010 groundwater elevation data (Figure A-7).

4.3 Predictive Simulations

The barrier walls installed prior to 2014 form an impediment to groundwater at the Site. In addition, the Phase II and unfinished Phase IV barrier walls form a partial downgradient barrier. These existing barrier walls have created a partial “bathtub” effect where upgradient groundwater flow is diverted around the Site, but where recharge on the Site is being retained compared to natural conditions.

Once the model was developed and calibrated to pre-2014 conditions based on historical water level data, the model was used to simulate the modified ground surface in the area of the WESP, completion of the Phase III barrier wall, and completion of the proposed Phase I and II extensions (Figure A-1). The modified ground surface elevation of Layer 1 was obtained from the proposed final ground surface elevation in the vicinity of the WESP (Figure A-1) and input into the model through automated digitization techniques (Figure A-14). The Phase III barrier wall and Phase I and II extensions were assigned to both Layers 1 and 2 at a hydraulic conductivity of 6.4×10^{-8} cm/sec and a thickness of 3 feet. Due to shallow subgrade design restrictions imposed by the construction of the WESP, the portion of the Phase III barrier wall near the proposed WESP was only assigned to Layer 2 (i.e., elevations less than or equal to 507 ft amsl; Figures A-15 and A-16).

Under natural groundwater conditions, it would be expected that once the barrier walls completely encircled the facility, groundwater elevations would increase until the hydrostatic pressures force the groundwater through an outlet before resuming the regional flow direction. As expected, the predictive model simulations indicate groundwater mounding behind the barrier walls (Figures A-17 and A-18). A zone budget analysis was performed to compare the pre-2014 and proposed final barrier wall scenarios to determine the rate at which groundwater extraction would be necessary to maintain the current hydrostatic pressures (Figure A-19). The zone budget analyzes the volume of groundwater entering and exiting Layer 1 and Layer 2 within the area inside of the barrier walls (Figure A-19). The predicted flow discrepancy is only 0.1 gallons per minute (gpm). The existing extraction wells (EW-1 through EW-4) have considerable excess capacity to manage this marginal increase in total flow rate. The pneumatic pumps installed at these locations are capable of automatically self-adjusting to changes in the amount of available groundwater for extraction and are designed to pump up to 9 gpm of water at the design system pressure. Therefore, no additional capacity is necessary within the capture zones of the existing extraction wells, which each have a radius of influence of about 75 to 100 feet.

5 References

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6 Acronyms

bgs	below ground surface
cm/sec	centimeters per second
feet amsl	feet above mean sea level
ft/day	feet per day
gpm	gallons per minute
h_o	observed head
h_s	simulated head
in/year	inches per year
PCG	preconditioned conjugate-gradient
RMS	root-mean-square
WESP	wet electrostatic precipitator
WHSSolv	WHS Solver for Visual MODFLOW

Figures

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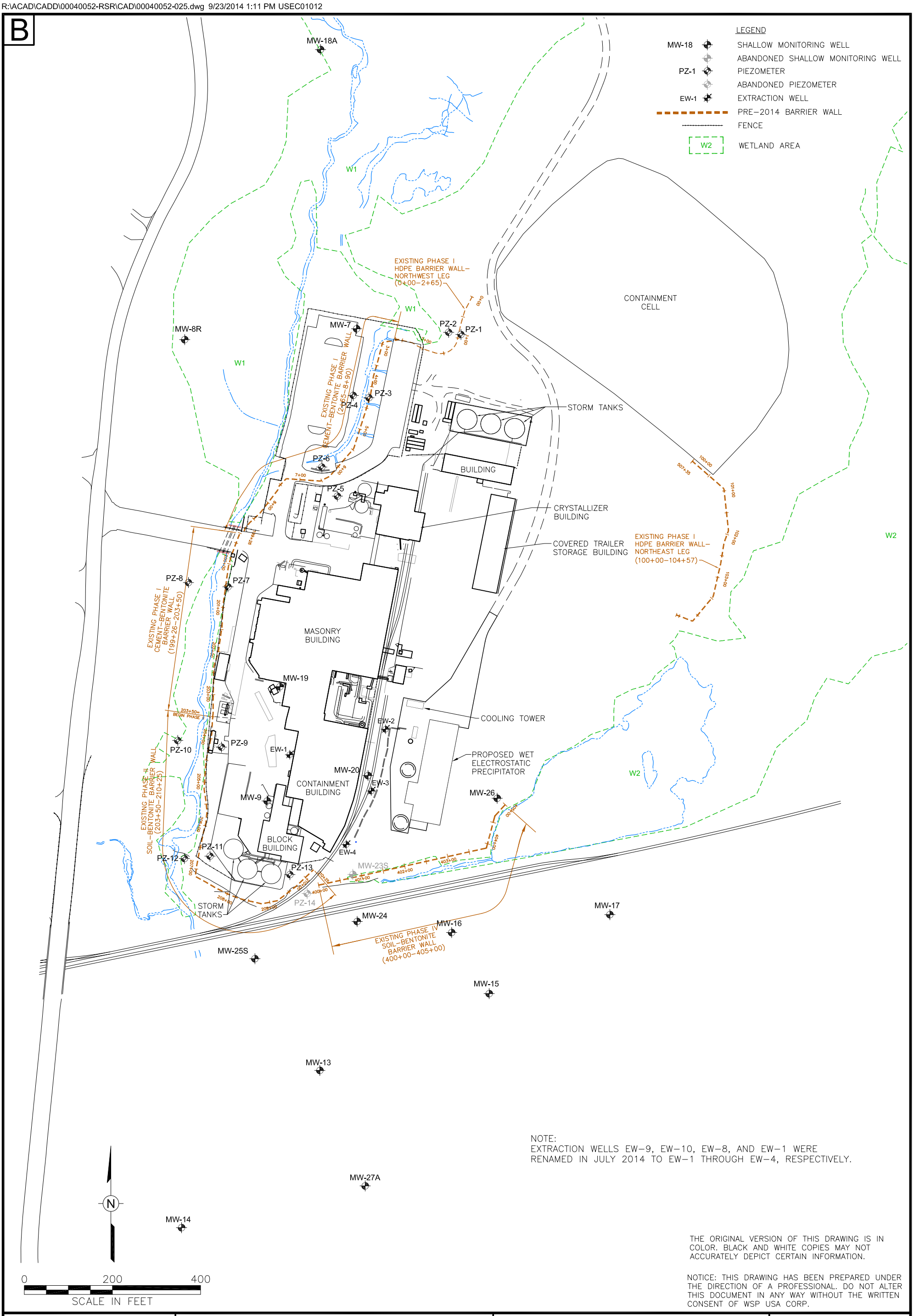

NOTE:
EXTRACTION WELLS EW-9, EW-10, EW-8, AND EW-1 WERE RENAMED IN JULY 2014 TO EW-1 THROUGH EW-4, RESPECTIVELY.

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Figure A-1

PRE-2014 BARRIER WALL

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Figure A–2

LAYOUT OF MODEL GRID

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Figure A–3

EXISTING GROUND SURFACE ELEVATION

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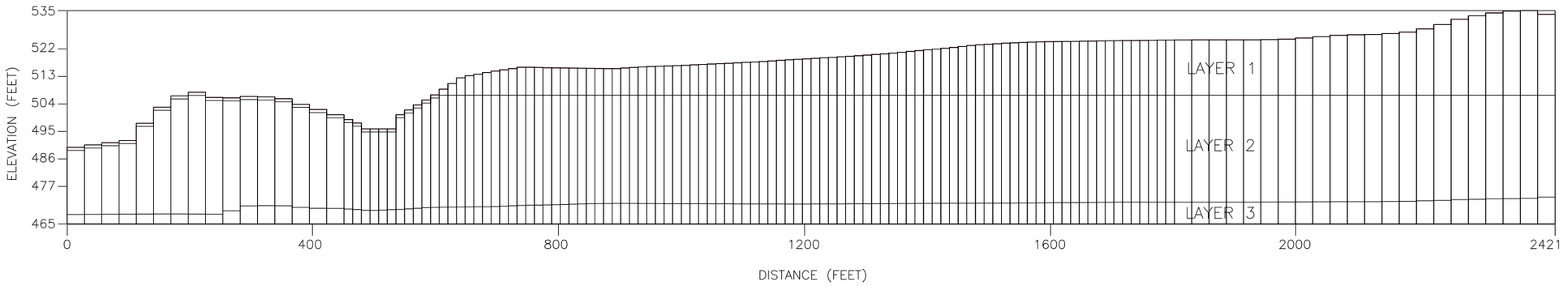
SOUTH

NORTH



NOTE: COLUMN 54 SHOWN

0 200 400

HORIZONTAL SCALE IN FEET

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Approved: JS 9/23/2014

DWG Name: 00040052-012

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Figure A-4

CROSS-SECTION OF GROUNDWATER FLOW MODEL

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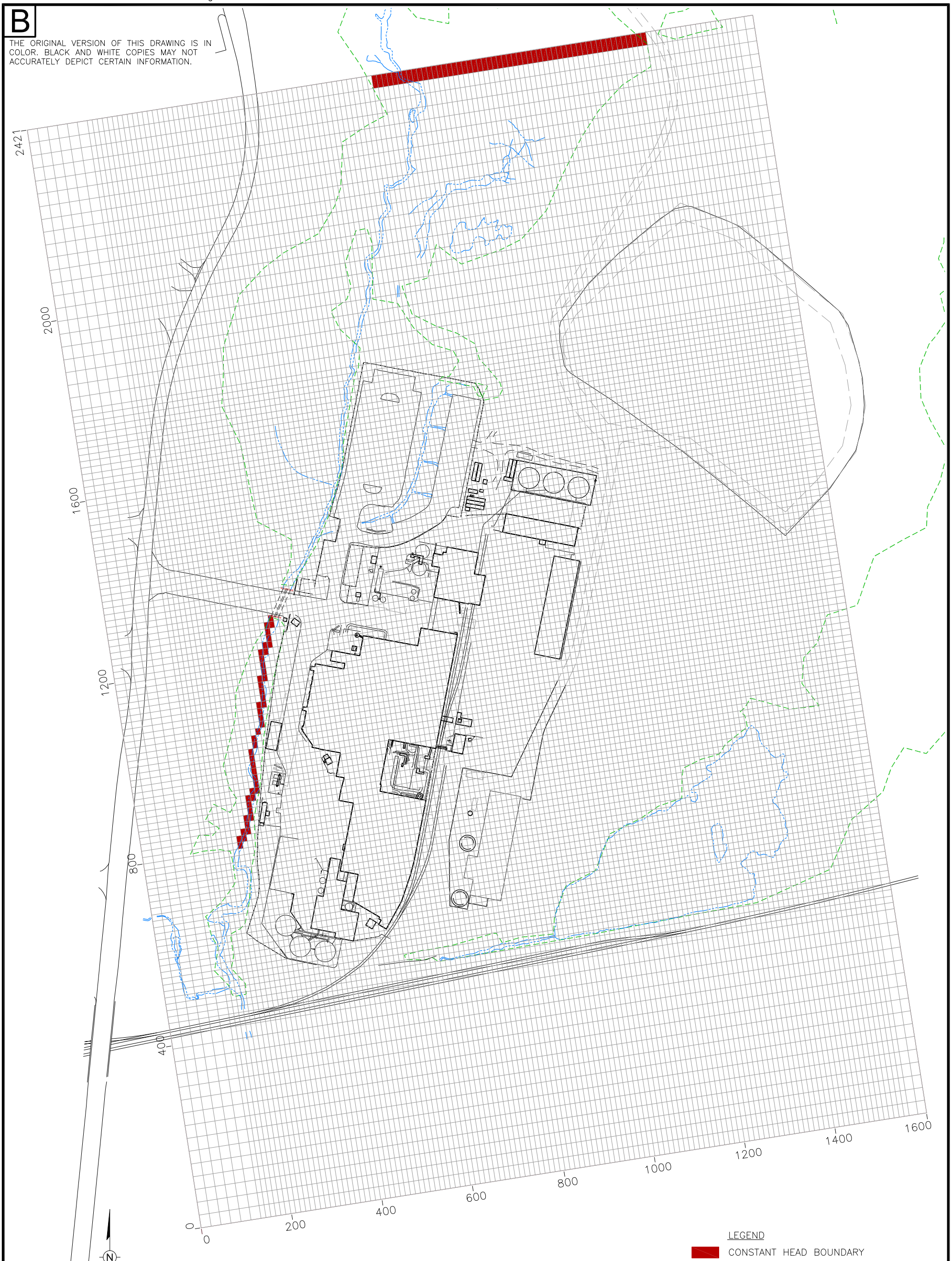

