2015 Annual Monitoring Report
Site 34 – Lower Burning Ground (PICA-002)
Groundwater and Surface Water

Picatinny Arsenal, New Jersey

Prepared for

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
Contract No. W91ZLK-13-D-0004-0009

March 2016

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U.S. Army

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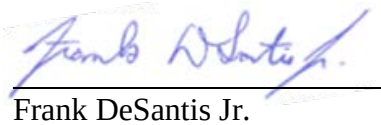

8 March2016
Frank DeSantis Jr. Date
Project Manager

8 March 2016
James Costello Date
Deputy Program Manager

March 2016
EA Project No. 62686.09

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	Microgram(s) per liter
amsl	Above mean sea level
ARCADIS	ARCADIS U.S., Inc.
EA	EA Engineering, Science, and Technology, Inc., PBC
ft	Foot (feet)
LUC	Land use control
mg/L	Milligram(s) per liter
PICA	Picatinny Arsenal
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
SL	Screening Level
USEPA	United States Environmental Protection Agency

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1. INTRODUCTION

EA Engineering, Science, and Technology, Inc., PBC (EA) has been contracted by the United States Army Environmental Command to perform Installation Restoration Program activities at Picatinny Arsenal (PICA), located in Morris County, New Jersey (**Figure 1**). This work is being conducted under a Performance Based Contract that encompasses 84 PICA sites. The full scope of services for this contract is defined in the Contract W91ZLK-13-D-0004 Delivery Order 0009. Field activities associated with this contract are being conducted by EA's subcontractor Sovereign Consulting Inc.

1.1 SITE HISTORY AND BACKGROUND

PICA is located in Rockaway Township, Morris County, New Jersey, as presented on Figure 1. Site 34 (PICA-002) is located near the southern boundary of PICA, within the 100-year floodplain of Green Pond Brook (Figure 2). Site 34 (PICA-002) has been utilized for the burning of explosive and explosive-contaminated material generated at PICA. Additionally, the Site was used for the landfilling and storage of waste. COCs include metals, PAHs, dioxins/furans, and explosives in site soil.

As stated within the Record of Decision (U.S. Army 2005) and as modified in the Explanation of Significant Differences (ARCADIS 2014a), the selected response action for this site includes the following:

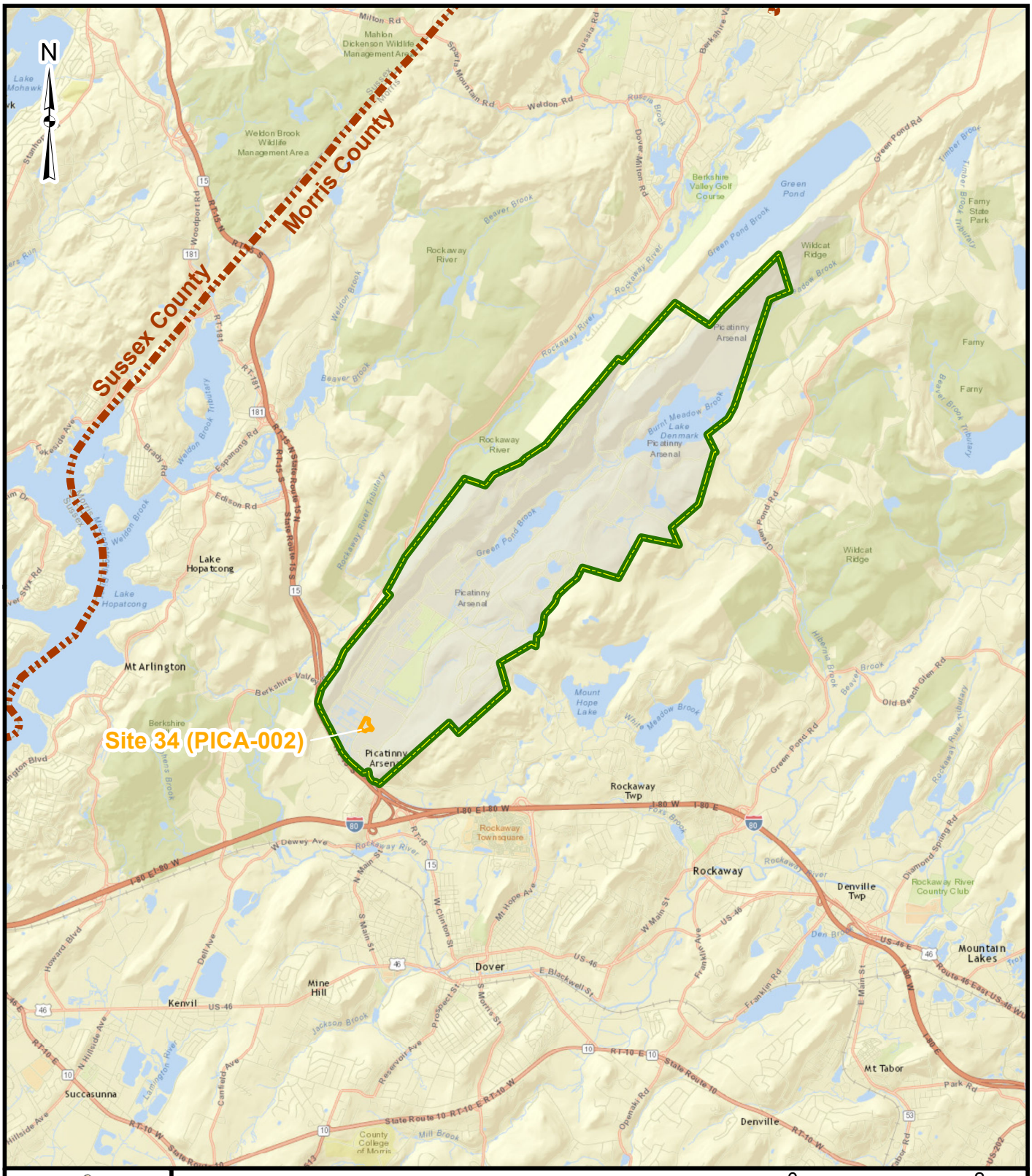
- Installation of an engineered hybrid soil and asphalt cap
- Maintenance and periodic inspections of the cap to ensure the continued protectiveness of the cap
- Long-term groundwater and surface water monitoring
- Implementation of land use controls (LUCs)
- Wetland mitigation and enhancement.

