FIFTH FIVE-YEAR REVIEW REPORT FOR PALMERTON ZINC PILE SUPERFUND SITE CARBON COUNTY, PENNSYLVANIA

SEPTEMBER 2017

Prepared by

U.S. Environmental Protection Agency
Region 3
Philadelphia, Pennsylvania

SEP 5 2017

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Date

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LIST OF ACRONYMS

AOC	Administrative Order on Consent
Borough	Palmerton Borough
BTAG	Biological Technical Assistance Group
CBS	CBS Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CD	Consent Decree
ECOLOAM	synthetic soil mixture primarily composed of sludge and fly ash
EDD	Eastern Diversion Ditch
ENVIRON	ENVIRON-Ramboll International Corporation
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
GA	Geographical Area
GW	Groundwater
ICIP	Institutional Control Implementation Plan
IRM	Iron-Rich Material
LGNC	Lehigh Gap Nature Center
MRZ	Metal Reduction Zone
N/A	Not Applicable
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NPS	National Park Service
O&M	Operation and Maintenance
OU	Operable Unit
PA	Pennsylvania
PADEP	Pennsylvania Department of Environmental Protection
ppm	Part Per Million
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RC	Regional Counsel
RI	Resource Island
RI/FS	Remedial Investigation/Feasibility Study
RIM	Remedial Interim Measure
ROD	Record of Decision
RPM	Remedial Project Manager
Twp	Township
Site	Palmerton Zinc Superfund Site
USFWS	United States Fish & Wildlife Service
UU/UE	Unlimited Use/Unrestricted Exposure
ZCA	Zinc Corporation of America

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate and determine whether the remedy at a Site continues to be protective of human health and the environment. In addition, FYR reports identify any issues found during the review, and documents recommendations to be addressed. Methods, findings, and conclusions of reviews are documented in FYR reports such as this one.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy. This is the fifth FYR for the Palmerton Zinc Superfund Site (Site). The triggering action for this statutory review is the completion date of the *Fourth Five-Year Review Report*, September 27, 2012. This FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The Site is composed of four Operable Units (OUs): OU1 – Blue Mountain; OU2 – Cinder Bank; OU3 – Community Soils; and OU4 – Groundwater, Surface Water and Site-wide Ecological Risk. All four OUs will be discussed in this FYR.

This FYR was led by EPA Region 3 remedial project manager (RPM) Andrew Hass. The FYR team included EPA Hydrogeologist Mark Leipert, EPA Toxicologist Dawn Ioven, EPA Biological Technical Assistance Group (BTAG) Bruce Pluta, U.S. Fish & Wildlife Service (USFWS) BTAG Kathy Patnode, EPA Community Involvement Coordinator (CIC) Alexander Mandell, EPA Regional Counsel (RC) Cynthia Nadolski (retired) and EPA RC Susan Hodges.

Site Background

The Site is located in Carbon County, Pennsylvania, in the vicinity of the Lehigh Gap and is approximately 15 miles north of Allentown, Pennsylvania. The Site is located in a narrow valley bounded by Stony Ridge on the north and Blue Mountain to the south. Figure 1 presents a general Site location map and Figure 2 presents a map of OUs.

From 1898 to 1967, the New Jersey Zinc Company (New Jersey Zinc) operated two zinc smelters within Palmerton Borough (Borough) at what were known as the East and West Plant locations. During smelting operations, lead, cadmium, zinc, and arsenic were emitted as dust and particulate fallout from stack emissions. The smelting operation was purchased from New Jersey Zinc in 1967 by Gulf & Western, Inc. (G&W). Primary zinc smelting operations ceased at the East and West Plants in about 1981.

In 1981, Horsehead Industries, Inc. (HII) purchased the smelters and began operating the facility as a hazardous waste recycling plant. It presently utilizes the East Plant to process Resource Conservation and Recovery Act (RCRA) hazardous waste K061, electric arc furnace (EAF) dust. This dust is a residue from the steel mill industry and contains lead, cadmium, and zinc.

The East Plant and the Borough are separated by Aquashicola Creek which flows westward and joins the Lehigh River in Lehigh Gap southwest of the Borough. The Borough is located north of Aquashicola Creek. The East Plant property is located towards the eastern end of the Borough at

the foot of Blue Mountain. The West Plant property is located in the western end of the Borough near the northern bank of the Lehigh River. The West Plant was demolished in the early 1990's and the 120-acre property is currently being redeveloped as an industrial park.

A residue pile, known as the Cinder Bank, lies adjacent to the East Plant along the base of Blue Mountain. The Cinder Bank is approximately 2.5 miles long, 200 feet high, 200 feet wide at its crest, 1,000 feet wide at the base. The Cinder Bank is comprised of approximately 33 million tons of residual metals and carbonaceous material. Due to poor historical residue management practices (i.e., deposition of residue on to the pile before it was fully quenched), portions of the Cinder Bank continue to smolder.