0 200 400
SCALE IN FEET

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Figure A–5

LAYER 1 CONSTANT HEAD BOUNDARIES, CURRENT CONDITIONS

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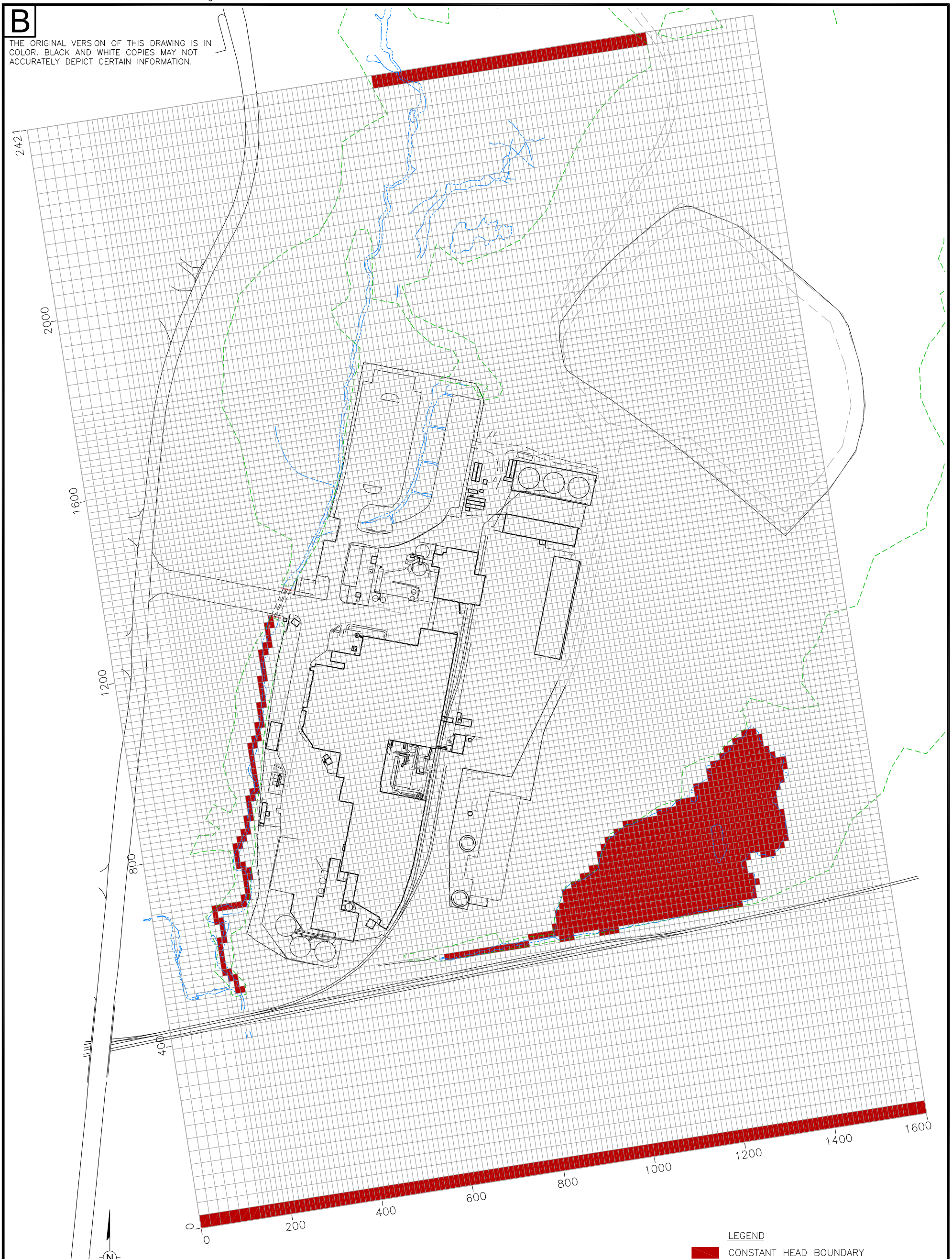

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Figure A–6

LAYERS 2 AND 3 CONSTANT HEAD BOUNDARIES, CURRENT CONDITIONS

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LEGEND

MW-18 SHALLOW MONITORING WELL
PZ-1 PIEZOMETER
PRE-2014 BARRIER WALL
W2 WETLAND AREA
GROUNDWATER ELEVATION CONTOUR
527.00 GROUNDWATER ELEVATION (FT. AMSL)

MW-18A 527.00
MW-8R 522.78
MW-7 521.79
PZ-2 522.08
PZ-1 521.98
PZ-4 520.82
PZ-3 520.36
PZ-6 518.82
PZ-5 518.85
PZ-8 518.75
PZ-7 517.46
MW-19 514.80
PZ-10 514.25
PZ-9 514.50
MW-20 499.19
MW-9 512.95
MW-26 496.32
PZ-12 507.96
PZ-11 508.12
PZ-13 495.38
MW-23S 494.58
PZ-14 492.30
MW-24 485.60
MW-16 486.63
MW-17 478.00
MW-25S 489.76
MW-15
MW-13 478.13
MW-27A 470.00
MW-14 465.09

525 520 515 510 500 500 495 490 485 480 475 470

W1 W1 W1 W2 W2

EXISTING PHASE I HDPE BARRIER WALL-NORTHWEST LEG (0+00-2+65)
EXISTING PHASE I CEMENT-BENTONITE BARRIER WALL (2+90-8+90)
EXISTING PHASE I HDPE BARRIER WALL-NORTHEAST LEG (100+00-104+57)
EXISTING PHASE II CEMENT-BENTONITE BARRIER WALL (199+26-203+50)
EXISTING PHASE II SOIL-BENTONITE BARRIER WALL (203+50-210+25)
EXISTING PHASE IV SOIL-BENTONITE BARRIER WALL (400+00-405+60)

CONTAINMENT CELL
STORM TANKS
BUILDING
CRYSTALLIZER BUILDING
COVERED TRAILER STORAGE BUILDING
MASONRY BUILDING
COOLING TOWER
PROPOSED WET ELECTROSTATIC PRECIPITATOR
CONTAINMENT BUILDING
BLOCK BUILDING
STORM TANKS

N

0 200 400
SCALE IN FEET

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Figure A-7

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE 2010 AVERAGE

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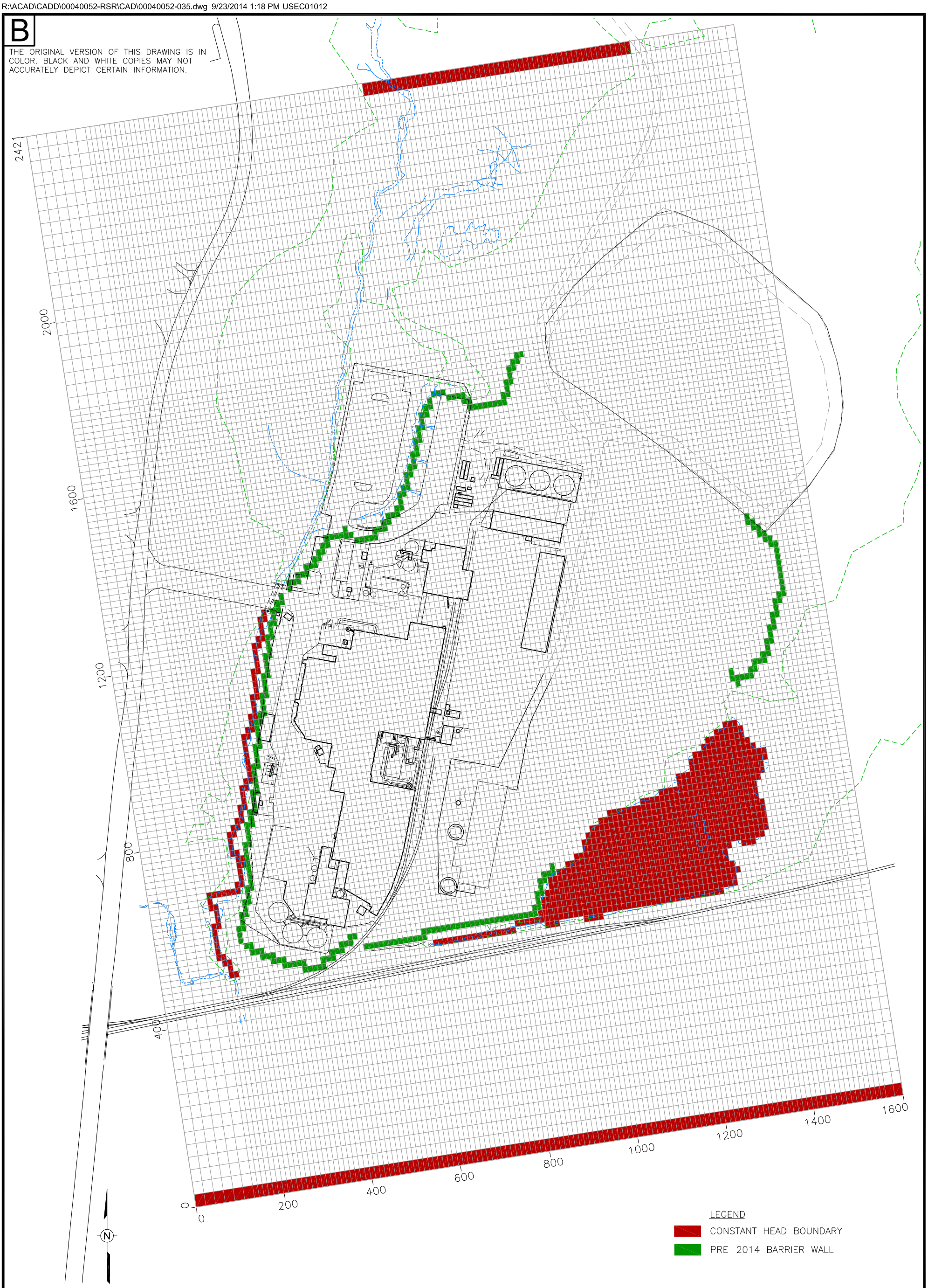

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Figure A-8

PRE-2014 BARRIER WALL LOCATIONS
(LAYER 2)