The selected response action was conducted during 2014 and is documented in the Remedial Action Report (ARCADIS 2014b). LUCs for soil and groundwater have been implemented to control current and future activities that could result in unacceptable risk to human health as detailed in the Final Remedial Action Work Plan (RAWP) (ARCADIS 2014c). LUCs for this Site will also be documented in the 2015 Land Use Certification report being submitted under separate cover. The Land Use Certification report also includes any activities conducted in response to maintenance of the cap.

Wetland assessment and maintenance activities will be described in the 2015 Wetland Mitigation Report being submitted under separate cover.

1.2 SCOPE OF WORK

This Annual Monitoring Report was prepared in accordance with the RAWP (ARCADIS 2014c). The long-term monitoring program at Site 34 (PICA-002) consists of groundwater and surface water sampling and is implemented according to the schedule presented in **Table 1**. This report presents results of the third and fourth quarter 2015 groundwater and surface water sampling.



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SITE 34 - LOWER BURINING GROUND (PICA-002)
PICATINNY ARSENAL

Figure 1
Picatinny Arsenal
General Location

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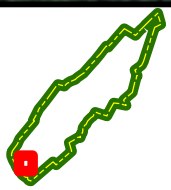

Installation Boundary

Site 34 - Lower Burning Ground (PICA-002)

0 325

Feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX,

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SITE 34 - LOWER BURNING GROUND (PICA-002)
PICATINNY ARSENAL

Figure 2
Site 34 - (PICA-002)
Location Map

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Table 1. Long-Term Monitoring Program Summary

Media	Schedule	Calendar Year:	2014				2015				2016			
		Operation Year:	First Year of Operation				Second Year of Operation				Third Year of Operation			
		Months:	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec
		Parameters	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	3rd
Groundwater	Year 1 - 2: quarterly Year 3 - 4: semi-annually Year 5 - 30: annually	Target Analyte List Metals	Completed: March 2014	Completed: April 2014	Completed: August 2014	Completed: Oct 2014			Completed: Sept 2015	Completed: Nov 2015	Planned Feb 2016	Planned May 2016		Planned Nov 2016
Surface Water	Year 1 - 2: quarterly Year 3 - 4: semi-annually Year 5 - 30: annually	Target Analyte List Metals	Completed: March 2014	Completed: April 2014	Completed: August 2014	Completed: Oct 2014			Completed Sept 2015	Completed: Nov 2015	Planned Feb 2016	Planned May 2016		Planned Nov 2016

NOTES:

1. Groundwater monitoring wells are: 1179A-1, 1179A-2, 1179A-3, 1179D-1, 1179D-2, 1179D-3, 1179-3, 1180-2A, and 1179-4B.
2. Surface water monitoring locations are: GPBSW-03, SW34-4, and C-34-SW-0008.

Media	Schedule	Calendar Year:	2017				2018				2019			
		Operation Year:	Fourth Year of Operation				Fifth Year of Operation				Sixth Year of Operation			
		Months:	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec
		Parameters	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	3rd
Groundwater	Year 1 - 2: quarterly Year 3 - 4: semi-annually Year 5 - 30: annually	Target Analyte List Metals		Planned: April 2017		Planned: Oct 2014		Planned: April 2018				Planned: April 2018		
Surface Water	Year 1 - 2: quarterly Year 3 - 4: semi-annually Year 5 - 30: annually	Target Analyte List Metals		Planned: April 2017		Planned: Oct 2014		Planned: April 2018				Planned: April 2018		

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2. 2015 LONG-TERM MONITORING

Long-term groundwater and surface water monitoring at the Site is conducted to verify protection of human health and the environment until promulgated groundwater standards are achieved. Long-term monitoring sampling locations are presented in **Figure 3**. This monitoring program complies with the substantive requirements of Resource Conservation and Recovery Act (RCRA) Subpart F, 40 Code of Federal Regulations 265.90-94 and meets the RCRA Subtitle C closure and post-closure requirements.