Figure 1. – Site Location

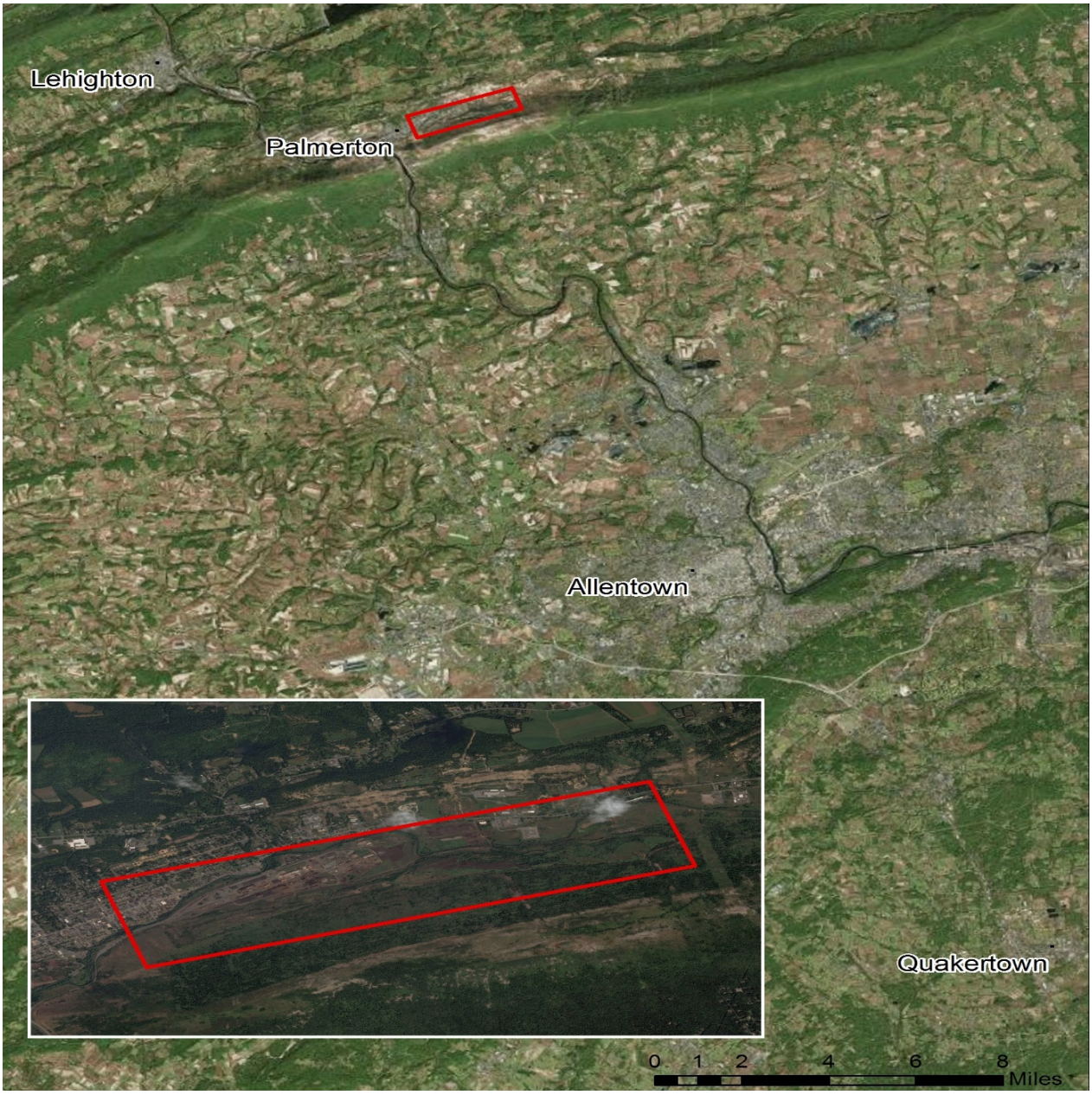


Figure 2. – OU Map

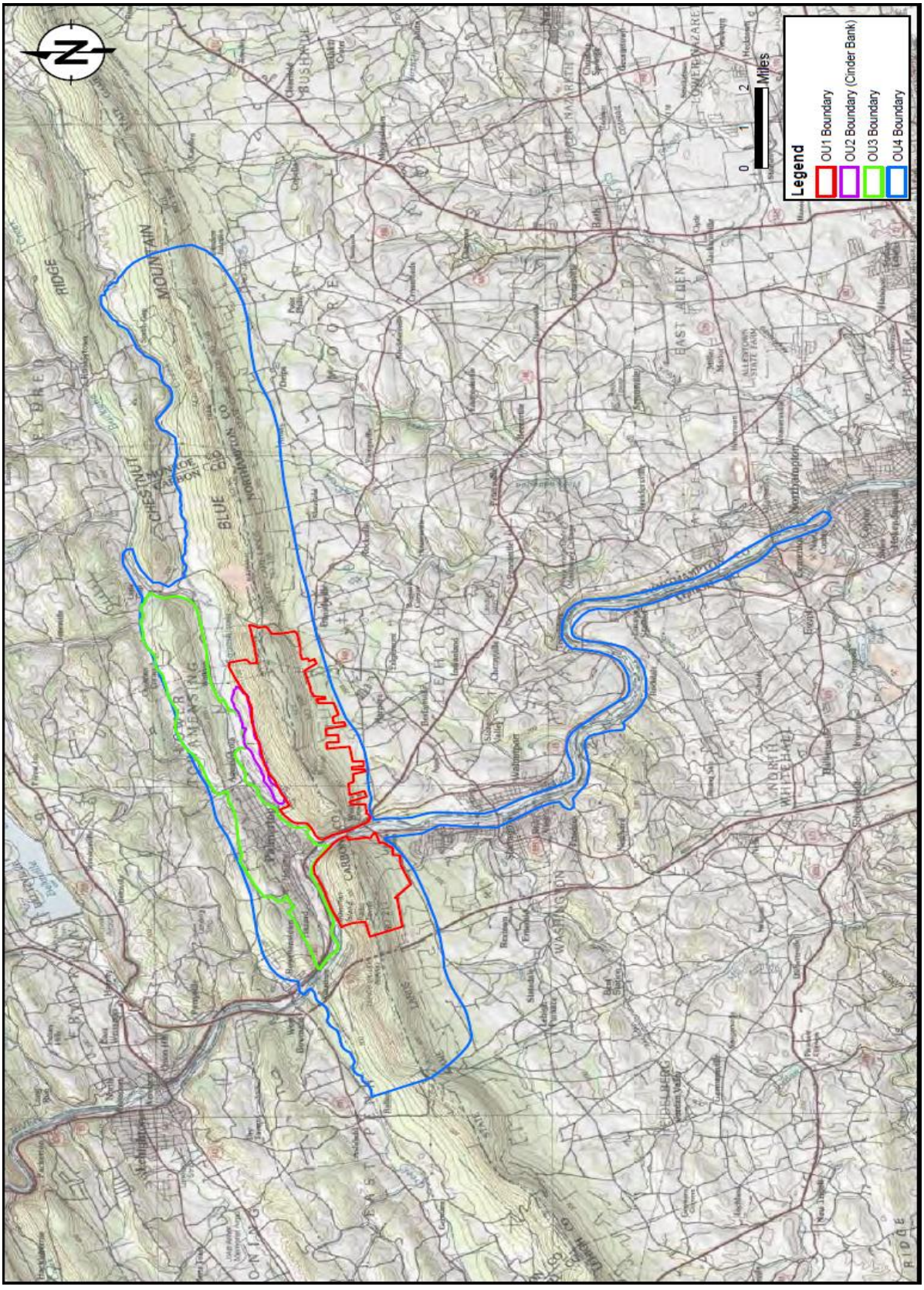


Table 1. - Five Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Palmerton Zinc Superfund Site		
EPA ID: PAD002395887		
Region: 3	**State:** PA	**City/County:** Palmerton/Carbon County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**		
Author name (Federal or State Project Manager): Andrew Hass		
Author affiliation: US EPA Region 3		
Review period: April 2016 – September 2017		
Date(s) of site inspection: August 10, 2016 (OU1) & November 2, 2016 (OU2 & OU4)		
Type of review: Statutory		
Review number: 5		
Triggering action date: September 27, 2012		
Due date *(five years after triggering action date)*: September 27, 2017		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Zinc, lead, cadmium, and sulfur dioxide emissions from the smelters resulted in metal particulate deposition near the Site, including the Borough and Blue Mountain. Nearly 90 years of metal particulate deposition accumulating in the surrounding area soils created an environment that was toxic to vegetation. As the soil became toxic, vegetation started dying and eventually the north slope of Blue Mountain became devoid of almost all vegetation.

In addition to the metals particulate deposition, the Cinder Bank was another major source of metals contamination for the Site. The 33 million tons of slag material in the Cinder Bank allowed for metals from the slag pile to leach out and migrate into the groundwater and surface water.

In the early-1980's, analytical results for groundwater, soil, surface water, sediment, and biota samples indicated the presence of elevated metals concentrations. The metals with the highest detected concentrations were arsenic, cadmium, copper, lead, and zinc. All of these metals are listed as hazardous substances pursuant to CERCLA in Table 302.4 - List of Hazardous Substances and Reportable Quantities (40 CFR § 302.4(a)), and as toxic pollutants pursuant to the Federal Water Pollution Control Act (40 CFR § 401.15). On September 8, 1983, the Site was formally added to the National Priorities List (NPL). Additional information on historic contamination at the Site is included in the 2002, 2007, and 2012 FYRs, available on EPA's FYR website: https://www.epa.gov/superfund/search-superfund-five-year-reviews.

Response Actions

EPA divided the Site into four OUs because of the size and complexity of the Site:

- OU1 – Blue Mountain
- OU2 – Cinder Bank
- OU3 – Community Soils
- OU4 – Groundwater, Surface Water, and Site-wide Ecological Risk

Brief descriptions of the Selected Remedies for each OU are provided below. More detailed discussions of the Remedial Investigations and Feasibility Study (RI/FS) and the Selected Remedies for each OU are provided in the 2002, 2007, and 2012 FYRs.

OU1 – Blue Mountain

OU1 addresses metals exposure and migration on approximately 3,000 acres of non-residential land on the north face of Blue Mountain. EPA issued the ROD for OU1 on September 4, 1987, and included the following Remedial Action Objectives (RAOs):

1. minimize direct contact with contaminated soil
2. reduce volume of runoff
3. reduce contamination in runoff
4. mitigate environmental damage

The remedy selected in the 1987 ROD included the application of a sludge/lime/fly ash mixture with grass and tree seeds. While not addressing all applicable or relevant and appropriate requirements (ARARs), the selected alternative was deemed consistent with those action-specific ARARs addressing sludge application, and PADEP concurred with the interim remedy selected in the ROD.

Based on the experiences and evaluations of the initial remedy implementation (1988 through 2001), EPA adopted an alternate approach to implementing the remedy on the remaining

acreage. EPA implemented a self-sustaining meadowland revegetation approach that has lesser metals uptake and includes sampling and analysis of appropriate indicator plant species for metals to determine if translocation of contaminants is occurring. Based on pilot testing results, EPA determined that this approach would achieve the RAOs of the September 4, 1987 ROD. Institutional Controls (ICs) to limit activities that would interfere or adversely impact the protectiveness of the remedy and to prevent the use of OU1 for residential and/or agricultural purposes were required in the 2003 Consent Decree (CD).

OU2 – Cinder Bank

OU2 addresses the Cinder Bank, consisting of approximately 33 million tons of metal processing residue. EPA issued the ROD for OU2 on June 29, 1988 and included the following RAOs:

1. Minimize direct contact with the Cinder Bank
2. Reduce volume of runoff from the Cinder Bank
3. Reduce contamination in runoff from the Cinder Bank
4. Reduce the volume of run-on from Blue Mountain to the Cinder Bank
5. Collect and treat leachate from the Cinder Bank
6. Reduce wind-borne emissions
7. Reduce particulate erosion

The Selected Remedy for OU2 consisted of the following components:

- Contouring the cinder bank slopes;
- Constructing surface-water diversion channels to divert runoff from Blue Mountain away from the Cinder Bank and into a treatment system, if necessary, and divert leachate from the Cinder Bank into a treatment system;
- Constructing a cap over the Cinder Bank to prevent infiltration and leaching of constituents into the groundwater and to prevent seeps;
- Placing a vegetative cover over the cap to stabilize cinder bank slopes, reduce/prevent erosion, and control surface-water flow;
- Pre-design studies to identify the best methods for controlling or extinguishing internal fires within portions of the Cinder Bank;
- Treatability studies regarding collection and treatment of surface water runoff from the Cinder Bank through the use of constructed wetlands and lime treatment;
- Required implementation of an O&M plan to evaluate the effectiveness of the Selected Remedy.