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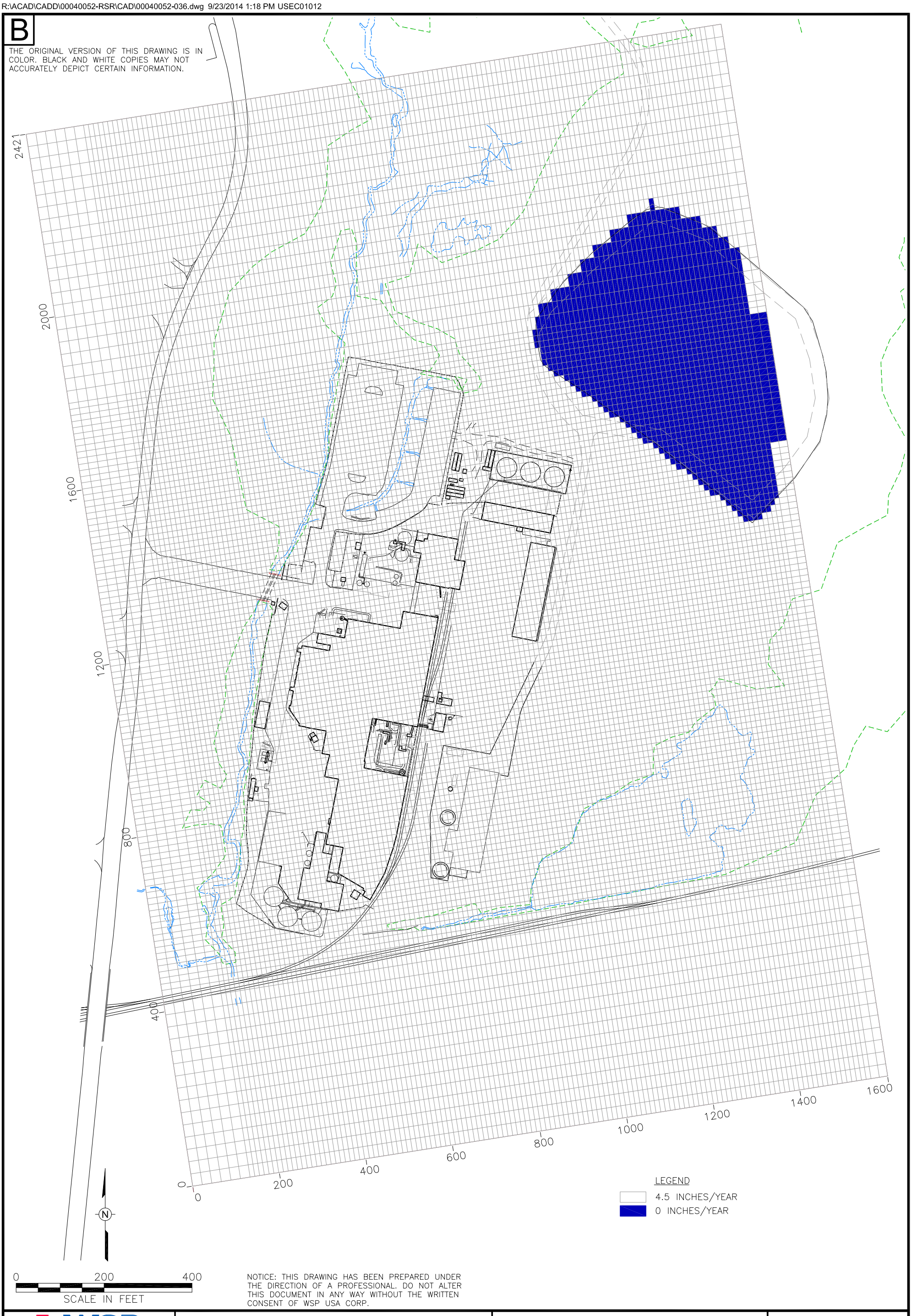

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Figure A–9

RECHARGE AREAS
(LAYER 1)

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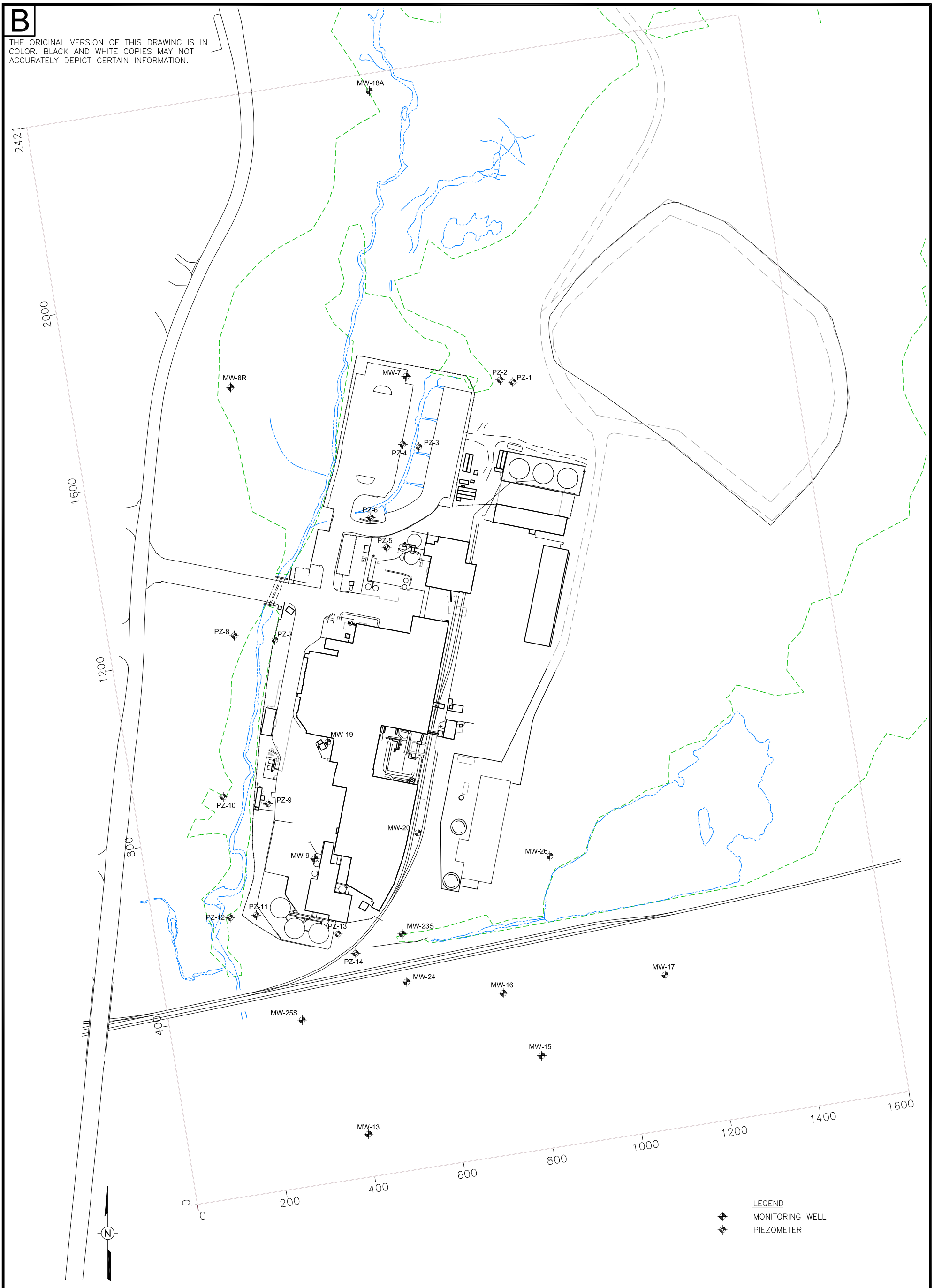

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Figure A–10

CALIBRATION TARGET LOCATIONS

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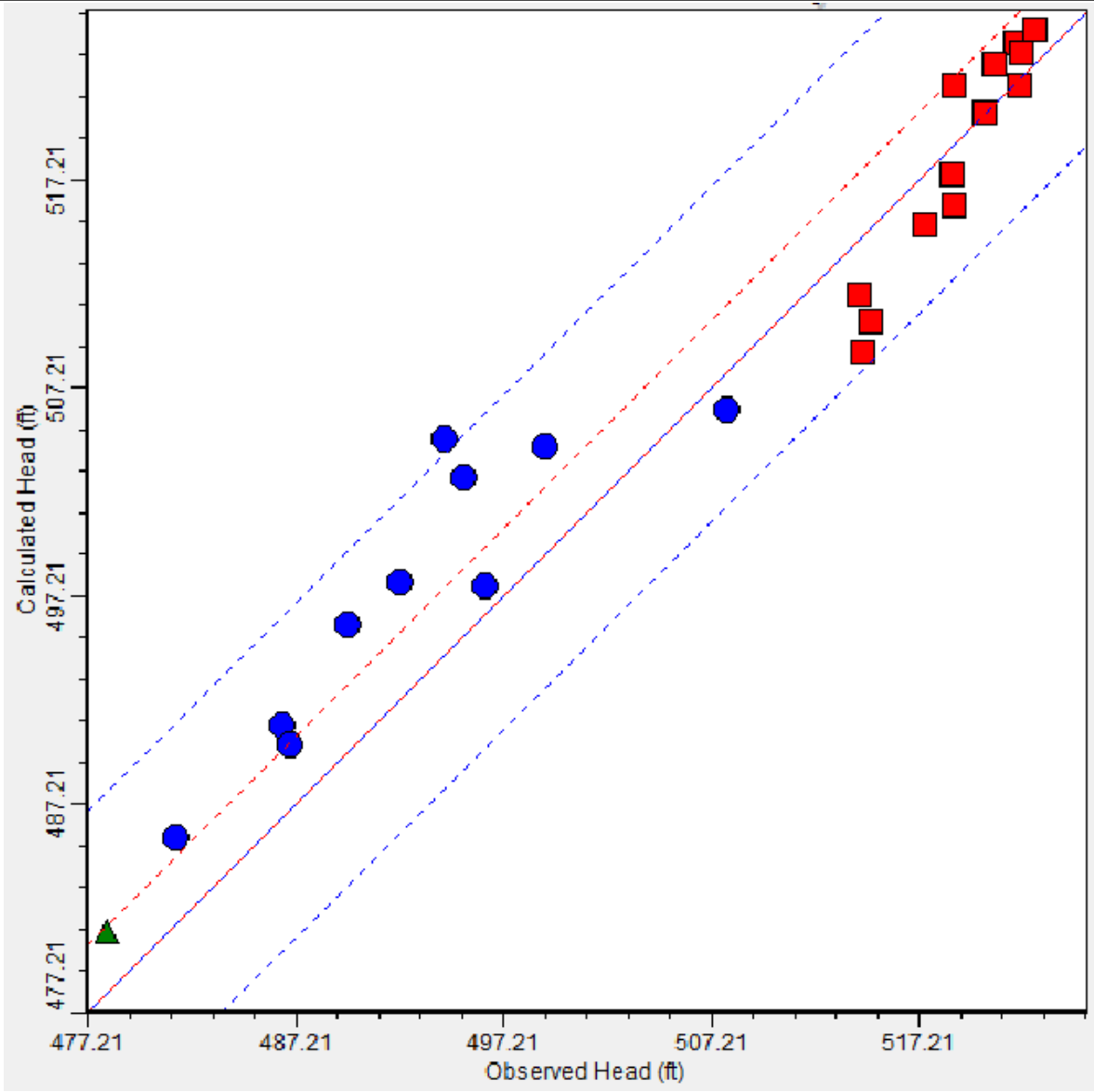

Max. Residual: 10.347 (ft) at MW-23/A
Min. Residual: 0.065 (ft) at PZ-03/A
Residual Mean : 1.619 (ft)
Abs. Residual Mean : 3.396 (ft)