2.1 GROUNDWATER ELEVATION MEASUREMENTS

Prior to groundwater sampling activities, water levels in the monitoring network were gauged; and groundwater elevations for the most recent gauging event in the fourth quarter of 2015 are presented on **Figure 4**. Groundwater data for the both the third and fourth quarter 2015 gauging events are provided in **Table 2**.

2.2 2015 SAMPLING ACTIVITIES

Site sampling activities were conducted on 2 September 2015 and 2 November 2015 in accordance with the following:

- The Site-Specific Groundwater Sampling and Analysis Plan (provided as Appendix I in the Final RAWP [ARCADIS 2014c]);
- The Final Quality Assurance Project Plan (ARCADIS 2007); and
- The Final Abbreviated Accident Prevention Plan (EA 2015).

Sample locations are presented in **Figure 3**, groundwater elevations are presented in **Figure 4,** and field forms for third and fourth quarter sampling and gauging are included as **Appendix A**. The following summarizes the Site activities during the 2015 sampling events:

- Nine groundwater samples were collected using Hydrasleeves® from the following monitoring wells:
  - Seven monitoring well locations in the unconfined shallow aquifer (1179A-1, 1179A-2, 1179A-3, 1179D-1, 1179D-2, 1179D-3, and 1179-3
  - Two monitoring well locations in the lower semi-confined aquifer (1180-2A and 1179-4B).
- Three surface water samples were collected from Green Brook Pond using a bailer:
  - One upstream of the Site (GPBSW-03)

— One adjacent to the Site (SW34-4)

— One downstream of the Site (C-34-SW-0008).

All data collected were third party validated in accordance with the United States Environmental Protection Agency (USEPA) National Functional Guideline for Organic Data Review, dated August 2014. The validation criteria for long-term monitoring data include a review of the laboratory report narrative for noted deficiencies and the potential impact to data usability. Therefore, a review of chain-of-custodies, sample preservation, sample receipt logs, and quality control parameters was performed for all data packages. No major deficiencies were identified during the data validation; therefore, no additional review was performed. A copy of the Data Validation Report is included with **Appendix B**.

Installation Boundary
Site 34 - Lower Burning Ground (PICA-002)
Monitoring Well
Surface Water Sampling Location
Abandoned Monitoring Well*

*Abandoned wells include: 1181-1, 1181-2, 1180-1, 1180-2, 1179-4, 1179-4A, 1179-6 1179-7, and 1179-5.
All decommisioned in 2014.

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SITE 34 - LOWER BURNING GROUND (PICA-002)
PICATINNY ARSENAL

Figure 3
Site 34 (PICA-002)
Sample Locations

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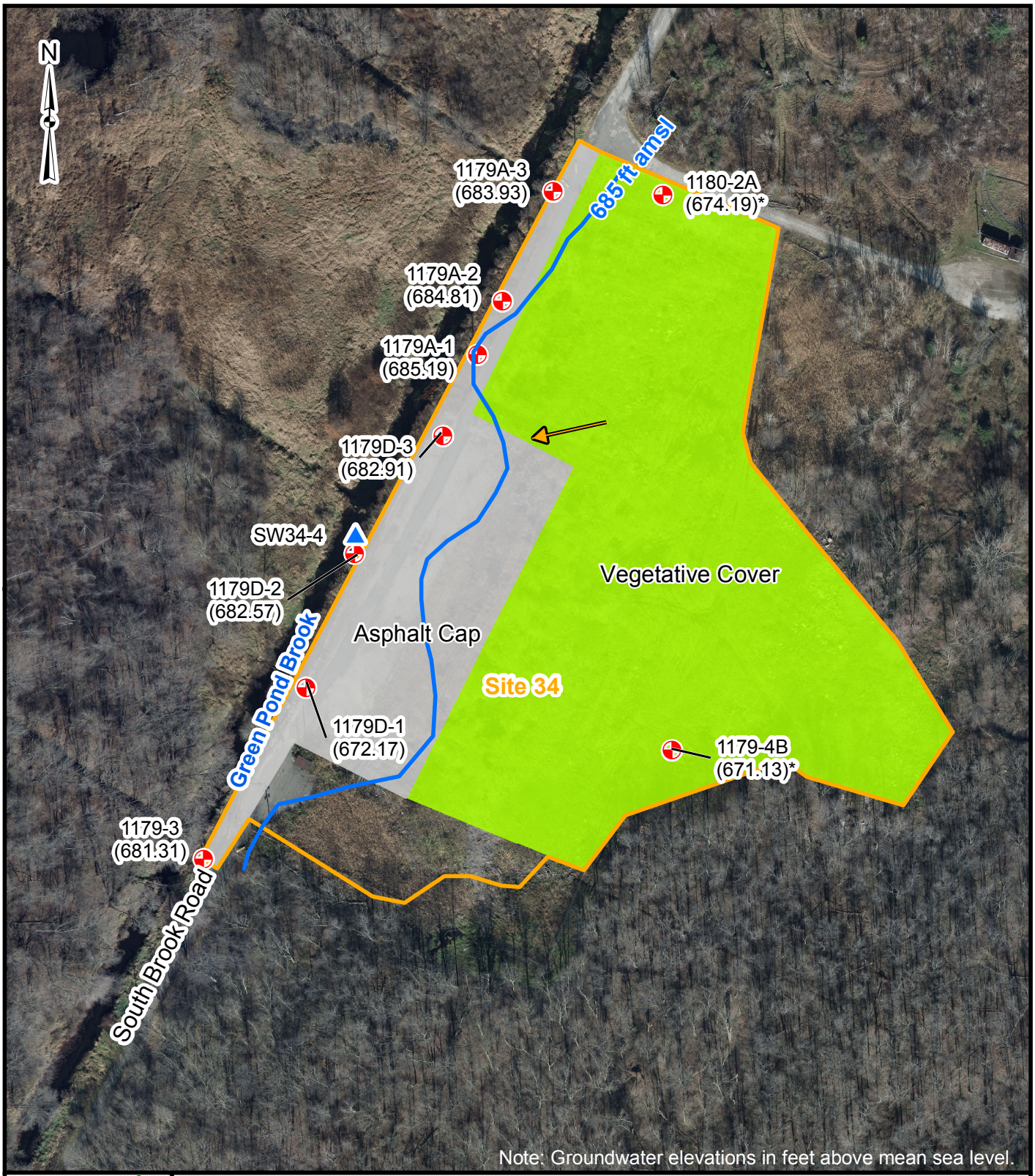