EPA and HII entered into a 1995 Multi-Media CD which required HII to design and install pollution reduction technologies (PRTs) at and in the vicinity of the Cinder Bank to address National Pollutant Discharge Elimination System (NPDES) limit violations related primarily to discharges from outfalls associated with the Cinder Bank. Many tasks included in PRT work plans were consistent with the remedy selected in the 1988 ROD.

Based on the coincidence of 1988 ROD and PRT work plan requirements, EPA issued an Explanation of Significant Differences (ESD) in August 2002 that summarized the differences between the remedy selected in the 1988 ROD and the remedy implemented under the PRT work plans. The 2002 ESD concluded that remedial actions conducted in accordance with the PRT

work plans will accomplish the remedy selected in the 1988 ROD provided that O&M activities also include access control measures and inspections of portions of the Cinder Bank that continue to smolder. ICs to limit activities that would interfere with or adversely impact the protectiveness of the remedy and to require implementation of an access control plan for the Cinder Bank were required in the 2003 CD.

OU3 – Community Soils

OU3 addresses residential soils and interior house dust exhibiting elevated concentrations of lead resulting from historical zinc processing operations. Based on the findings of initial investigations in February 1991, a removal action to address interior dust in 24 residences was performed in early 1992. Additionally, in October 1991, EPA conducted a comprehensive environmental sampling program in the Palmerton area in conjunction with the Agency for Toxic Substances and Disease Registry (ATSDR) and performed an interim removal action between April 1994 and 1997 to address 202 additional residences. The RI/FS for OU3 was completed in June 2000.

EPA issued the ROD for OU3 on October 9, 2001 and included the following RAOs:

1. Remediate residential soils contaminated with lead greater than 650 parts per million (ppm)
2. Remediate residential soils in play areas with lead greater than 400 ppm
3. Clean interior homes for lead-dust greater than 650 ppm

The Selected Remedy for OU3 consisted of adding amendments and/or excavating residential soils until the confirmatory samples showed that the levels of lead met the performance standard of 650 ppm. In addition, if a residential property had a play area, that particular property was to be remediated to a performance standard of 400 ppm. Homes were also tested to determine if remedial action was needed indoors. Dust samples were also required and home interiors were to be remediated until lead concentrations in dust met the 650 ppm performance measure. The Real Estate Seller Disclosure Law (Pa. C.S.A. §§ 7301 -7315) requires sellers of residential property to disclose any material defects with the property known to the seller prior to the signing of an agreement of sale with respect to the property. This law was considered sufficient to ensure the protectiveness of the OU3 Selected Remedy.

OU4 - Groundwater, Surface Water, and Site-wide Ecological Risk

OU4 consists of an area-wide investigation of groundwater and surface water (including a human health risk assessment) and Site-wide ecological risk assessment. OU4 also includes erosion control and revegetation of more than 100 acres of land on Stoney Ridge, the consolidation and covering of electric furnace cinder material (EFCM) at Stoney Ridge Materials, and installation of a permeable reactive cell to treat shallow groundwater in the East End Cinder Bank Remedial Interim Measures (RIMs). The RI/FS for OU4 is currently being conducted and a ROD is anticipated for OU4 in 2020.

Status of Implementation

Implementation of the Selected Remedies from 2012 through 2017 is described below. Components of the Selected Remedies for each of the OUs that were completed prior to 2012 are described in additional detail in the 2002, 2007, and 2012 FYRs.

The OU1, OU2 and OU3 Selected Remedies are being implemented in accordance with a November 21, 2003 CD between EPA, Horsehead Industries, Inc., Horsehead Resource Development Company, Inc. (collectively Horsehead), Viacom International, Inc., and TCI Pacific Communications, Inc. (collectively Viacom). Additionally, Horsehead is required to implement the OU2 Selected Remedy in accordance with a 1995 Multi-Media CD. Finally, the OU4 RI/FS is being conducted in accordance with a September 30, 2005 Unilateral Administrative Order (UAO) issued to Viacom and Horsehead entities. For the purposes of this FYR, Horsehead and Viacom will be referred to collectively as the Potentially Responsible Parties (PRPs).

OU1 – Blue Mountain

Over 2,000 acres of Blue Mountain have been revegetated to date. The first phase of revegetation occurred between 1991 and 1996 with portions of the mountain receiving ECOLOAM, which is a mixture of sludge/lime/fly ash, plus seed application. Two defined Geographic Areas, GA-1 and GA-2 were seeded in mid-late 2000's either through ground seeding or aerial application. In addition to the revegetation, trees and shrubs have been planted in over 16,000 planting holes throughout the five resource islands atop Blue Mountain. The five resource islands were created to re-establish a hardwood forest ecosystem atop Blue Mountain. Since the 2012 FYR, the remaining resource islands were completed atop Blue Mountain. Currently, a total of five resource islands comprising approximately 93 acres have had approximately 22,000 trees and shrubs planted in the more than 16,000 planting holes between 2012 and 2016. Every year, these planting holes are monitored to ensure plants are viable. Monitoring of the plants within the resource island will continue until the performance standard of viable 5-10 year oaks and chestnuts trees are measured at 50 per acre and 35 per acre for other woody species.

Outside of the OU1 resource islands, performance monitoring is performed in GA-1 and GA-2. Monitoring will continue until live vegetation coverage of 60% or greater for 10 acres (or larger) plots for GA-1 and 70% or more for GA-2 (5 acres or larger).

Invasive plant management will also continue in OU1 to ensure the desired tree and plant species have established themselves. Since the last FYR, invasive plant management has been conducted in over 500 acres of OU1. Invasive plant management activities have typically utilized cutting and applying approved herbicides to species that are known hyper-accumulators of metals from the sub-soil and/or invasives. In addition to manually controlling the invasive plants, the Lehigh Gap Nature Center (LGNC) has recently been utilizing prescribed burns as a means to control undesirable vegetation on its property. Since 2013, LGNC has conducted three prescribed burns to control any undesirable plants from out-competing more desirable trees and plant species. Invasive plant management activities will continue on Blue Mountain until the vegetative coverage meets the performance standard of invasive species comprising less than 5% of the total vegetative cover within GA-2.

OU2 – Cinder Bank

Semi-annual inspection of the Cinder Bank is required since part of the pile is still smoldering. During the semi-annual Site inspection, the Cinder Bank is observed to determine if the internal smoldering is still on-going and to what extent. The semi-annual OU2/OU4 inspection determines if the vegetation coverage over the Cinder Bank is receding due to the internal smoldering.

The remedy implemented for OU2 also included installation of Metal Reduction Zones (MRZ) at known Cinder Bank seep locations and installation of the Eastern Diversion Ditch (EDD) above the Cinder Bank to capture water flowing down Blue Mountain before coming in to contact with the Cinder Bank. The EDD is inspected semi-annually to ensure it is functioning as intended by the OU2 remedy. Ancillary access controls and posted signs warning of the Cinder Bank burning area danger are checked during OU2/OU4 Site inspections.

OU3 – Community Soils

All planned remedial work has been completed for OU3. There are no further actions planned as part of OU3 to remediate exterior soil or interior dust within the Site boundaries. Periodically, realtors and prospective home buyers looking to buy or sell property within the Site boundary contact EPA requesting information about the clean-up status of certain properties.

OU4 - Groundwater, Surface Water, and Site-wide Ecological Risk

For OU4, the RI/FS process is currently underway. Even though a ROD has not been finalized for OU4, the PRPs have completed Remedial Interim Measures (RIM) since the 2012 FYR. During this FYR period, the PRPs completed work to restore the 40-acre wetland on the east end of the Site. The wetland restoration was necessary after excavation of elevated metals in the top layer of soil and installation of an Iron Rich Material (IRM) cell to treat shallow groundwater was performed in 2011. The wetland was regraded, a level spreader was installed, and a broad crested weir to control hydrology was constructed adjacent to the Aquashicola Creek. Once the hydrology controls for the wetland were constructed, native trees, shrubs, and grasses were planted.

The PRPs also conducted revegetation work to a property below Stoney Ridge. It was noted during a past OU2/OU4 semi-annual Site inspection that this property was not meeting vegetative coverage performance standards from the previous revegetation efforts. During the same OU2/OU4 Site inspection, it was noted that past work performed on two erosion channels running through the property was not functioning as intended. The property owner allowed the PRP to apply lime, fertilizer and seed on his property. Though the property was in need of additional control measures to slow the flow of water through the property after heavy rains, the property owner declined work to be performed in the two erosion channels.