Num. of Data Points : 24
Standard Error of the Estimate : 0.793 (ft)
Root Mean Squared : 4.135 (ft)
Normalized RMS : 9.26 (%)
Correlation Coefficient : 0.972

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Figure A–11

MODEL CALIBRATION

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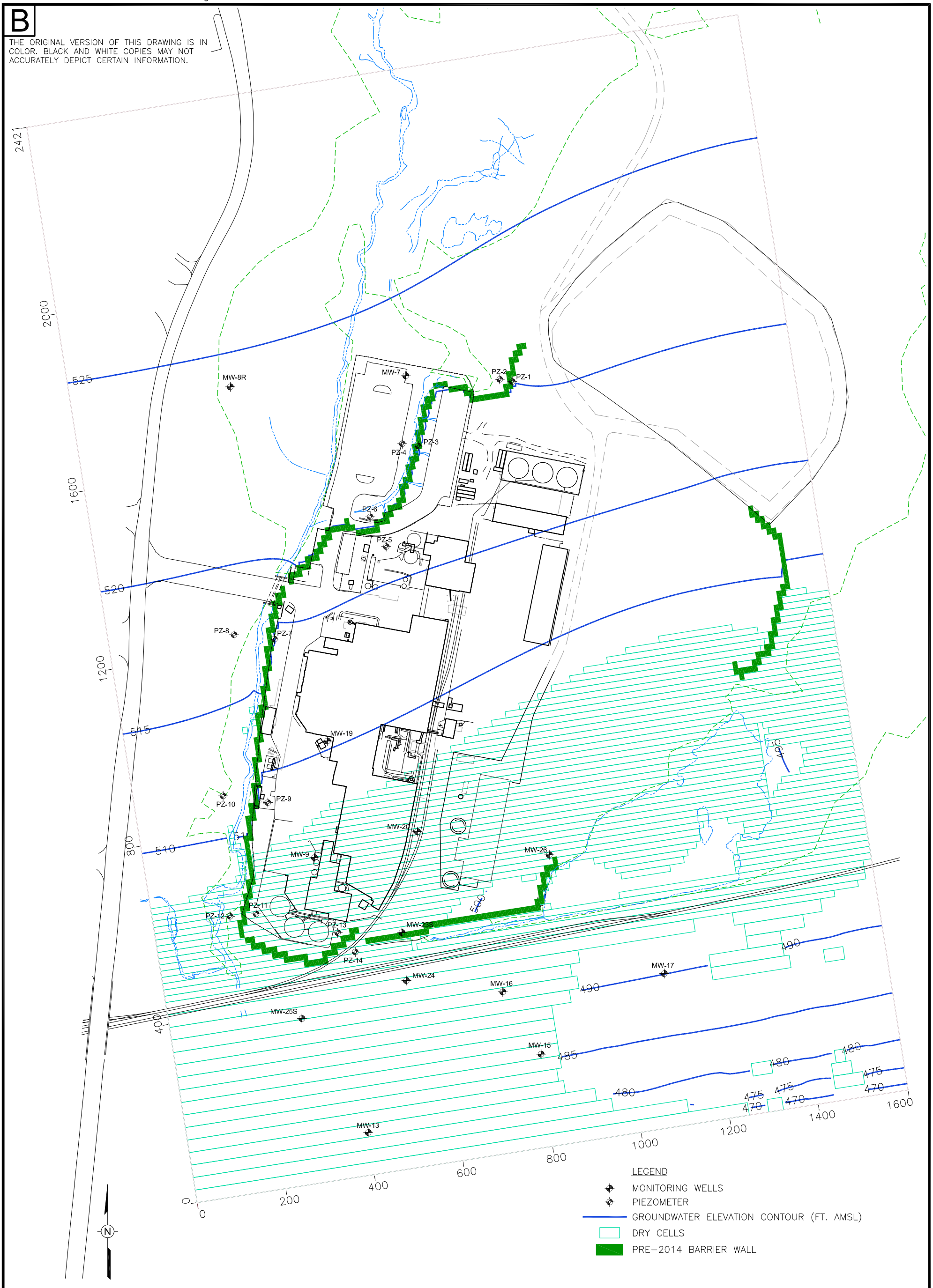

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Figure A-12

CALIBRATED LAYER 1
GROUNDWATER ELEVATION

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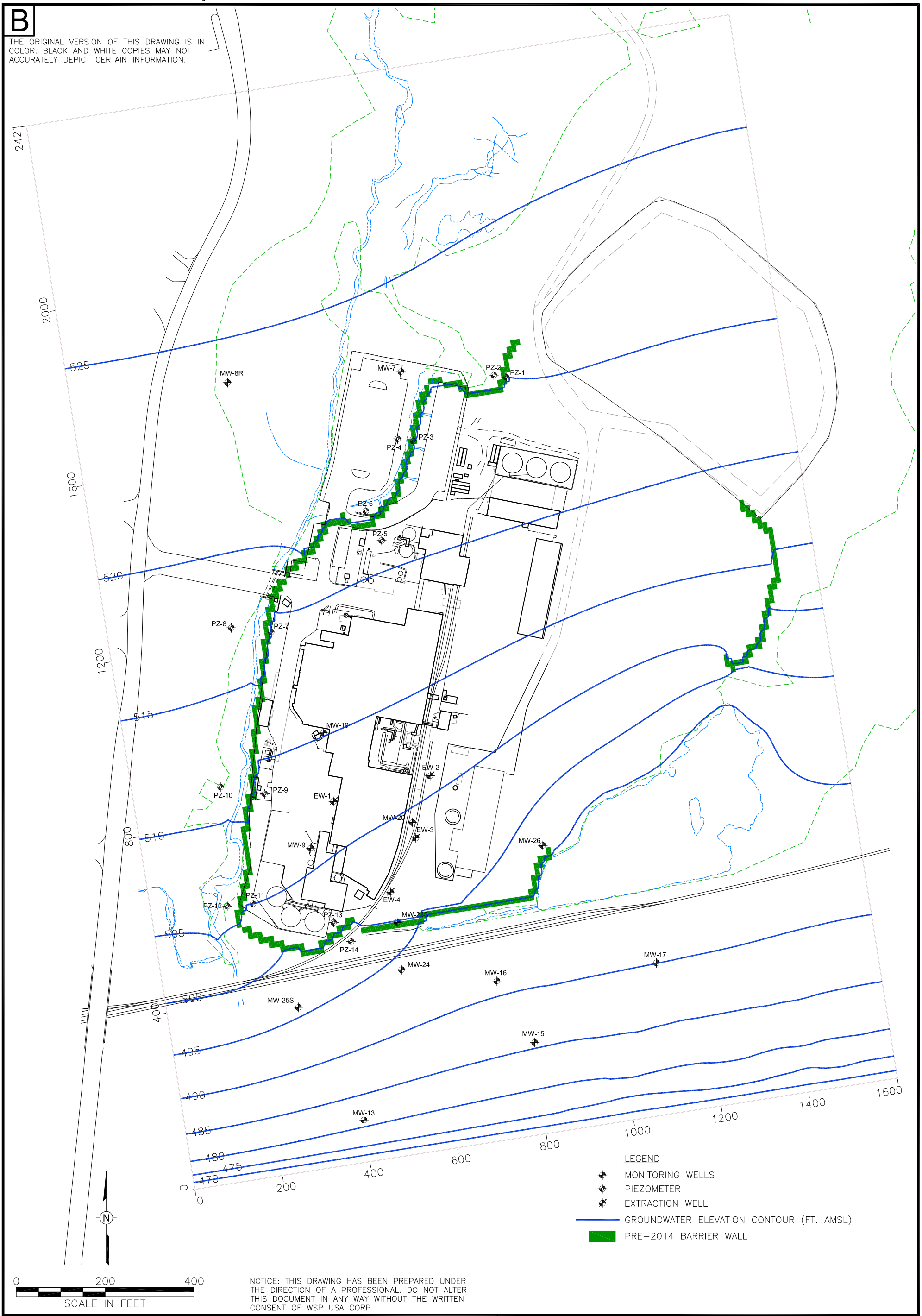

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Figure A–13

CALIBRATED LAYER 2
GROUNDWATER ELEVATION

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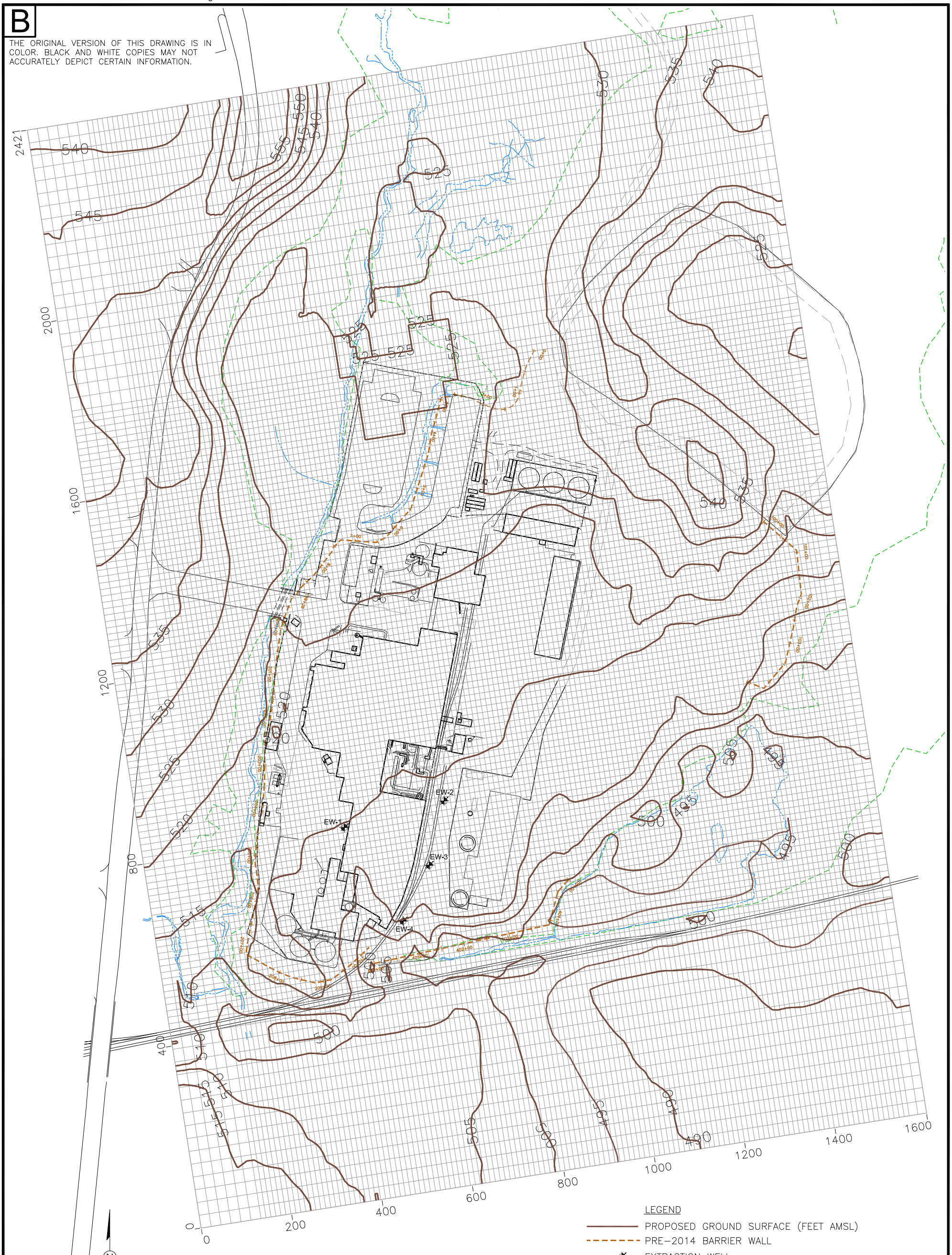