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SITE 34 - LOWER BURNING GROUND (PICA-002)
PICATINNY ARSENAL

Figure 4
Groundwater Elevations
November 2015

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Table 2. Groundwater Elevations

Well ID	TIC (ft)	Screened Geologic Unit	Total Depth (ft bgs)	Screen Interval (ft)	Inner Casing Construction	Groundwater Elevation 8/26/2015		Groundwater Elevation 11/2/2015	
						Measured Elevation (ft)	Corrected Elevation (ft)	Measured Elevation (ft)	Corrected Elevation (ft)
1179-3	687.8	Unconfined	20.45	10	2 PVC	6.58	681.22	6.49	681.31
1179-4B	690.7	Semi-confined	152.3	10	2 PVC	19.77	670.93	19.57	671.13
1179A-1	690.87	Unconfined	21.68	10	2 PVC	6.58	684.29	5.68	685.19
1179A-2	690.65	Unconfined	1865	10	2 PVC	6.91	683.74	5.84	684.81
1179A-3	689.41	Unconfined	21.6	10	2 PVC	6.54	682.87	5.48	683.93
1179D-1	687.65	Unconfined	19.5	10	2 PVC	14.65	673.00	15.48	672.17
1180-2A	691.6	Semi-confined	134.1	10	2 PVC	17.25	674.35	17.41	674.19
1179D-3	689.58	Unconfined	25	10	2 PVC	7.80	681.78	6.67	682.91
1179D-2	689.62	Unconfined	20.6	10	2 PVC	7.67	681.95	7.05	682.57

Notes

ft = Feet

bgs = Below ground surface

TIC = Top of inner casing

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2.3 THIRD QUARTER 2015 RESULTS

Groundwater and surface water samples were analyzed for total target analyte list metals via USEPA Method 6020/7470. Laboratory analytical reports are included with **Appendix B**.

2.3.1 Groundwater Sample Results

Groundwater elevations (**Table 2**) ranged from 670.93 feet (ft) above mean sea level (amsl) at 1179-4B (screened in the semi-confined aquifer) to 684.29 ft amsl at 1179A-1. Overburden groundwater flow direction from the site is westerly toward Green Pond Brook (**Figure 4**).

Metals were detected in all nine groundwater samples collected in September 2015 (**Table 3**). Summaries of screening level exceedances are discussed below:

- Aluminum was detected above the screening level of 0.2 milligrams per liter (mg/L) in eight of nine monitoring wells sampled (all wells sampled except 1179-D3). Concentrations exceeding the screening level ranged from 0.245 mg/L in 1179A-2 to 1.71 mg/L in 1179D-2.

- Arsenic was detected above the screening level of 0.003 mg/L in six of nine wells sampled. Concentrations exceeding the screening level ranged from 0.0046 mg/L in 1180-2A to 0.0763 mg/L in 1179A-1.

- Cadmium was detected above the screening level of 0.004 mg/L in monitoring well 1179A-2 at a concentration of 0.0047 mg/L.

- Iron was detected in eight of the nine wells above the screening level of 0.3 mg/L. Concentrations exceeding the screening level ranged from 0.639 mg/L in 1179-4B to 36.50 mg/L in 1179D-2.

- Lead was detected in well 1179-3 in exceedance of the 0.005 mg/L screening level at a concentration of 0.0071 mg/L.