Institutional Controls

The status of ICs for each of the OUs is summarized in Table 2, below. ICs are in place for OU1, OU2, and OU3, but are not required by decision documents. A Site-wide ICs Plan has been completed and will be included as part of any remedy selected in the ROD for OU4.

Table 2. - IC Summary Table

Media, Engineered Controls, and areas that do not support UU/UE based on current conditions	Institutional Controls (IC) Needed	ICs Called for in the Decision Documents	Impacted Parcels/Areas	IC Objective	Title of IC Instrument Implemented and Date (or planned)
OU1 – Blue Mountain Soil/ Revegetation	Yes	No	GA-1, GA-2, ECLOLOAM area, LGNC	Minimize runoff; No residential or agricultural use; No excavation may occur unless approved by state environmental agency; No direct contact.	March 2004 - Joinder of Declaration of Restrictive Covenant Conservation Easement for LGNC property
OU2 – Cinder Bank Waste/ Revegetation	Yes	No	Cinder Bank	No excavation may occur unless approved by state environmental agency; No direct contact; Access control.	November 21, 2003 CD
OU3 – Residential Soils	Yes	No	Residential Areas within the OU3 Boundary	Disclosure during property transfer.	PA Real Estate Disclosure Act
OU4 – Groundwater, Surface Water, and Site-wide Ecological Risk	Yes	N/A	OU4 All Areas;	Minimize direct contact; No drinking water supply wells may be installed in shallow groundwater.	N/A

Systems Operation/Operations & Maintenance

OU1 – Blue Mountain

Invasive plant management is conducted spring through early-winter on an annual basis. Throughout OU1, invasive plants, such as butterfly bush, tree of heaven, and knapweed are controlled to ensure that native plants in the resource islands have reduced competition and can thrive. In addition, resource island native trees and shrubs are inspected throughout the growing season to determine how many die off and need to be replanted. Recently, O&M activity focused on keeping small mammals out of the resource islands to stop them from eating the small trees, shrubs, plants etc. Over the past few years, performance monitoring has shown that the number of replanted trees, shrubs, etc. due to die-off from herbivorous activity has steadily decreased as a result of the protective measures installed (i.e. installation of deer fencing, rabbit trapping, etc.).

OU2 – Cinder Bank

Semi-annual OU2/OU4 Site inspections are performed to ensure the vegetative cover and erosion control for the Cinder Bank are functioning as intended. The EDD is also inspected to ensure no repairs are necessary. Occasional minor maintenance (i.e. debris removal, washout repair) is necessary on the EDD. Posted warning signs alerting people of the Cinder Bank burn area dangers are inspected semi-annually as well. Ancillary controls are also reviewed to ensure the Cinder Bank primary access points have been secured with gates, cables and/or berms to prevent unauthorized access.

OU3 – Community Soils

No O&M is necessary for OU3 because contaminated soils and interior dust were removed from residential properties.

OU4 - Groundwater, Surface Water, and Site-wide Ecological Risk

Monitoring of surface water and groundwater at the East Cinder Bank area was conducted quarterly from July 2011 through March 2014 after the IRM cell installation. Groundwater data collected from these wells was used to evaluate the IRM cell effectiveness in reducing overall zinc loading of the Aquashicola Creek by the Cinder Bank. Additional groundwater samples were taken in 2016 at existing wells around the East Plant. Groundwater samples in these wells were taken to support the on-going RI/FS. Prior to the 2016 groundwater sampling at the East Plant wells, the most current sample results from these wells were over a decade old. The 2016 groundwater samples at the East Plant and groundwater data from wells around the IRM cell will help determine the “nature and extent” of metals in the shallow groundwater for the on-going OU4 RI/FS.

Semi-annual Site inspections are conducted for OU4 to ensure the completed RIMs are functioning properly.

III. Progress Since the Last Review

The protectiveness statements from the 2012 FYR are presented in Table 3, below.

Table 3. - Protectiveness Statements from the 2012 Five Year Review

OU#	Protectiveness Determination	Protectiveness Statement
1	Will be Protective	The remedy is expected to be protective of human health. However, the final protectiveness determination with regard to ecological risks will be made following the evaluation of long term survivability and translocation of contaminants.
2	Short-term Protective	The remedy has been completed and is protective of human health and the environment in the short term. However, follow-up action concerning the burning area of the Cinder Bank is needed to insure long term protectiveness.
3	Protective	The planned remedial activities has been completed and is protective of human health and the environment.
4	Protectiveness Deferred	A remedy has yet to be selected for OU4 so a protectiveness determination cannot be made at this time. Further information will continue to be obtained during the Remedial Investigation/Feasibility Study (RI/FS), currently underway. It is expected that the RI/FS will be completed and a ROD issued in 2019.

The status of issues and recommendations from the 2012 FYR are presented in Table 4, below.

Table 4. – Status of Recommendations from the 2012 Five Year Review

	OU	Issues	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable
1	**OU 1**	Two Resource Islands on Blue Mountain remain to be installed.	Complete installation of Resource Islands on National Park Service (NPS)property on Blue mountain	Completed	All (5) Resource Island installations have been completed	June 2013
2	**OU 1**	Question of translocation of contaminants re: long term survivability.	Monitor and evaluate the completed portion of Blue Mountain for long-term vegetation survivability and translocation	On-Going	Resource Islands 3, 4 & 5 were installed in 2013. 10 years are needed until long term survivability is determined. Metals sampling was conducted in 2016 to determine extent of metals translocation	2023

3	**OU 2**	Long term Operation & Maintenance (O&M) of and access control of Cinder Bank burning areas.	Continue O&M of Cinder Bank. Once areas of Cinder Bank stop burning, develop a plan to vegetate the areas	On-Going	Cinder Bank continues to burn internally and long term monitoring will continue	N/A
4	**OU 4**	Need for Site wide institutional controls plan.	Develop Institutional Controls Implementation Plan for the Site	Completed	Institutional Control Implementation Plan (ICIP) has been completed	September 2017
5	**OU 4**	RI/FS remains to be completed and a remedy selected for OU4.	Upon completion of RI/FS, select a remedy for OU 4	On-Going	Issues with delineating the groundwater contamination have delayed the RI/FS	N/A

Additional information related to Issue/Recommendations #2, 3, and 5 are presented below.

Recommendation #2 – EPA will need to wait until the resource island trees have matured to 10 years old to determine if the remedy has achieved the performance measure goals. The performance measure goals for the long-term survivability of trees require the establishment of 10-year-old oaks and American chestnuts at 50 per acre. In addition, establishment of 10-year-old target woody species at 35 per acre are required by the OU1 performance standards. Metals monitoring of soil and vegetation will need to be incorporated into the long-term monitoring plan to ensure that metals translocation does not increase exposure as the vegetation on the Site shifts from predominantly herbaceous to primarily trees and shrubs.

Recommendation #3 – During the most recent semi-annual Site inspections, the Cinder Bank was observed to be smoldering internally. Long term O&M of the access controls will still be necessary. Once the internal fires within the Cinder Bank have been extinguished, the access control can be relaxed and a plan for revegetation can be completed.

Recommendation #5 – The issue of fully characterizing the "nature and extent" of the metals contamination in the shallow and deep bedrock aquifer is on-going as part of the RI/FS process. Delineation of the shallow aquifer in the horizontal and vertical planes will determine any impacts to Aquashicola Creek, as well as, need to investigate the deep bedrock aquifer. Past groundwater sampling data was used to determine areas where additional monitoring wells are needed to characterize horizontal and/or vertical delineation. Should the metals contamination not be fully delineated vertically in the alluvial aquifer, the need for bedrock groundwater monitoring wells will be required. In the past, there were access issues relating to the installation of deep bedrock groundwater monitoring wells in the Borough due to fears of cross-contaminating the Borough public water supply. The need for bedrock groundwater monitoring wells could cause further delay based on past Borough concerns.

IV. Five Year Review Process

Community Notification, Involvement & Site Interviews

A public notice was made available through an ad in the Times News on August 4, 2017, stating that the FYR process was on-going. The ad also invited the public to submit any comments to the EPA. Results of the review and the report will be made available at the Site's information repository located at the Borough public library as well as online at:

https://www.epa.gov/superfund/search-superfund-five-year-reviews.

During the FYR process, interviews were conducted with Palmerton Borough and Lower Towamensing Township officials on November 2, 2016. The interview questions focused on noting any perceived problems or successes residents have with the remedies implemented to date. Overview of the interviews with the Borough and Twp. officials are summarized below:

-The Palmerton Borough Council President and Borough Manager were interviewed. They were asked about any issues regarding the Site raised by the community. Palmerton officials had not heard any concerns recently from residents regarding the Site. The Borough Council President noted that deep bedrock monitoring well installation for investigating the groundwater had been discussed in the past and they know it may still be needed for the upcoming OU4 RI/FS. The Palmerton officials were interested in being kept informed with any decisions regarding the need for installing bedrock monitoring wells during the OU4 RI/FS process.