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Figure A–14

PROPOSED GROUND SURFACE ELEVATION

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

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RSR CORPORATION
DALLAS, TEXAS

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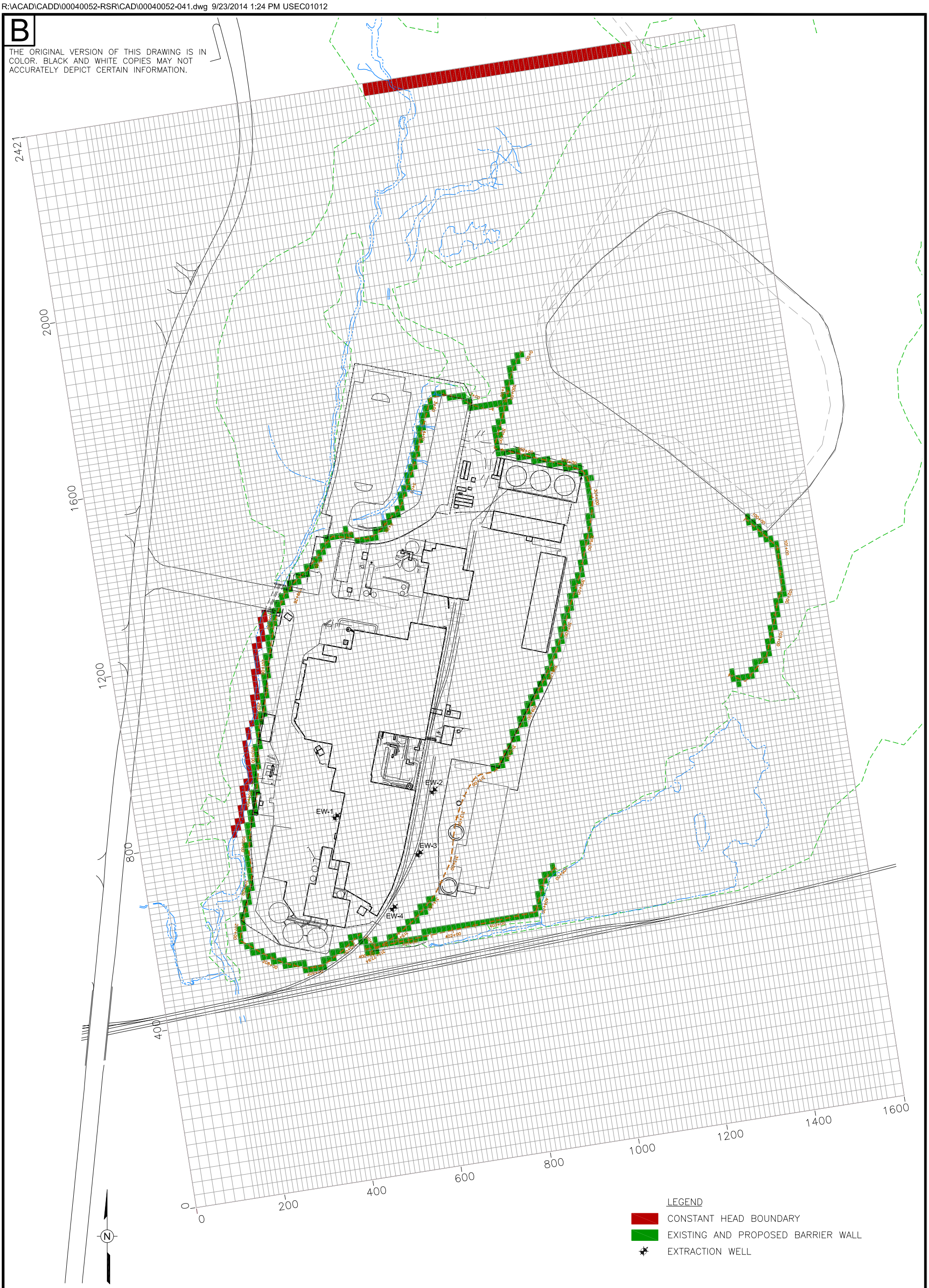

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Figure A–15

PROPOSED LAYER 1 BARRIER WALL LOCATIONS

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

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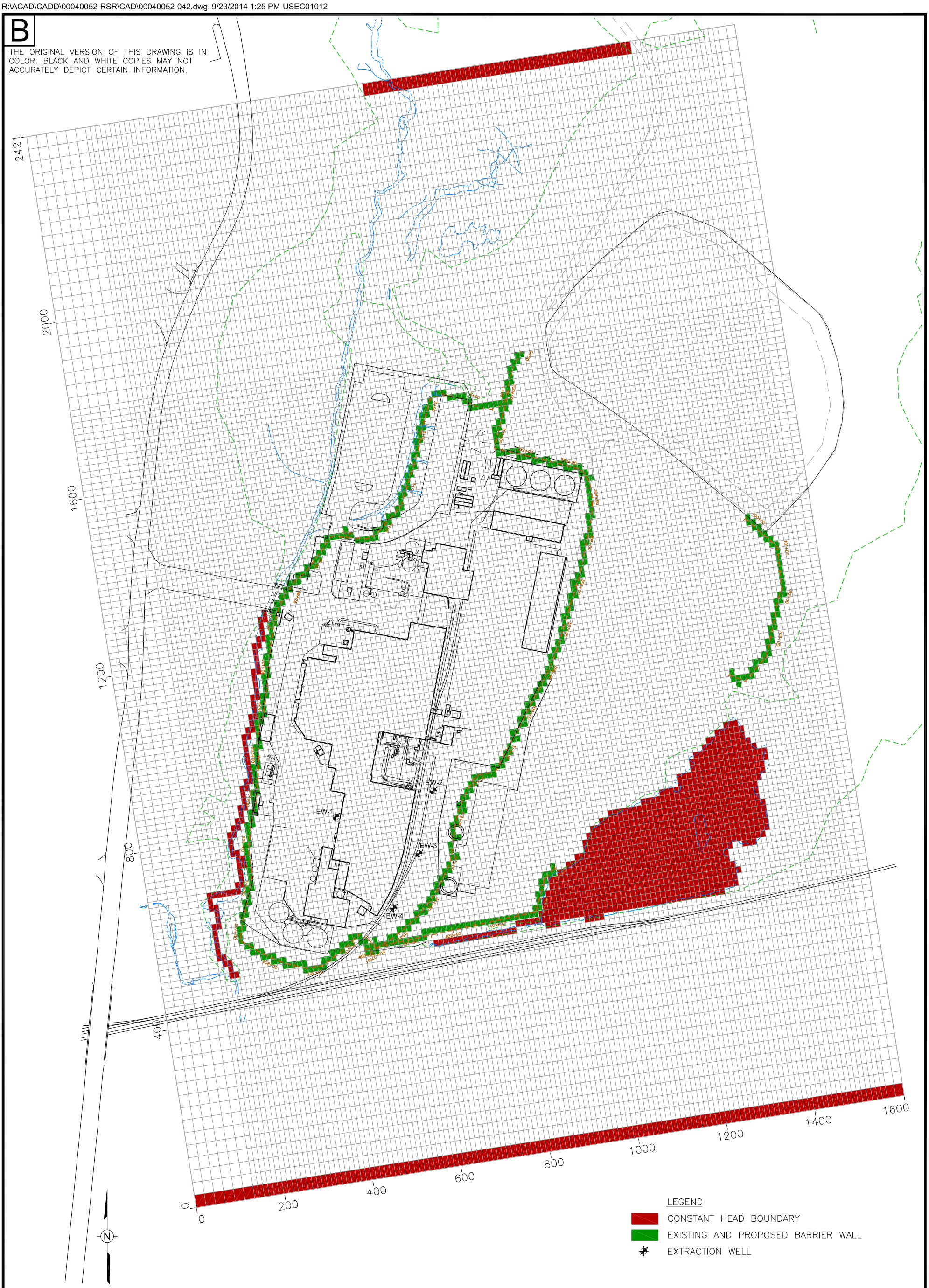

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Figure A–16

PROPOSED LAYER 2 BARRIER WALL LOCATIONS

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

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DALLAS, TEXAS

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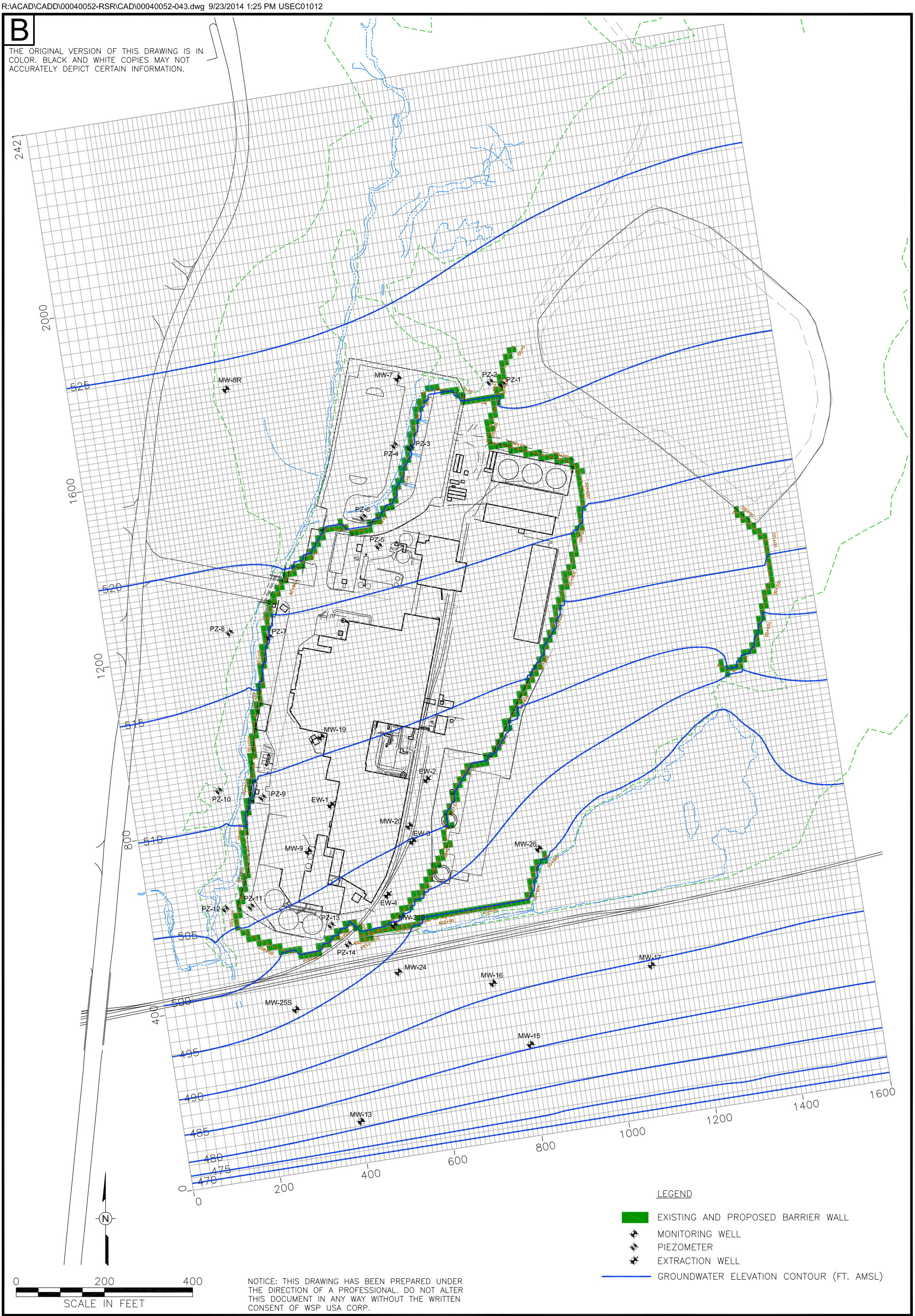