- Manganese exceeded the screening criteria of 0.05 mg/L in samples collected from eight of the nine wells sampled with concentrations ranging from 0.26 in 1179-3 to 0.2.92 mg/L in 1180-2A.

All remaining groundwater constituents detected during this event were below screening levels or non-detect.

Table 3 also presents a summary of field parameters (pH, temperature, oxidation reduction potential, and dissolved oxygen).

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Table 3. Groundwater Analytical Results

		Location ID	1179-3		1179-4B		1179A-1		1179A-2		1179A-3		1179D-1		1179D-2		1179D-3	
		Sample Date	9/2/2015	11/2/2015	9/2/2015	11/2/2015	9/2/2015	11/2/2015	9/2/2015	11/2/2015	9/2/2015	11/2/2015	9/2/2015	11/2/2015	9/2/2015	11/2/2015	9/2/2015	11/2/2015
Chemical Name	**Units**	**Groundwater Screening Level***																
Metals																		
Aluminum	mg/l	0.2	**0.936**	**2.22 J**	**0.647**	**0.229 J**	**0.774**	**8.45 J**	**0.245**	**0.596 J**	**0.291**	**0.15 J**	**0.33**	**0.33 J**	**1.71**	**7.11 J**	**0.0854**	**0.492 J**
Antimony	mg/l	0.006	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U
Arsenic	mg/l	0.003	< 0.0020 UB	**0.0083**	< 0.0020 UB	**0.0045**	**0.0763 J+**	**0.0395**	**0.0139 J+**	**0.0096**	**0.0428 J+**	**0.0201**	< 0.0020 UB	**0.0116**	**0.0186 J+**	**0.0095**	**0.0651 J+**	**0.0364**
Barium	mg/l	2	**0.0381 J+**	**0.0402**	**0.0244 J+**	**0.017**	**0.113**	**0.176**	**0.0852**	**0.0241**	**0.167**	**0.126**	**0.331**	**0.298**	**0.131**	**0.134**	**0.0700 J+**	**0.0721**
Beryllium	mg/l	0.001	< 0.00050 U	< 0.0005 U	< 0.00050 U	< 0.0005 U	< 0.00050 U	**0.00064 J**	< 0.00050 U	< 0.0005 U	< 0.00050 U	< 0.0005 U	< 0.00050 U	< 0.0005 U	< 0.00050 U	**0.00055 J**	< 0.00050 U	< 0.0005 U
Cadmium	mg/l	0.004	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	**0.0047**	**0.0047**	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U
Calcium	mg/l	500	**26.4 J+**	**27.1 J**	**26.9 J+**	**25.6 J**	**43.9 J+**	**63.7 J**	**38.5 J+**	**5.48 J**	**41.4 J+**	**39.3 J**	**242 J+**	**223 J**	**35.8 J+**	**58.2 J**	**42.4 J+**	**44.4 J**
Chromium	mg/l	0.07	< 0.0040 U	**0.0041 J**	< 0.0040 U	< 0.004 U	< 0.0040 U	**0.0155**	< 0.0040 U	< 0.004 U	< 0.0040 U	< 0.004 U	< 0.0040 U	< 0.004 U	**0.0517**	**0.0139**	< 0.0040 U	< 0.004 U
Cobalt	mg/l	0.1	**0.0012**	**0.0026**	< 0.00050 U	< 0.0005 U	**0.0014**	**0.008**	< 0.00050 U	< 0.0005 U	**0.0012**	**0.0007 J**	**0.0016**	**0.0014**	**0.0016**	**0.0063**	< 0.00050 U	**0.0006 J**
Copper	mg/l	1.3	**0.0063 J**	**0.0102**	< 0.0040 U	< 0.004 U	< 0.0040 U	**0.0202**	< 0.0040 U	< 0.004 U	< 0.0040 U	< 0.004 U	< 0.0040 U	< 0.004 U	**0.01**	**0.0197**	< 0.0040 U	< 0.004 U
Iron	mg/l	0.3	**3.91**	**6.53 J**	**0.639**	**0.217 J**	**13.6**	**34.8 J**	**13.9**	**6.08 J**	**19.2**	**12.9 J**	< 0.0250 U	< 0.025 U	**36.5**	**30.7 J**	**4.71**	**4.03 J**
Lead	mg/l	0.005	**0.0071**	**0.008**	**0.0012 J**	< 0.001 U	**0.0010 J**	**0.0093**	< 0.0010 U	< 0.001 U	**0.0011 J**	**0.0014 J**	< 0.0010 U	< 0.001 U	**0.0037**	**0.011**	< 0.0010 U	< 0.001 U
Magnesium	mg/l	175	**7.8**	**8.69**	**4.52**	**4.29**	**9.33**	**19**	**10.6**	**1.03**	**8.76**	**8.26**	< 0.25 U	< 0.25 U	**7.52**	**17.5**	**8.14**	**8.63**
Manganese	mg/l	0.05	**0.26**	**0.297**	**0.474**	**0.185**	**0.692**	**1.7**	**0.638**	**0.114**	**0.675**	**0.504**	< 0.0020 U	< 0.002 U	**0.602**	**1.42**	**0.612**	**0.246**
Mercury	mg/l	0.002	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ
Nickel	mg/l	0.1	**0.0020 J**	**0.0029 J**	< 0.0020 U	< 0.002 U	**0.0022 J**	**0.0144**	< 0.0020 U	< 0.002 U	< 0.0020 U	**0.0026 J**	**0.0066**	**0.0046**	**0.0056**	**0.011**	< 0.0020 U	< 0.002 U
Potassium	mg/l	1000	**0.865**	**1.25**	**0.708**	**0.641**	**1.66**	**3.88**	**25.6**	**28.7**	**0.903**	**1.25**	**10.1**	**9.64**	**51**	**3.83**	**1.01**	**1.64**
Selenium	mg/l	0.04	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	
Silver	mg/l	0.04	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U
Sodium	mg/l	50	**6.86**	**6.9 J**	**11**	**11.2 J**	**11**	**9.59 J**	**23.5**	**12.5 J**	**11.5**	**11.6 J**	**18**	**17.9 J**	**29.6**	**14.6 J**	**13.2**	**13.4 J**
Thallium	mg/l	0.0005	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U
Vanadium	mg/l	0.26	< 0.0100 U	< 0.01 U	< 0.0100 U	< 0.01 U	< 0.0100 U	**0.0212**	**0.0107 J**	< 0.01 U	**0.0118 J**	< 0.01 U	< 0.0100 U	< 0.01 U	**0.0357**	**0.0147 J**	< 0.0100 U	< 0.01 U
Zinc	mg/l	2	< 0.0050 UB	**0.0209**	< 0.0050 UB	< 0.005 U	< 0.0050 UB	**0.0398**	< 0.0050 UB	**0.0071 J**	< 0.0050 UB	**0.0059 J**	< 0.0050 UB	< 0.005 U	**0.0903 J+**	**0.0374**	< 0.0050 UB	< 0.005 U
Field Parameters																		
pH	--	--	7.87	9.53	7.96	8.06	7.09	7.51	6.97	7.4	7.35	7.53	11.87	9.03	6.86	7.39	7.14	7.02
Temperature	°C	--	17.21	11.97	17.83	12.05	17.85	13.8	20.12	14.79	20.33	14.16	17.69	13.05	19.04	14.41	17.02	14.03
Oxidation Reduction Potential	mV	--	-61	-228	282	-173	-93	-130	-80	-129	-105	-103	-190	-328	-67	-127	-80	-131
Dissolved Oxygen	mg/L	--	2.83	2.87	2.33	2.5	1.46	3.01	6.12	4.69	3.87	308	1.28	3.05	8.7	7.84	2.51	7.07