-The Lower Towamensing Township Council President was also interviewed. When asked if the Township council has heard of any resident's concern about the Site, the Twp. official had not heard of any concerns regarding the Site recently. The Township President invited EPA to participate in future Lower Towamensing Township municipal meetings (similar to the meeting EPA held to provide an update on the wetland restoration) should information with the Site need to be related to the local residents.

Data Review

Data was collected during this FYR to evaluate the protectiveness of the OU1 Selected Remedy.

No data collected was collected during the FYR period for OU2 and OU3. The 2004 O&M plan for OU2 requires only visual inspections of the Cinder Bank ensuring vegetation has not receded and access controls are functioning as intended. For OU3, the residential soil and indoor dust remediation has been completed and no additional data collection is required. Data collected during the OU4 RI/FS is also presented below.

OU1 – Blue Mountain

For OU1, data was collected during this FYR period to determine if Blue Mountain revegetation performance monitoring goals have been achieved. Trees are counted throughout the resource islands to determine if the 10-year old oak and chestnuts are meeting the 50 per acre viability goal. All other woody tree species are required to meet 35 per acre viability performance

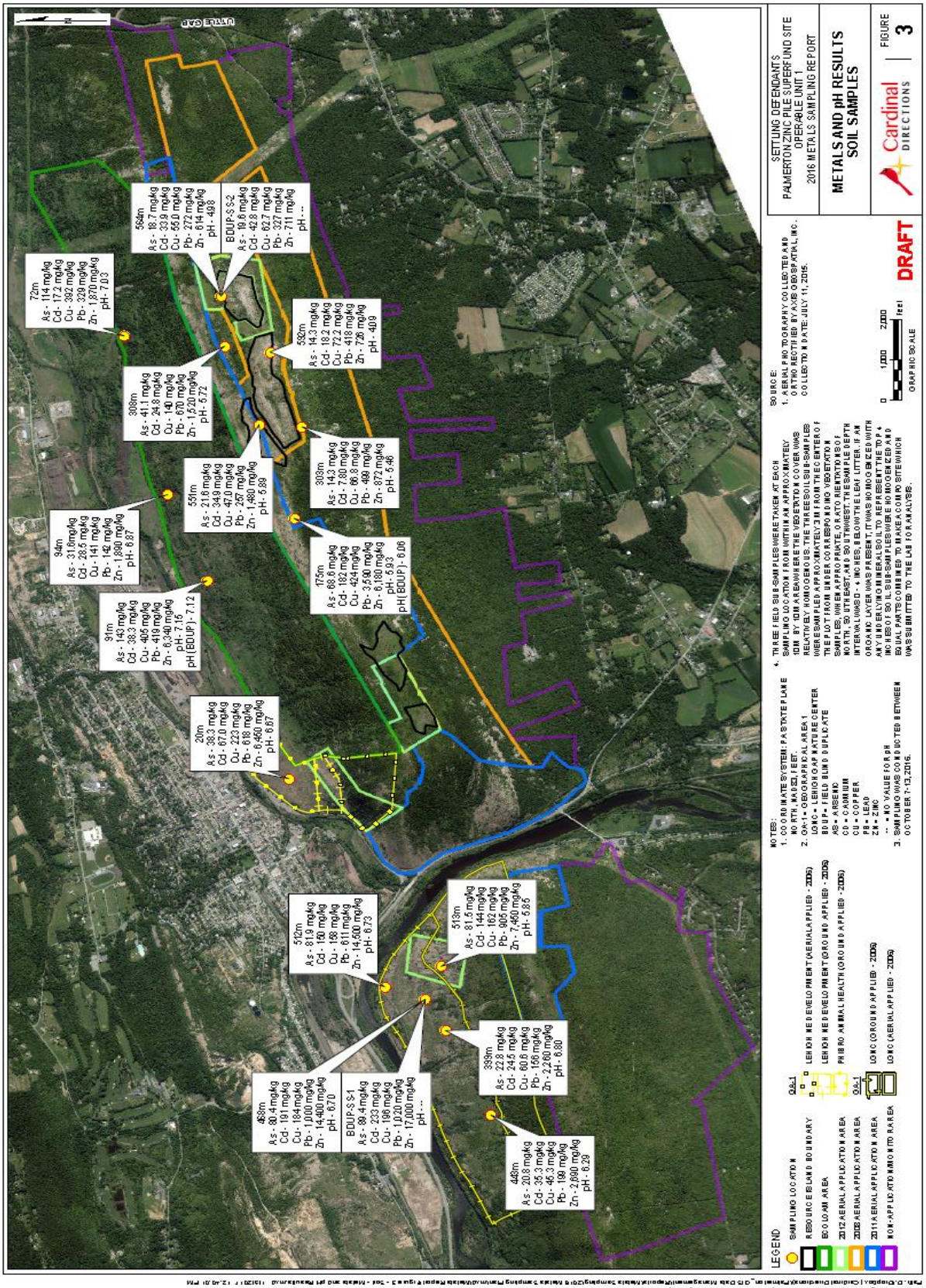
standard in the resource islands by year 10. At this time, the 50 per acre (chestnut/oak trees) and 35 per acre (other tree species) viability performance standard through the resource islands are not being met. Recent performance monitoring data collected will aid in the development of an OU1 adaptive management plan to determine best practices for future tree planting within the resource islands. Table A-1 provides data on tree planting throughout the resource islands.

Vegetation coverage throughout GA-1 and GA-2 is another performance standard set for OU1. For GA-1, the live vegetation coverage performance standard is met when 60% coverage is measured within 10-acre plots. For GA-2, performance standards are met when the vegetation coverage of 70% is achieved in 5-acre plots. Live vegetation cover performance monitoring was conducted in 2015 using aerial imagery and field plot data. The results of the aerial imagery of GA-1 showed the total area having 84% live vegetative coverage. However, the performance standard has not been met because one 10-acre area plot in the LGNC was determined to have less than 60% coverage. Results of aerial imagery for the ECOLOAM area showed that there was 90% live vegetative coverage in 2015 over the entire area. However, even though the ECOLOAM area has achieved approximately 90% vegetative coverage, the performance standard in the ECOLOAM area has not been met since all 10-acre plots were not meeting the 60% live vegetative coverage.

Using aerial imagery within GA-2 in 2015, total live vegetative cover was determined to be 81%. However, like GA-1, GA-2 has not achieved the performance standards even though total vegetation exceeds 70%. GA-2 has not met the performance standards due to individual 5-acre plots not meeting the 70% performance standard.

In addition to vegetation coverage data collected, metals soil samples were collected in 2016 in support of this FYR. Table A-2 (in Appendix A) provides information on samples collected to determine current concentrations of metals in the soils throughout OU1. The metals soil data will help determine the extent of metals exposure and translocation throughout OU1. As with the tree viability and vegetative coverage data, results of the soil samples showed areas with elevated metals concentrations that may be hindering the viability of the vegetation. This soil data will be used in developing an OU1 adaptive management plan to better manage the revegetation effort and meet performance standards. This data will also help determine the efficacy of the vegetation in reducing metals exposure. Sampling of multiple indicator plant species provide information on potential pathways of metals recycling (i.e. quaking aspen leaf litter role in translocation of metals from sub-surface to surface). The results of the soil samples collected are also provided in Figure 3.

Figure 3. – Metals and pH Soil Sample Results



OU4 - Groundwater, Surface Water, and Site-wide Ecological Risk

During this FYR period, groundwater samples were collected at existing monitoring wells in the East Plant area for OU4. Groundwater samples were collected at East Plant monitoring wells since the most recent data available is over ten years old. The groundwater samples collected from these wells were used to evaluate and determine additional needs for plume delineation as part of the on-going OU4 RI/FS. Review of East Plant groundwater monitoring data showed that additional wells are necessary to fully delineate, vertically and horizontally, the groundwater metals contamination. Results for the East Plant groundwater sampling is presented in Table A-3.

In addition to the East Plant data, groundwater samples were collected at monitoring wells in the East Cinder Bank after the RIMs were completed in 2012. Groundwater samples were collected at these monitoring wells to evaluate the effectiveness of the IRM cell and MRZs. As with the East Plant data, the groundwater data from the East Cinder Bank area will also be used to support the on-going RI/FS. Data from these wells was evaluated to determine if the metals contamination in the East Cinder Bank area groundwater was fully delineated. Results of the groundwater sampling showed that additional wells are needed in the East Cinder Bank area to further delineate, vertically and horizontally, the groundwater contamination. Results of the East Cinder Bank area groundwater sampling is presented in Table A-4.