LEGEND

- EXISTING AND PROPOSED BARRIER WALL
- MONITORING WELL
- PIEZOMETER
- EXTRACTION WELL
- GROUNDWATER ELEVATION CONTOUR (FT. AMSL)

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Figure A–17

PREDICTED LAYER 2
GROUNDWATER ELEVATION

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

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RSR CORPORATION
DALLAS, TEXAS

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Approved:	9/23/2014
DWG Name:	00040052–043

LEGEND

PREDICTED WATER TABLE ELEVATION

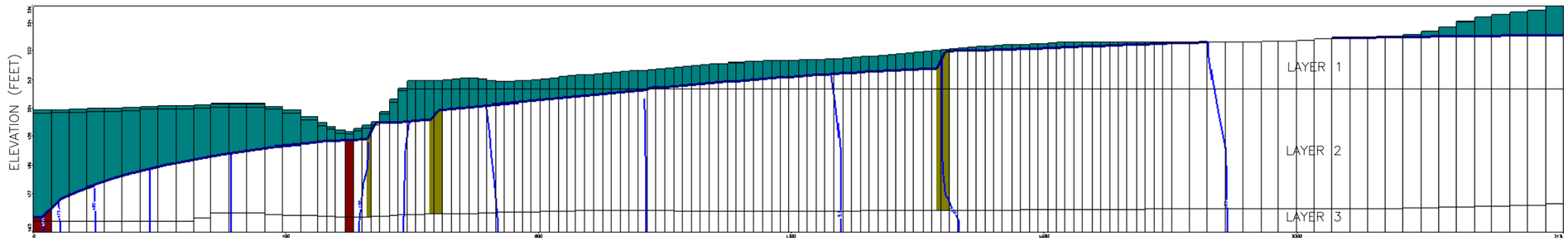
UNSATURATED CELLS

BARRIER WALLS

CONSTANT HEAD BOUNDARY

SOUTH

NORTH



DISTANCE (FEET)

NOTE: COLUMN 54 SHOWN

0 200 400

HORIZONTAL SCALE IN FEET

Drawn By: EGC

Checked: DA 9/12/2014

Approved: JS 9/23/2014

DWG Name: 00040052-023

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

PREPARED FOR
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DALLAS, TEXAS

Figure A-18

PREDICTED GROUNDWATER FLOW
IN CROSS-SECTION

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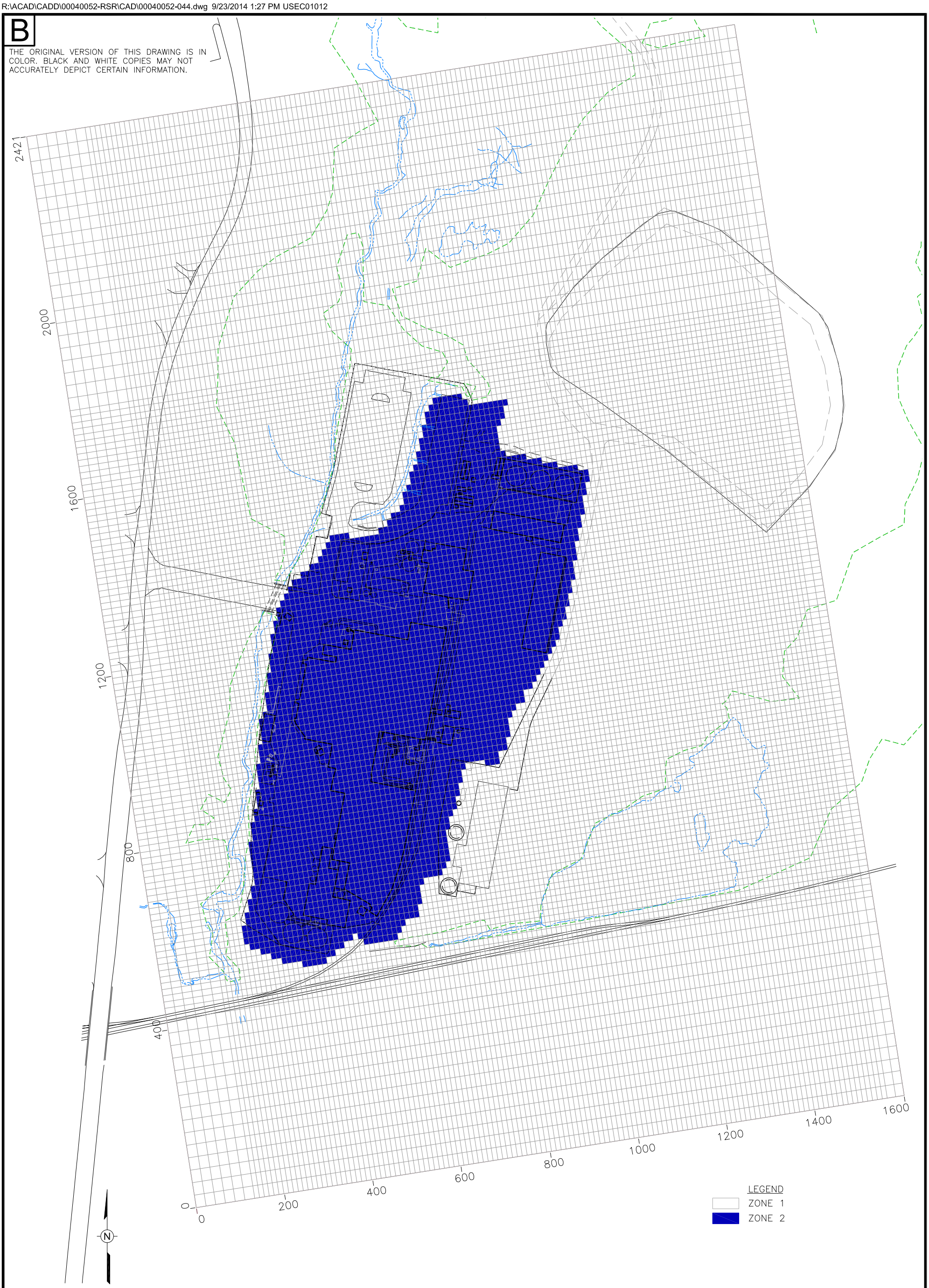

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Figure A–19

ZONE BUDGET AREAS

REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK

PREPARED FOR
RSR CORPORATION
DALLAS, TEXAS

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Tables

Table 1

Calibration Target Well Construction Details
Revere Smelting & Refining Facility
Middletown, New York (a)

Well ID	Easting	Northing	Screen Midpoint	Groundwater Elevation (feet amsl)				
				March	June	September	December	Average
MW-7	530587.90	957806.77	515.49	523.12	521.52	520.36	522.16	521.79
MW-8R	530197.91	957782.09	519.23	524.69	522.65	520.50	523.29	522.78
MW-13	530504.53	956123.70	468.33	478.88	478.42	476.72	478.52	478.14
MW-15	530888.74	956297.97	477.89	483.36	482.25	479.83	480.47	481.48
MW-16	530803.57	956436.61	481.61	487.76	487.01	484.47	487.26	486.63
MW-17	531162.61	956477.19	480.26	487.77	487.14	485.85	487.25	487.00
MW-19	530413.89	956994.48	488.32	516.36	514.47	513.78	514.61	514.81
MW-20	530613.78	956792.78	483.32	499.58	500.08	497.99	499.13	499.20
MW-23	530579.39	956568.44	486.50	496.04	494.79	493.99	492.7	494.38
MW-25	530357.11	956377.16	485.00	490.55	489.61	488.94	489.94	489.76
MW-26	530906.91	956741.27	485.00	497.23	496.19	495.72	496.12	496.32
PZ-01	530824.65	957793.73	524.10	524.92	521.98	520.20	520.81	521.98
PZ-02	530796.75	957798.68	519.05	524.58	522.54	517.5	523.69	522.08
PZ-03	530615.90	957650.15	517.61	522.62	521.35	515.76	521.71	520.36
PZ-04	530580.25	957655.53	514.16	522.38	521.17	518.22	521.49	520.82
PZ-05	530544.40	957426.91	514.79	519.79	518.93	517.68	518.99	518.85
PZ-06	530508.93	957492.92	513.64	519.72	518.89	517.68	518.98	518.82
PZ-07	530296.07	957221.06	514.88	518.11	517.50	516.64	517.57	517.46
PZ-08	530206.32	957230.76	518.01	522.35	518.35	514.86	519.42	518.75
PZ-10	530181.93	956872.44	510.63	515.42	513.94	513.21	514.42	514.25
PZ-11	530255.20	956609.99	508.22	507.23	508.27	508.13	508.83	508.12
PZ-12	530197.24	956604.54	503.94	510.25	508.80	505.96	506.89	507.98
PZ-13	530436.54	956568.03	490.08	497.26	494.50	493.91	495.83	495.38
PZ-14	530475.73	956525.13	487.86	493.95	491.77	490.81	492.66	492.30

a/ feet amsl = feet above mean sea level

b/ Average of 2010 quarterly groundwater elevation measurements.

Table 2

Extraction Well Construction and Operation Details
Revere Smelting & Refining Facility
Middletown, New York (a)

Well ID (a)	Easting	Northing	Top of Screen Elevation (feet amsl)	Bottom of Screen Elevation (feet amsl)	Screen Radius (feet)	Casing Radius (feet)	Cycle Counter Extraction Rate (gpm) (c)	Ratio of Extraction Rate Based on Cycle Counters	Extraction Rate Using Cycle Counter Ratio and Flow Totalizer Readings (gpm)
EW-1	530435.62	956839.98	508.21	498.21	0.33	0.33	1.10	52%	0.54
EW-2	530652.92	956898.34	503.8	493.8	0.33	0.33	0.19	9%	0.09
EW-3	530652.92	956898.34	502.27	487.27	0.33	0.33	0.24	11%	0.11
EW-4	530564.01	956636.09	498.79	488.79	0.33	0.33	0.60	28%	0.29
						Total:	**2.13**		
						Total Average Extraction Rate Per Well From Flow Totalizer Readings:	**1.04**		

a/ Extraction wells EW-9, EW-10, EW-8, and EW-1 were renamed to EW-1 through EW-4, respectively, in July 2014.
b/ feet amsl = feet above mean sea level; gpm = gallons per minute.
c/ Based on data collected since startup in 2007 through March 20, 2014.

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Appendix B – Cut Sheet for Bottom-Inlet AP4+B Autopump®

AP4+B Bottom Inlet, Long

Max. Flow	14 gpm (53 lpm)
O.D.	3.6 in (91 mm)
Length	51.4 in. (131cm)

Description

The AP4+ Bottom Inlet Long AutoPump provides maximum capabilities and flow in a bottom inlet pump for 4" (100 mm) diameter and larger wells with shorter water columns and/or the need to pump down to lower water levels, compared to full-length pumps. It is offered in optional versions to handle even the most severe remediation and landfill pumping applications, and delivers flow rates up to 14 gpm (49 lpm)*. The AP4+ Long Bottom Inlet AutoPump is complemented by the most comprehensive selection of accessories to provide a complete system to meet site specific requirements. Call QED for prompt, no-obligation assistance on your pumping project needs.