Notes:

All detections are boldfaced.

Values exceeding the chemical=specific criteria are shaded gray.

°C = Degrees Celsius.

mg/L = Milligrams per liter.

mV = Millivolt.

J = Estimated concentration.

U = Non-detect at the specified reporting limit.

B = Detected in associated method blank.

+ = Value biased high.

- = Value biased low.

***** Groundwater screening criteria are the lower of the United States Environmnetal Protection Agency Maximum Contaminant Level and the New Jersey Groundwater Quality Standards.

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Table 3. Groundwater Analytical Results

		Location ID	1180-2A	
		Sample Date	9/2/2015	11/2/2015
Chemical Name	**Units**	**Groundwater Screening Level***		
Metals				
Aluminum	mg/l	0.2	**0.78 J**	**0.296 J**
Antimony	mg/l	0.006	< 0.0020 U	< 0.002 U
Arsenic	mg/l	0.003	**0.0046**	**0.0048**
Barium	mg/l	2	**0.104 J**	**0.0476**
Beryllium	mg/l	0.001	< 0.00050 U	< 0.0005 U
Cadmium	mg/l	0.004	< 0.0010 U	< 0.001 U
Calcium	mg/l	500	**32.2 J+**	**25.5 J**
Chromium	mg/l	0.07	< 0.0040 UJ	< 0.004 U
Cobalt	mg/l	0.1	**0.0015 J**	**0.00062 J**
Copper	mg/l	1.3	< 0.0040 UJ	< 0.004 U
Iron	mg/l	0.3	**1.28 J**	**0.582 J**
Lead	mg/l	0.005	**0.0047 J**	**0.0018 J**
Magnesium	mg/l	175	**4.83**	**4.39**
Manganese	mg/l	0.05	**2.92 J**	**1.21 J**
Mercury	mg/l	0.002	< 0.00015 UJ	< 0.00015 UJ
Nickel	mg/l	0.1	< 0.0020 UJ	< 0.002 U
Potassium	mg/l	1000	**0.559**	**0.421 J**
Selenium	mg/l	0.04	< 0.0010 U	< 0.001 U
Silver	mg/l	0.04	< 0.0010 U	< 0.001 U
Sodium	mg/l	50	**9.24**	**8.99 J**
Thallium	mg/l	0.0005	< 0.0010 U	< 0.001 U
Vanadium	mg/l	0.26	< 0.0100 U	< 0.01 U
Zinc	mg/l	2	< 0.0050 UB	**0.0106**
Field Parameters				
pH	--	--	7.57	7.99
Temperature	°C	--	23.17	13.77
Oxidation Reduction Potential	mV	--	288	-119
Dissolved Oxygen	mg/L	--	2.61	7.79

Notes:

All detections are boldfaced.