Site Inspection

Due to the size of the Site and multiple OU's, the OU1 Site inspection was conducted separately from the other OU Site inspections, on August 10, 2016. Participants of the Site inspection were: Andrew Hass (RPM-EPA), Bruce Pluta (BTAG-EPA), Kathy Patnode (BTAG-USFWS), Kimberly Plank (BTAG-EPA), Matthew Traynor (BTAG-EPA) and Jennifer Lansing (Cardinal Directions). The resource islands within OU1 were visited and it was observed that the vegetation was doing very well. An area of concern observed during the Site inspection was the vegetation on the Phibro property. The grasses were either dead or severely stressed and only plants having a high zinc tolerance were thriving. A similar situation with respect to the large areas of dead bunch grass and high tolerant zinc plants was seen in areas of the LGNC. These areas were discussed with the PRP contractor and will be addressed in a future adaptive management plan.

The Site inspection for OU2 and OU4 was conducted on November 2, 2016. Participants for this inspection were: Andrew Hass (EPA-RPM), Alexander Mandell (EPA-CIC), Mark Leipert (EPA Hydro), Kimberly Scharl (EPA -CIC), Nick Scala (ENVIRON), Russ Cepko (CBS), Jen Lansing (Cardinal Direction), Margaret Boyer (PADEP), Ron Schock (PADEP) and Bob Davies (PADEP). During the inspection, it was noted that the EDD was functioning as intended with some minor clean-out of debris and vegetation where build up occurred at culverts and/or grates. In addition, it was noted during the inspection that there appeared to be minimum loss of trees, shrubs and other vegetation that were planted in late-Fall of 2015 throughout the wetland. It was also observed that invasive plant control measures performed throughout the wetland appeared to have kept the phragmites and purple loosestrife species under control. A concern was noted at the property situated below Stoney Ridge. The revegetation activity performed on the property

during Spring 2016 had minimal success. The property will be re-evaluated to determine if additional measures will need to be implemented.

V. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

The OU1, OU2 and OU3 remedies have been implemented and appear to be functioning as intended by the decision documents. OU1 revegetation was completed on Blue Mountain after the remaining resource islands were installed in 2013. The PRPs are now in the process of ensuring that resource island and Blue Mountain revegetation performance standards are being achieved. The OU1 performance measures improved during this FYR period. However, there are areas of vegetation on the mountain that are stressed and/or dying. On-going inspections of the Cinder Bank under the OU2 O&M plan continue to assess burning areas and the effectiveness of access controls. Areas of the Cinder Bank have not been successfully re-vegetated due to the elevated surface temperatures caused by the internal smoldering. Remediation associated with OU3 have been completed and no further action is necessary at this time. A decision document has not been finalized for OU4. The RI/FS for OU4 currently on-going with an expected completion date of June 2020.

ICs are in place for OU1, OU2, and OU3, but are not required by Site decision documents. Site-wide ICs will be included in the OU4 ROD.

Question B: Are the exposure scenario assumptions, toxicity data, clean-up levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Question B Summary:

The exposure scenario assumptions, toxicity data, clean-up levels, and RAOs described earlier in this report are generally still valid. EPA issued OLEM Directive 9200.2-167, *Updated Scientific Considerations for Lead in Soil Cleanups*, on December 22, 2016, which generally recommends developing Site-specific lead cleanup goals. Site-specific lead cleanup goals were established for OU3 and in the 2001 ROD and evaluated during this FYR with respect to the OLEM Directive. The evaluation indicated that the Site-specific cleanup goals for OU3 remain protective of human health.

Changes in Exposure Pathways

Translocation of contaminants may be occurring through plant uptake in the revegetated acreage of Blue Mountain (OU1) as the vegetation on the Site shifts from predominantly herbaceous to primarily trees and shrubs. Metals monitoring of soil and vegetation will need to be incorporated into the long-term monitoring plan to ensure that metals translocation does not increase exposure. In addition, continued sampling and evaluation needs to be conducted to determine if translocation of contaminants is affecting long term survivability of vegetation.

Expected Progress Towards Meeting RAOs

Review of the current remedies in place at the Site have shown that most of the RAOs for OU1 and OU2 are being achieved. For OU1, the remedies in place appear to achieving the RAOs. The revegetation effort on Blue Mountain has been successful and continues to mitigate the past environmental damage caused by aerial deposition of metals from historical smelting operations. Due to the revegetation effort on Blue Mountain, soil and metals runoff has been reduced. In addition, direct contact with contaminated soil has been reduced due to the newly established vegetation on Blue Mountain.

RAOs for OU2 have mostly been achieved. The OU2 remedy called for the Cinder Bank to be revegetated to: minimize direct contact; reduce volume runoff, reduce wind-borne emissions, reduce particulate emissions and reduce contamination. These RAOs have mostly been achieved. However, due to the continued internal smoldering of the Cinder Bank, vegetation does not grow in certain areas of the pile. The volume of runoff from Blue Mountain coming in contact with the Cinder Bank has been minimized since the EDD is maintained and inspected semi-annually to ensure it is functioning as intended. The three MRZs constructed at the Cinder Bank still collect and treat leachate from the Cinder Bank.

The RAOs for OU3 have been achieved. All properties that had elevated indoor/outdoor lead concentrations above EPA action levels and provided access for EPA to perform remediation, have been addressed.

There are no RAOs for OU4 at this time. Once the OU4 RI/FS is complete, RAOs will be documented in the ROD.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

VI. Issues/Recommendations

Table 5. – 2017 Five Year Review Issues & Recommendations

OUs without Issue/Recommendations Identified in the Five Year Review Process				
OU3				
Issue/Recommendations Identified in the Five Year Review Process				
OU(s): OU1	**Issue Category: Remedy Performance**			
	Issue: Dying vegetation has been identified in areas of GA-1 at OU1.			
	Recommendation: Determine the cause of the dying vegetation using recently collected performance monitoring and soil metals data and incorporate any needed O&M changes into the Adaptive Management Plan.			
Affect Current Protectiveness:	Affect Future Protectiveness:	Party Responsible:	Oversight Party:	Milestone Date:
Yes	Yes	PRP	EPA	3/31/2018.
OU(s): OU1	**Issue Category: Remedy Performance**			
	Issue: Translocation of contaminants may be occurring at OU1.			
	Recommendation: Monitor and evaluate the vegetation throughout Blue Mountain to determine extent of translocation. Control known metal hyper-accumulating vegetation and incorporate metals monitoring of soils, leaf litter and vegetation into the long-term monitoring plan to ensure metals translocation does not increase ecological exposure as the vegetation on the Site shifts from predominantly herbaceous to predominantly trees and shrubs.			
Affect Current Protectiveness:	Affect Future Protectiveness:	Party Responsible:	Oversight Party:	Milestone Date:
No	Yes	PRP	EPA	On-going
OU(s): OU1	**Issue Category: Institutional Controls**			
	Issue: ICs for all OUs are not required in decision documents.			
	Recommendation: Include requirements for Site-wide ICs in the OU4 ROD.			
Affect Current Protectiveness:	Affect Future Protectiveness:	Party Responsible:	Oversight Party:	Milestone Date:
No	Yes	EPA	EPA	6/30/2020
OU(s): OU2	**Issue Category: Operation & Maintenance**			
	Issue: Long term O&M of, and access control to, the Cinder Bank burning areas need to continue because areas of the Cinder Bank continue to smolder, and revegetation of the Cinder Bank has not been achieved.			
	Recommendation: Continue semi-annual inspections of the Cinder Bank to ensure vegetation is not receding and access controls are functioning as intended. Once areas of the Cinder Bank stop burning, develop a plan to vegetate the areas.			
Affect Current Protectiveness:	Affect Future Protectiveness:	Party Responsible:	Oversight Party:	Milestone Date:
No	Yes	PRP	EPA	On-Going

OU(s): OU4	Issue Category: Other			
	Issue: The RI/FS has not been completed and a remedy has not been selected for OU4.			
	Recommendation: Complete the RI/FS and issue a ROD for OU4.			
Affect Current Protectiveness:	Affect Future Protectiveness:	Party Responsible:	Oversight Party:	Milestone Date:
No	Yes	PRP	EPA	6/30/2020

VII. Protectiveness Statements

Table 6. - Protectiveness Statements for the 2017 Five Year Review

Protectiveness Statement(s)		
Operable Unit: OU1 – Blue Mountain	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy has been completed and is protective of human health in the short-term. The final protectiveness determination regarding ecological risks will be made following completion of the OU1 evaluation of long term survivability and translocation of contaminants.		
Operable Unit: OU2 – Cinder Bank	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy has been completed and is protective of human health and the environment in the short term. However, long term protectiveness concerning the burning area of the Cinder Bank will be achieved when internal fires have been extinguished.		
Operable Unit: OU3 – Community Soils	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedial work for OU3 was completed and is currently protective of human health and the environment.		
Operable Unit: OU4–Groundwater, Surface Water & Site-Wide Eco Risk	*Protectiveness Determination:* Protectiveness Deferred	*Addendum Due Date (if applicable):*
Protectiveness Statement: A remedy has yet to be selected for OU4 so a protectiveness determination cannot be made at this time. Further information will continue to be obtained during the RI/FS, currently underway. It is expected that the RI/FS will be completed in 2020.		