The AutoPump Heritage

The AP4+ Bottom Inlet Long AutoPump is part of the famous AutoPump family of original automatic air-powered pumps, developed in the mid 1980s specifically to handle unique pumping needs at remediation and landfill sites. Over the years they've proven their durability at thousands of sites worldwide. AutoPumps are designed to handle difficult pumping challenges that other pumps can't, such as hydrocarbons, solvents, suspended solids, corrosives, temperature extremes, viscous fluids and frequent start/stop cycles. Beyond just the pump, AutoPump systems offer the most complete range of tubing, hose, connectors, wellhead caps and accessories to help your installation go smoothly. This superior pumping heritage, application experience and support back up every AutoPump you put to work on your project.

Advantages

1. **The original automatic air-powered well pump, proven worldwide over 18 years**
2. **The highest flow rates and deepest pumping capabilities in the industry**
3. **Patented, proven design for superior reliability and durability, even in severe applications**
4. **Handles solids, solvents, hydrocarbons corrosive conditions, viscous fluids and high temperatures beyond the limits of electric pumps**
5. **Five-year warranty**

***Consult QED for higher flow requirements**

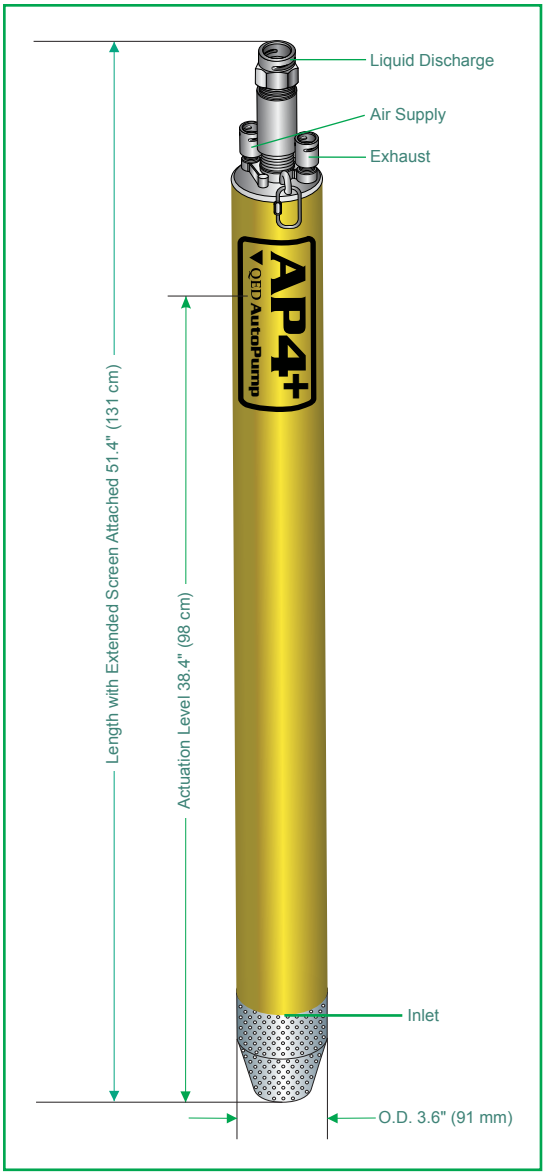
QED Environmental Systems

AP4+ AutoPump®

Bottom Inlet, Long

AP4+B

Pump Dimensions



Specifications & Operating Requirements

Model	**4" - Long AP4+ Bottom Inlet**
Liquid Inlet Location	Bottom
O.D.	3.6 in. (91 mm)
Overall Length With Extended Screen	51.4 in. (131 cm)
Weight	16.7 lbs. (7.6 kg)
Maximum Flow Rate	14 gpm (53 lpm)* - See Flow Rate Chart
Pump Volume/Cycle	0.58 - 0.78 gal (2.2 - 3L)
Minimum Accuation Level	38.4 in. (98 cm)
Standard Pump	
Maximum Depth	250 ft. (76 m)
Air Pressure	5 - 120 psi (0.4 - 8.4 kg/cm2)
Air Usage	0.4 - 1.1 scf / gal. (3.0 - 8.5 liter of air / fluid liter) - See air usage chart
High Pressure Pump	
Maximum Depth	425 ft. (130 m)
Air Pressure	5 - 200 psi (0.4 - 14.1 kg/cm2)
Minimum Liquid Density	0.7 SpG (0.7 g/cm3)
Standard Construction Materials[1]	
Pump Body	Fiberglass or Stainless Steel
Pump Ends	Stainless Steel
Internal Components	Stainless Steel, Viton, PVDF, Hastelloy-C
Tube & Hose Fittings	Brass or Stainless Steel
Fitting Type	Barbs, Quick Connects or Easy Fittings
Tube & Hose Options	
Tubing Materials[2]	Nylon
Sizes - Liquid Discharge	1 in. (25 mm) or 1-1/4 in. (32 mm) OD
Pump Air Supply	1/2 in. (13 mm) OD
Air Exhaust	5/8 in. (16 mm) OD
Hose Material	Nitrile
Sizes - Liquid Discharge	3/4 in. (19 mm) or 1 in. (25 mm) ID
Pump Air Supply	3/8 in. (9.5 mm) ID
Air Exhaust	1/2 in. (13 mm) ID

[1] Material upgrades available
[2] Applies to QED supplied tubing; other tubing sources may not conform to QED fittings.

Long and short AP4+ AutoPumps are warranted for five(5) years: Low-Drawdown AP4+ AutoPumps are warranted for one (1) year.

Application Limits (Base model)

AP4+ AutoPumps are designed to handle the application ranges described below. For applications outside these ranges, consult QED about AP4+ upgrades.

Maximum Temperature: 180°F (82°C)
pH Range: 4-9
Solvents and Fuels: diesel, gasoline, JP1-JP6,#2 heating oils, BTEX, MTBE, landfill liquids

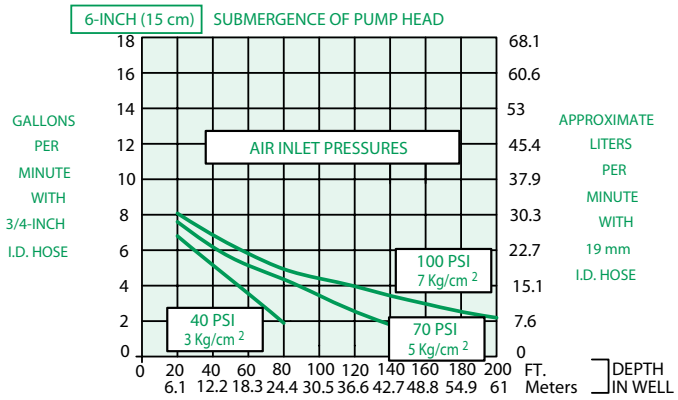
***Consult QED for higher flow requirements**

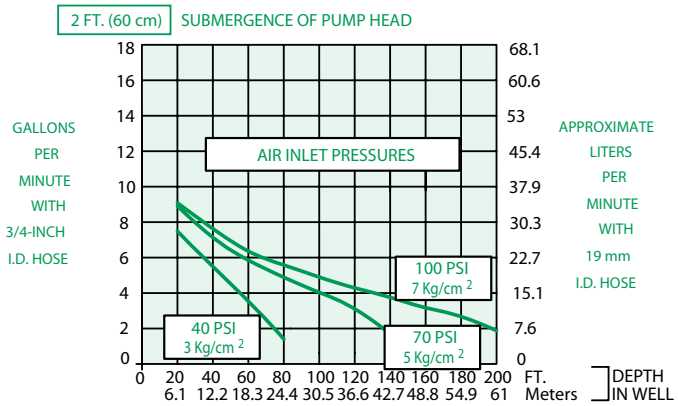
P.O. Box 3726 Ann Arbor, MI 48106-3726 USA **1.800.624.2026** **F 1.734.995.1170** info@qedenv.com www.qedenv.com

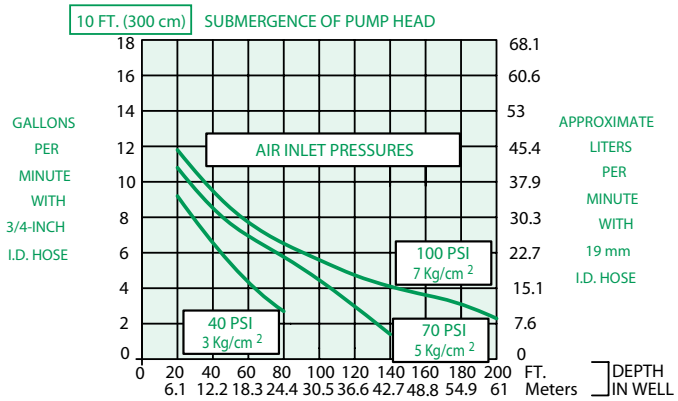
AP4 +B Bottom Inlet, Long

Flow Rates[1]

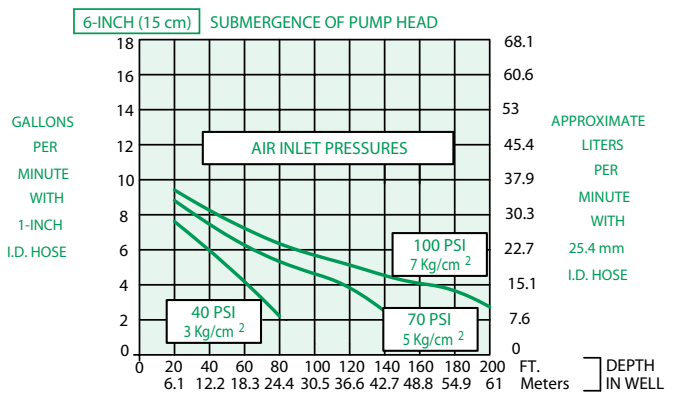
3/4 inch (19 mm) Inside Diameter Discharge Hose
(Equivalent to 1-Inch O.D. Tubing)

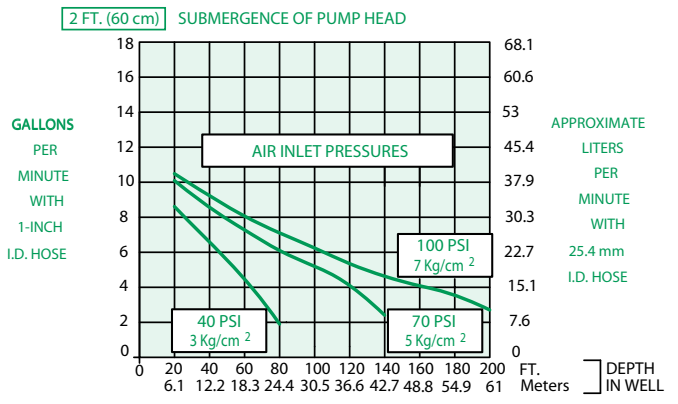


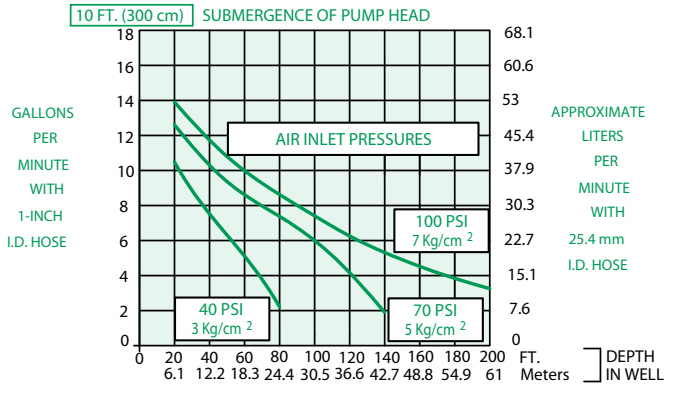




1 inch (25.4 mm) Inside Diameter Discharge Hose
(Equivalent to 1.25-Inch O.D. Tubing)







[1]FLOW RATES MAY VARY WITH SITE CONDITIONS. CALL QED FOR TECHNICAL ASSISTANCE.