Values exceeding the chemical=specific criteria are shaded gray.

°C = Degrees Celsius.

mg/L = Milligrams per liter.

mV = Millivolt.

J = Estimated concentration.

U = Non-detect at the specified reporting limit.

B = Detected in associated method blank.

+ = Value biased high.

- = Value biased low.

***** Groundwater screening criteria are the lower of the United States Environmnetal Protection Agency Maximum Contaminant Level and the New Jersey Groundwater Quality Standards.

2.3.2 Surface Water Sample Results

Metals were detected in all three of the surface water samples collected in September 2015 (**Table 4**). Adjacent surface water location SW34-4 had screening level (SL) exceedances for aluminum (0.426 mg/L [SL 0.19 mg/L]), cadmium (0.0013 mg/L [SL 0.00028 mg/L]), chromium (0.0128 mg/L [0.01 mg/L]), copper (0.0212 mg/L [SL 0.0094 mg/L]), lead (0.0119 mg/L [0.0032 mg/L]), and sodium (43.9 mg/L [42.3 mg/L]). Downgradient surface water location 34-SW-8 had an exceedance for sodium (47.6 mg/L). Upradient surface water location GPBSW-3 had exceedances of aluminum (0.274 mg/L) and sodium (45.8 mg/L). All other constituents were below their respective screening level or non-detect.

2.4 FOURTH QUARTER 2015 RESULTS

Groundwater and surface water samples were analyzed for total target analyte list metals via USEPA Method 6020/7470. Laboratory analytical reports are included with **Appendix B**.

2.4.1 Groundwater Sample Results

Groundwater elevations (**Table 2**) ranged from 671.13 ft amsl at 1179-4B to 685.19 ft amsl at 1179A-1.

Metals were detected in all nine groundwater samples collected in November 2015 (**Table 3**). Summaries of screening level exceedances are discussed below:

- Aluminum was detected exceeding the screening level of 0.2 mg/L in eight of nine monitoring wells sampled (all wells sampled except 1179A-3). Concentrations exceeding the screening level ranged from 0.229 mg/L in 1179-4B to 8.45 mg/L in 1179A-1.

- Arsenic was detected above the screening level of 0.003 mg/L in all nine wells sampled. Concentrations exceeding the screening level ranged from 0.0045 mg/L in 1179-4B to 0.0395 mg/L in 1179A-1.

- Cadmium was detected above the screening level of 0.004 mg/L in monitoring well 1179A-2 at a concentration of 0.0047 mg/L.

- Iron was detected in seven of the nine wells above the screening level of 0.3 mg/L. Concentrations exceeding the screening level ranged from 0.582 mg/L in 1180-2A to 34.80 mg/L in 1179A-1.

- Lead was detected in three of the nine wells in exceedances of the 0.005 mg/L screening level. Concentrations exceeding the screening level ranged from 0.008 mg/L in 1179-3 to 0.011 mg/L in 1179-D2.

- Manganese exceeded the screening criteria of 0.05 mg/L in samples collected from eight of the nine wells sampled with concentrations ranging from 0.114 mg/L in 1179A-2 to 1.70 mg/L in 1179A-1.

All remaining groundwater constituents detected during this event were below screening levels or non-detect.

Table 3 also presents a summary of field parameters (pH, temperature, oxidation reduction potential, and dissolved oxygen).

2.4.2 Surface Water Sample Results

Metals were detected in all three of the surface water samples collected in November 2015 (**Table 4**). Adjacent surface water location SW34-4 had a SL exceedance for arsenic (0.0021 mg/L [SL 0.00138 mg/L]). Downgradient surface water location 34-SW-8 had exceedances for aluminum (0.60 mg/L [SL 0.19 mg/L]), arsenic (0.0029 mg/L [SL 0.00138 mg/L]), copper (0.0126 mg/L [SL 0.0094 mg/L]), iron (4.20 mg/L [1.79 mg/L]), and lead (0.0092 mg/L [SL 0.0032 mg/L]). Upgradient surface water location GPBSW-3 had exceedances of aluminum (0.288 mg/L), arsenic (0.0023 mg/L), and lead (0.0184 mg/L). All other constituents were below their respective screening level or non-detect.

2.5 GROUNDWATER AND SURFACE WATER DATA SUMMARY

Surface and groundwater sampling results indicate low level exceedances of several metals at the site. Results from upgradient surface water sampling location GPBSW-3 indicate the presence of naturally occurring metals at the site as evidenced by screening level exceedances of several metals at this location. Six quarterly sampling events have been conducted to date; therefore, additional sampling events are necessary to elucidate data trends within groundwater and surface water post remedy implementation. Per the exit strategy specified within the RAWP (ARCADIS 2014c), a statistical analysis will be conducted following eight quarterly sampling events to evaluate data trends and to specify the constituent levels at which the frequency of groundwater monitoring can be altered or discontinued.