VIII. Next Review

The next FYR report for the Site is required five years from the completion date of this review.

APPENDIX A – FYR Data

Table A-1. – 2016 Planting Summary

2015 Resource Island Summary Report
Settling Defendants - Palmerton Zinc Pile Superfund Site
Palmerton, Carbon County, Pennsylvania

	Total Estimated Alive Per Acre (2012-2015 Plantings)					Total Per Acre	2016 Planting Plan (Total per Resource Island)					Total Plantings Per Acre (After 2016 Planting)					Total Per Acre
Species	R1	R2	R3	R4	R5		R1	R2	R3	R4	R5	R1	R2	R3	R4	R5	
Oaks																	
Chestnut	10	12	12	19	15	13	55	50	25		10	14	14	14	19	16	15
Black	13	14	23	13	15	16	15			25	10	14	14	23	15	17	16
Blackjack	1	4	6	5	3	4						1	4	6	5	3	4
Northern red	16	11	20	15	15	15		50			10	16	13	20	15	17	16
Post	17	9	5	11	11	11	plants ordered for spring 2017					17	9	5	11	11	11
Scrub	22	15	20	17	11	17						22	15	20	17	11	17
White	10	14	16	12	16	14	none available in 2016					10	14	16	12	16	14
Subtotal	89	78	101	92	86	89	70	100	25	25	30	94	82	103	93	92	93
American chestnut																	
BC2F3	15	29	0	0	0	9						15	29	0	0	0	9
BC3F3 (seed)	11	5	4	7	5	6						11	5	4	7	5	6
BC3F3 (seedlings)	19	9	7	4	7	9						19	9	7	4	7	9
Subtotal	45	43	11	11	12	24						45	43	11	11	12	24
Other Species												0	0	0	0	0	
Black gum	16	10	17	11	8	12						16	10	17	11	8	12
Chokecherry	14	12	10	11	14	12		50	25	50	10	14	14	12	14	16	14
Coralberry	10	19	22	14	14	16						10	19	22	14	14	16
Smooth sumac	10	14	15	14	16	14						10	14	15	14	16	14
Staghorn sumac	10	10	13	15	17	13						10	10	13	15	17	13
Sweet fern	2	1	2	1	3	2	20	20	20	20	20	4	2	4	3	6	4
Subtotal	61	67	80	67	72	348						63	70	84	72	77	366
Total Oaks	89	78	101	92	86	89	70	100	25	25	30	94	82	103	93	92	93
Total Oaks & Chestnuts	134	121	112	103	98	113	70	100	25	25	30	139	125	114	104	104	117
Total Other	61	67	80	67	72	348	0	0	0	0	0	63	70	84	72	77	366

Notes:

1. Resource island performance standard: At year 10, 5- to 10-year-old oaks or American chestnuts at 50 per acre.
2. Resource island performance standard: At year 10, 5- to 10-year-old target woody species at 35 per acre. Target woody species are defined as native tree and shrub species that are seeded or planted into GA-2 as part of remedial activities. Totals shown for other species are for planting holes only; plantings from aerial application, hand seeding, and additional plantings outside of planting holes not included in totals.
3. Confirmation on chokecherry availability still pending.

Table A-2. – Metals Soil Data

Analytical Results - Vegetation Metals

2016 Metals Sampling Report
Settling Defendants - Palmerton Zinc Pile Superfund Site
Palmerton, Carbon County, Pennsylvania

Staghorn Sumac	551m-VEG-ST				308m-VEG-ST				564m-VEG-ST				592m-VEG-ST				175m-VEG-ST			
Analyte	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ
Cadmium	7.2	Q8Q9	0.103	1.05	1.19	Q8Q9	0.0842	0.860	0.740	J Q8Q9	0.0918	0.937	6.02	Q8Q9	0.0820	0.836	2.38		0.0860	0.878
Copper	5.58		0.495	2.11	4.01		0.395	1.72	3.18		0.431	1.87	6.98		0.385	1.67	2.87	Q9	0.404	1.76
Lead	5.55		1.16	3.16	7.87		0.946	2.58	2.73	J	1.03	2.81	9.99		0.920	2.51	4.50	Q8	0.966	2.63
Zinc	755	Q4Q9	1.43	4.22	134	Q4Q9	1.17	3.44	97.4	Q4Q9	1.27	3.75	300	Q4Q9	1.14	3.35	328	Q4	1.19	3.51

Quaking Aspen	308m-VEG-QA				091m-VEG-QA				020m-VEG-QA				303m-VEG-QA				072m-VEG-QA			
Analyte	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ
Cadmium	53.6	Q4Q8	0.0849	0.866	40.8	Q4Q8	0.0913	0.932	73.1	Q4Q8	0.106	1.08	32.4	Q4Q8	0.0919	0.938	41.2	Q4Q8	0.0942	0.962
Copper	5.62	Q4Q8	0.398	1.73	11.6	Q4Q8	0.429	1.86	10.7	Q4Q8	0.495	2.15	3.76	Q4Q8	0.431	1.88	5.82	Q4Q8	0.442	1.92
Lead	5.01	Q4Q8	0.953	2.60	56.7	Q4Q8	1.03	2.80	89.6	Q4Q8	1.18	3.23	5.29	Q4Q8	1.03	2.81	8.50	Q4Q8	1.06	2.88
Zinc	1,870	Q4Q8	1.18	3.47	2,480	Q4Q8	1.27	3.73	3,830	Q4Q8	1.46	4.31	1,950	Q4Q8	1.28	3.75	2,680	Q4Q8	1.31	3.85

Switchgrass	399m-VEG-SG				468m-VEG-SG				551-m-VEG-SG				564m-VEG-SG				443m-VEG-SG			
Analyte	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ
Cadmium	1.39		0.0505	0.515	5.51		0.0861	0.878	2.29		0.0778	0.794	1.04		0.0690	0.704	2.10		0.0781	0.797
Copper	2.36	Q9	0.237	1.03	4.17	Q9	0.404	1.76	11.5	Q9	0.365	1.59	3.05	Q9	0.324	1.41	6.42	Q9	0.367	1.59
Lead	4.87	Q8	0.567	1.55	18.3	Q8	0.966	2.64	10.7	Q8	0.873	2.38	2.21	Q8	0.775	2.11	5.82	Q8	0.877	2.39
Zinc	161	Q4	0.701	2.06	596	Q4	1.19	3.51	647	Q4	1.08	3.18	289	Q4	0.958	2.82	416	Q4	1.08	3.19

Deer Tongue	513m-VEG-DT				564m-VEG-DT				175m-VEG-DT				551m-VEG-DT				512m-VEG-DT			
Analyte	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ
Cadmium	10.3		0.0642	0.655	4.89		0.0879	0.897	7.04		0.0773	0.788	6.60		0.0643	0.656	9.75		0.0737	0.752
Copper	5.06	Q9	0.302	1.31	3.86	Q9	0.412	1.79	4.74	Q9	0.363	1.58	3.90	Q9	0.302	1.31	5.46	Q9	0.346	1.50
Lead	16.0	Q8	0.721	1.97	5.02	Q8	0.986	2.69	22.8	Q8	0.867	2.37	10.8	Q8	0.722	1.97	27.9	Q8	0.828	2.26
Zinc	1,380	Q4	0.891	2.62	757	Q4	1.22	3.59	832	Q4	1.07	3.15	988	Q4	0.893	2.63	1,400	Q4	1.02	3.01

Late Thoroughwort	468m-VEG-LT				512m-VEG-LT				399m-VEG-LT				443m-VEG-LT				094m-VEG-LT			
Analyte	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ	Result (mg/kg)	Qualifier	MDL	LOQ
Cadmium	27.1		0.120	1.22	18.4		0.113	1.15	27.3		0.103	1.05	35.1		0.0971	0.991	31.8		0.105	1.07
Copper	15.7	Q9	0.562	2.44	12.5	Q9	0.530	2.30	11.3	Q9	0.482	2.10	9.99	Q9	0.456	1.98	16.1	Q9	0.494	2.15
Lead	15.0	Q8	1.34	3.66	17.2	Q8	1.27	3.46	7.75	Q8	1.15	3.14	8.25	Q8	1.09	2.97	21.8	Q8	1.18	3.22
Zinc	775	Q4	1.66	4.88	721	Q4	1.57	4.61	473	Q4	1.43	4.19	647	Q4	1.35	3.96	1,330	Q4	1.46	4.29