QED Environmental Systems

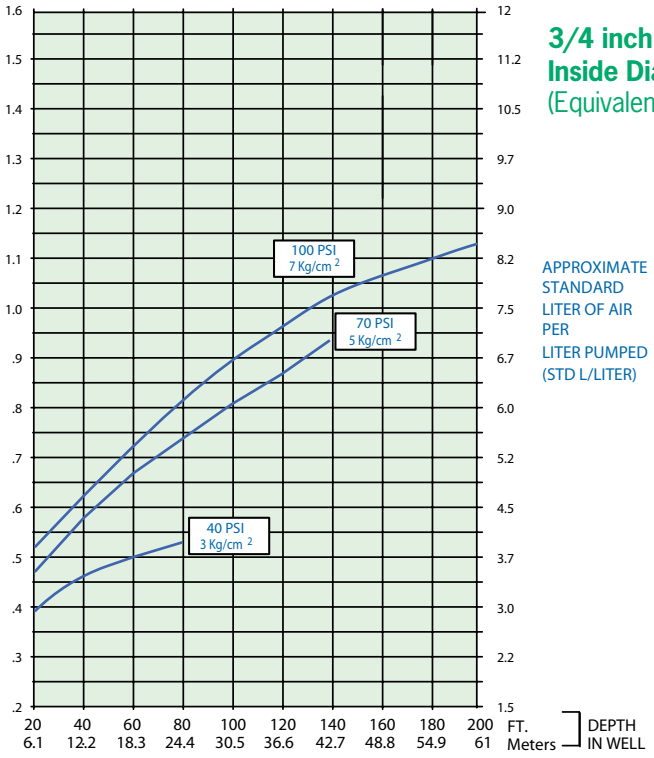
AP4+ AutoPump®

Bottom Inlet, Long

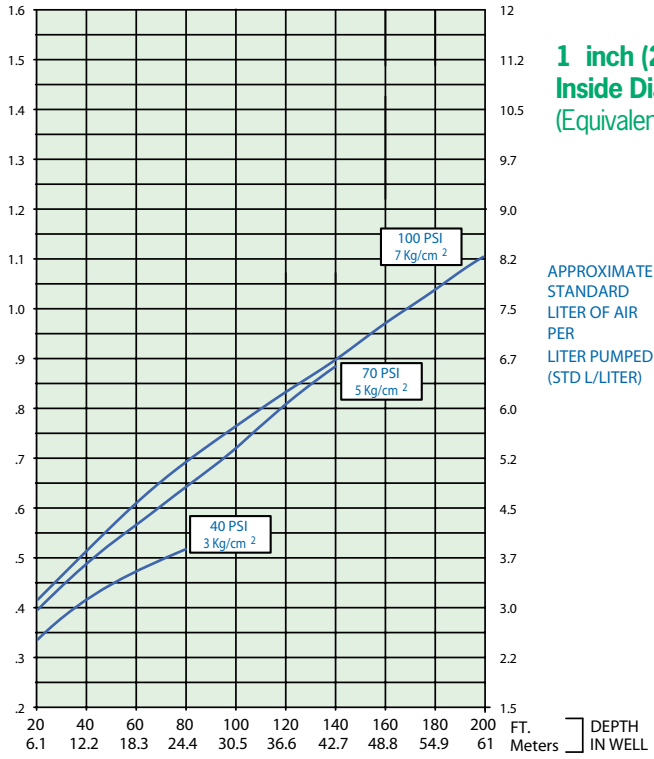
AP4+B

Air Consumption

3/4 inch (19 mm) Inside Diameter Discharge Hose
(Equivalent to 1-Inch O.D. Tubing)



1 inch (25.4 mm) Inside Diameter Discharge Hose
(Equivalent to 1.25-Inch O.D. Tubing)



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Appendix C – Routine O&M Log Sheet

Groundwater Extraction System
Operational Tracking Log
Revere Smelting & Refining Facility
Middletown, New York

EW-1 (Formerly EW-9)	
1.	Water Discharge Pressure (psi): _____
2.	Air Supply Pressure (psi): _____
3.	Current Cycle Counter Reading: _____
4.	Previous Cycle Counter Reading: _____
	Total Volume Extracted (gal)*: _____

EW-2 (Formerly EW-10)	
1.	Water Discharge Pressure (psi): _____
2.	Air Supply Pressure (psi): _____
3.	Current Cycle Counter Reading: _____
4.	Previous Cycle Counter Reading: _____
	Total Volume Extracted (gal)*: _____

General Information	
Date and Time:	_____
Inspector:	_____
Ambient Temp:	_____

EW-3 (Formerly EW-8)	
1.	Water Discharge Pressure (psi): _____
2.	Air Supply Pressure (psi): _____
3.	Current Cycle Counter Reading: _____
4.	Previous Cycle Counter Reading: _____
	Total Volume Extracted (gal)*: _____

EW-4 (Formerly EW-1)	
1.	Water Discharge Pressure (psi): _____
2.	Air Supply Pressure (psi): _____
3.	Current Cycle Counter Reading: _____
4.	Previous Cycle Counter Reading: _____
	Total Volume Extracted (gal)*: _____

Sump House	
Flow Rate (gal):	_____
Total Discharge (gal):	_____

EW-5	
1.	Water Discharge Pressure (psi): _____
2.	Air Supply Pressure (psi): _____
3.	Current Cycle Counter Reading: _____
4.	Previous Cycle Counter Reading: _____
	Total Volume Extracted (gal)*: _____

EW-6	
1.	Water Discharge Pressure (psi): _____
2.	Air Supply Pressure (psi): _____
3.	Current Cycle Counter Reading: _____
4.	Previous Cycle Counter Reading: _____
	Total Volume Extracted (gal)*: _____

*To calculate the Total Volume Extracted: Subtract Line 4 from Line 3 and multiply by 0.7.

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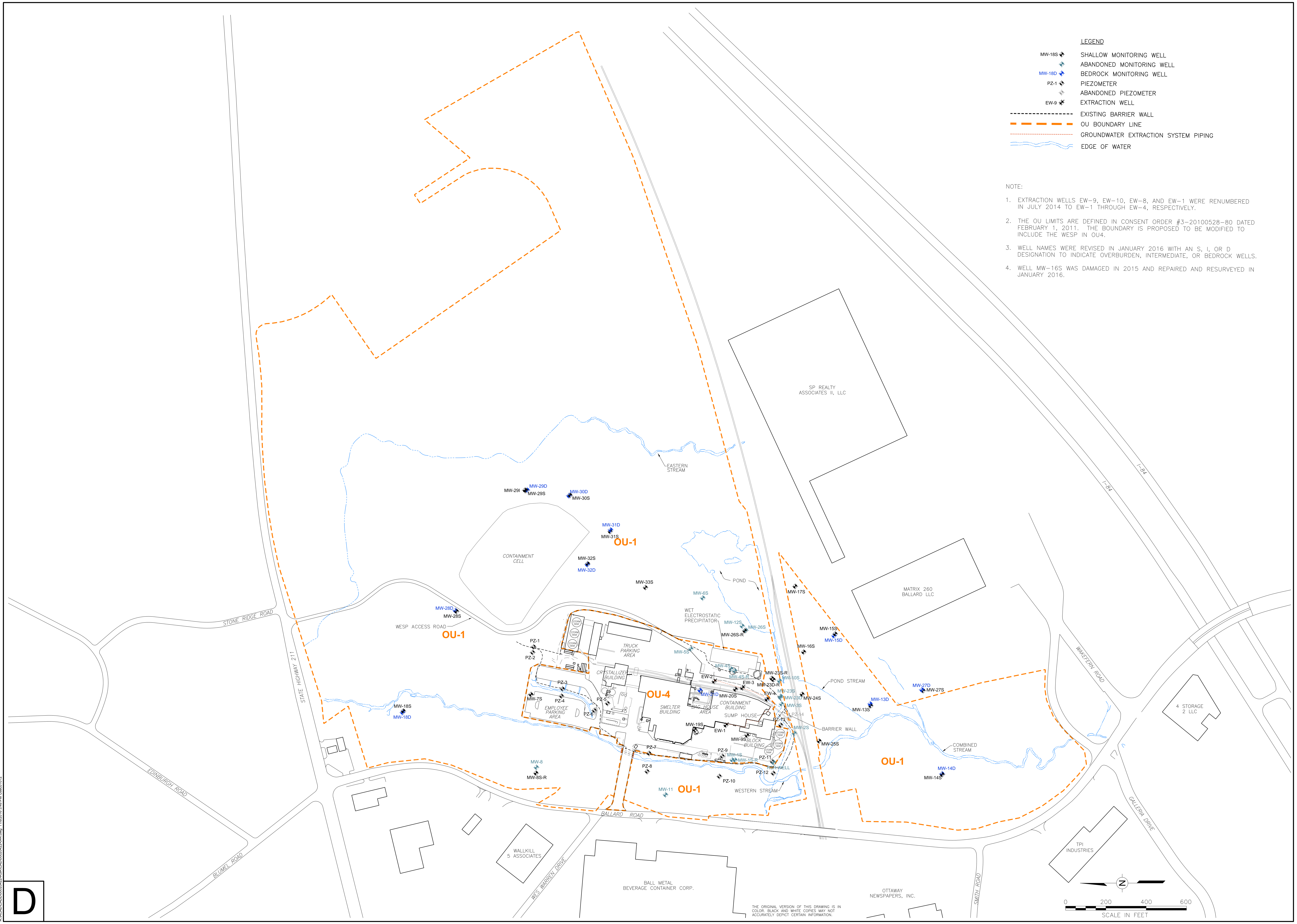
FIGURE 1

Site Map and Boundaries of Operable Units



NOTE:

1. EXTRACTION WELLS EW-9, EW-10, EW-8, AND EW-1 WERE RENUMBERED IN JULY 2014 TO EW-1 THROUGH EW-4, RESPECTIVELY.
2. THE OU LIMITS ARE DEFINED IN CONSENT ORDER #3-20100528-80 DATED FEBRUARY 1, 2011. THE BOUNDARY IS PROPOSED TO BE MODIFIED TO INCLUDE THE WESP IN OU4.
3. WELL NAMES WERE REVISED IN JANUARY 2016 WITH AN S, I, OR D DESIGNATION TO INDICATE OVERBURDEN, INTERMEDIATE, OR BEDROCK WELLS.
4. WELL MW-16S WAS DAMAGED IN 2015 AND REPAIRED AND RESURVEYED IN JANUARY 2016.

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REVISIONS

REV	DESCRIPTION

DRAWN BY EGC
CHECKED 11/8/2016
APPROVED 11/8/2016

SEAL

DATE

OPERABLE UNIT BOUNDARIES

AS-BUILT AND CONTINGENT EXPANSION CONSTRUCTION DRAWING PACKAGE
REVERE SMELTING & REFINING CORPORATION
MIDDLETOWN, NEW YORK
PREPARED FOR
RSR CORPORATION
DALLAS, TEXAS

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00020422-044

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