EA Engineering, Science, and Technology, Inc., PBC

Table 4. Surface Water Analytical Results

	Location ID:		34-SW-8		GPBSW-3		SW34-4	
	Sample Date:		9/2/2015	11/2/2015	9/2/2015	11/2/2015	9/2/2015	11/2/2015
Chemical Name	**Units**	**Surface Water Screening Level***						
Metals								
Aluminum	mg/l	0.19	**0.0909**	**0.6 J**	**0.274**	**0.288 J**	**0.426 J**	**0.0318 J**
Antimony	mg/l	0.0056	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U
Arsenic	mg/l	0.00138	< 0.0020 U	**0.0029 J**	< 0.0020 U	**0.0023 J**	< 0.0020 U	**0.0021 J**
Barium	mg/l	1	**0.0441 J+**	**0.0426**	**0.0413 J+**	**0.0364**	**0.0474 J+**	**0.03**
Beryllium	mg/l	0.073	< 0.00050 U	< 0.0005 U	< 0.00050 U	< 0.0005 U	< 0.00050 U	< 0.0005 U
Cadmium	mg/l	0.00028	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	**0.0013 J**	< 0.001 U
Calcium	mg/l	500	**24.7 J+**	**18.9 J**	**22.2 J+**	**18.7 J**	**22.9 J+**	**18 J**
Chromium	mg/l	0.01	< 0.0040 U	**0.0086 J**	< 0.0040 U	< 0.004 U	**0.0128 J**	< 0.004 U
Cobalt	mg/l	0.011	< 0.00050 U	**0.00064 J**	< 0.00050 U	**0.00075 J**	**0.00050 J**	< 0.0005 U
Copper	mg/l	0.0094	< 0.0040 U	**0.0126 J**	< 0.0040 U	**0.005 J**	**0.0212 J**	< 0.004 U
Iron	mg/l	1.79	**1.09**	**4.2 J**	**1.05**	**1.46**	**1.65 J**	**0.399 J**
Lead	mg/l	0.0032	**0.0017 J**	**0.0092 J**	**0.0014 J**	**0.0184**	**0.0119**	**0.0013 J**
Magnesium	mg/l	175	**7.86**	**6.5**	**7.36**	**6.4**	**7.45**	**6.24**
Manganese	mg/l	0.383	**0.0906 J+**	**0.152 J**	**0.184 J+**	**0.288**	**0.105 J+**	**0.0785**
Mercury	mg/l	0.00005	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ	< 0.00015 UJ
Nickel	mg/l	0.052	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U	< 0.0020 U	< 0.002 U
Potassium	mg/l	1000	**1.17**	**1.14**	**1.18**	**1.07**	**1.16**	**0.999**
Selenium	mg/l	0.005	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U
Silver	mg/l	0.0038	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U
Sodium	mg/l	42.3	**47.6**	**34.2 J**	**45.8**	**34.1 J**	**43.9**	**33.6 J**
Thallium	mg/l	0.0073	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U	< 0.0010 U	< 0.001 U
Vanadium	mg/l	0.26	< 0.0100 U	< 0.01 U	< 0.0100 U	< 0.01 U	< 0.0100 U	< 0.01 U
Zinc	mg/l	0.122	< 0.0050 UB	**0.019 J**	< 0.0050 UB	**0.0172**	< 0.0050 UB	**0.0068 J**
Field Parameters								
pH	--	--	10.05	8.5	8.65	8.25	7.08	8.29
Temperature	°C	--	23.4	12.1	18.1	12.64	22.99	12.69
Oxidation Reduction Potential	mV	--	--	-82	--	-34	--	55
Dissolved Oxygen	mg/L	--	6.1	5.67	7.9	8.26	7.38	5.39

Notes:

All detections are boldfaced

Values exceeding the chemical=specific criteria are shaded gray.

°C = Degrees Celsius.

mg/L = Milligrams per liter.

mV = Millivolt.

J = Estimated concentration.

U = Non=detect at the specified reporting

B = Detected in associated method blank.

+ = Value biased high.

* For surface water, the promulgated New Jersey Surafce Water Quality Criteria were slected as the screening criteria. If state criteria were absent, the United States Environmental Protection Agency Water Quality Criteria were selected as screening criteria. Only in the absence of water quality criteria was the USEPA Tap Water ($1E^{-06}$) Regional Screening Levels or the Federal Health Advisory Level selected as the screening criteria. If the Picatinny-specific background value was higher than the selected guidance criteria, the background value was selected as the screening criteria.

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3. FUTURE ACTIONS

Groundwater and surface water sampling is scheduled to be conducted on a quarterly basis for the first half of 2016 and then on a semi-annual basis for years three and four. Statistical analysis will be performed at the completion of 2 years of quarterly sampling (8th quarterly sampling event scheduled for second quarter of 2016) in accordance with the exit strategy specified within the RAWP (ARCADIS 2014c).

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