Notes:
mg/kg - milligrams per kilogram
MDL - minimum detection limit
LOQ - limit of quantitation
Qualifiers:
J - estimated value is greater than or equal to the MDL and less than the LOQ
Q4 - MS/MSD out of range
Q8 - DUP RPD (lab duplicate relative percent difference outside of specification)
Q9 - MS/MSD RPD (matrix spike/matrix spike duplicate relative percent difference outside of specification)

Table A-3. – East Plant groundwater sampling results

Summary of Groundwater Analytical Results
East Plant Area - June 2016
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	Units	MW01 MW1-160607 Groundwater Submersible Pump 6/7/2016	MW21 MW21-160608 Groundwater Submersible Pump 6/8/2016	MW22 MW22-160608 Groundwater Submersible Pump 6/8/2016	MW235 MW235-160608 Groundwater Submersible Pump 6/8/2016
General Water Chemistry							
Calcium	--	--	mg/L	25.8 (0.2)	2.69 (0.2)	293 (0.2)	112 (0.2)
Hardness (CaCO3)	--	--	mg/L	76.3 (0.2)	8.8 (0.2)	846 (0.2)	299 (0.2)
Magnesium	--	--	mg/L	2.89 (0.1)	.511 (0.1)	27.9 (0.1)	4.51 (0.1)
Dissolved solids (total)	--	--	mg/L	182 (30)	5050 (600)	1780 (120)	619 (60)
Suspended solids (total)	--	--	mg/L	6.6 (3)	42.4 (3)	119 (15)	133 (15)
Sulfate	250	250	mg/L	85 (10)	**2380 (500)**	**1070 (200)**	**362 (100)**
pH	--	--	--	6.43	10.47	5.05	7.34
Conductivity (S/m)	--	--	(S/m)	0.351	7.05	2.04	0.962
Dissolved Oxygen(mg/L)	--	--	mg/L	6.05	0.58	0.73	0.61
Temperature (°C)	--	--	(°C)	12.56	13.35	11.47	13.19
Oxidation Reduction Potential (mV)	--	--	(mV)	174	-223	178	-109
Metals (Dissolved)							
Cadmium	5	5	µg/L	ND (0.5)	4.7 (0.5)	**726 (0.5)**	**19.4 (0.5)**
Copper	1300	1000	µg/L	2.2 (2)	1.4 J (2)	24.4 (2)	0.62 J (2)
Iron	300	300	µg/L	ND (200)	ND (200)	**3010 (200)**	**924 (200)**
Lead	15	5	µg/L	1.9 (1)	ND (1)	0.92 J (1)	ND (1)
Manganese	50	50	µg/L	ND (2)	6.3 (2)	**8960 (20)**	**1280 (2)**
Zinc	5000	5000	µg/L	20.2 (15)	ND (15)	**162000 (1500)**	**6010 (75)**

Notes:

1 Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration

ND -- Not Detected

Summary of Groundwater Analytical Results
East Plant Area - June 2016
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	Units	MW23S MW23S-160608 Groundwater Submersible Pump 6/8/2016 Split Sample (PADEP)	MW23D MW23D-160608 Groundwater Submersible Pump 6/8/2016	MW24S MW24S-160607 Groundwater Submersible Pump 6/7/2016	MW24M MW24M-160607 Groundwater Submersible Pump 6/7/2016
General Water Chemistry							
Calcium	--	--	mg/L	NA	71.2 (0.2)	86.8 (0.2)	41.9 (0.2)
Hardness (CaCO3)	--	--	mg/L	NA	217 (0.2)	252 (0.2)	144 (0.2)
Magnesium	--	--	mg/L	NA	9.61 (0.1)	8.58 (0.1)	8.22 (0.1)
Dissolved solids (total)	--	--	mg/L	NA	368 (60)	910 (120)	204 (30)
Suspended solids (total)	--	--	mg/L	NA	45.8 (3)	54.7 (9)	1460 (120)
Sulfate	250	250	mg/L	NA	144 (50)	**299 (20)**	70.3 (20)
pH	--	--	--	7.34	7.29	6.65	6.93
Conductivity (S/m)	--	--	(S/m)	0.962	0.605	1.71	0.32
Dissolved Oxygen(mg/L)	--	--	mg/L	0.61	3.49	0.72	0.51
Temperature (°C)	--	--	(°C)	13.19	15.29	12.66	15.48
Oxidation Reduction Potential (mV)	--	--	(mV)	-109	100	-59	115
Metals (Dissolved)							
Cadmium	5	5	µg/L	**20**	**149 (0.5)**	2.9 (0.5)	ND (0.5)
Copper	1300	1000	µg/L	ND	3.5 (2)	3.1 (2)	2.7 (2)
Iron	300	300	µg/L	NA	ND (200)	**2870 (200)**	ND (200)
Lead	15	5	µg/L	ND	0.47 J (1)	0.35 J (1)	0.2 J (1)
Manganese	50	50	µg/L	NA	**1190 (2)**	**4900 (10)**	**114 (2)**
Zinc	5000	5000	µg/L	**6608**	**16400 (300)**	743 (15)	ND (15)

Notes:

1 Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration

ND -- Not Detected

Summary of Groundwater Analytical Results
East Plant Area - June 2016
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	Units	MW24D MW24D-160607 Groundwater Submersible Pump 6/7/2016	MW31 MW31-160608 Groundwater Submersible Pump 6/8/2016	MW33 MW33-160607 Groundwater Submersible Pump 6/7/2016	MW34 MW34-160607 Groundwater Submersible Pump 6/7/2016
General Water Chemistry							
Calcium	--	--	mg/L	111 (0.2)	141 (0.2)	79.8 (0.2)	75.9 (0.2)
Hardness (CaCO3)	--	--	mg/L	362 (0.2)	432 (0.2)	244 (0.2)	232 (0.2)
Magnesium	--	--	mg/L	19.5 (0.1)	19.2 (0.1)	10.8 (0.1)	10.3 (0.1)
Dissolved solids (total)	--	--	mg/L	998 (120)	4100 (240)	687 (60)	335 (60)
Suspended solids (total)	--	--	mg/L	1490 (60)	7.8 (3)	48.7 (3)	91.7 (9)
Sulfate	250	250	mg/L	**376 (100)**	**2420 (250)**	188 (20)	88.1 (10)
pH	--	--	--	5.9	6.17	7.01	6.47
Conductivity (S/m)	--	--	(S/m)	1.71	5.61	1.26	0.622
Dissolved Oxygen(mg/L)	--	--	mg/L	0.43	0.6	5.86	2.46
Temperature (°C)	--	--	(°C)	13.94	19.14	13.38	14.05
Oxidation Reduction Potential (mV)	--	--	(mV)	183	119	132	176
Metals (Dissolved)							
Cadmium	5	5	µg/L	**385 (0.5)**	**314 (0.5)**	4.9 (0.5)	**27.4 (0.5)**
Copper	1300	1000	µg/L	2.8 (2)	5 (2)	3.4 (2)	3.9 (2)
Iron	300	300	µg/L	ND (200)	ND (200)	ND (200)	ND (200)
Lead	15	5	µg/L	ND (1)	0.15 J (1)	0.32 J (1)	0.29 J (1)
Manganese	50	50	µg/L	**3720 (10)**	**22000 (40)**	1.6 J (2)	**83 (2)**
Zinc	5000	5000	µg/L	**51500 (750)**	**5260 (300)**	376 (15)	1070 (15)

Notes:

1 Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration

ND -- Not Detected

Summary of Groundwater Analytical Results
East Plant Area - June 2016
Palmerton Zinc Superfund Site
Palmerton, PA

Location				MW36	MW37	MW38	MW38
ENVIRON Sample ID	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	Units	MW36-160608	MW37-160607	DUP-160607	MW38-160607
Matrix				Groundwater	Groundwater	Groundwater	Groundwater
Sample Method				Submersible Pump	Submersible Pump	Submersible Pump	Submersible Pump
Sample Date				6/8/2016	6/7/2016	6/7/2016	6/7/2016
Comments						Field Duplicate	
General Water Chemistry							
Calcium	--	--	mg/L	93.6 (0.2)	87 (0.2)	42.5 (0.2)	41.1 (0.2)
Hardness (CaCO3)	--	--	mg/L	380 (0.2)	320 (0.2)	154 (0.2)	149 (0.2)
Magnesium	--	--	mg/L	35.6 (0.1)	25.7 (0.1)	11.7 (0.1)	11.3 (0.1)
Dissolved solids (total)	--	--	mg/L	750 (60)	455 (60)	316 (60)	339 (60)
Suspended solids (total)	--	--	mg/L	35.7 (3)	14.1 (3)	52.3 (9)	82.8 (12)
Sulfate	250	250	mg/L	**467 (100)**	**290 (20)**	195 (20)	196 (20)
pH	--	--	--	5.84	6.01	--	4.35
Conductivity (S/m)	--	--	(S/m)	1.05	0.782	--	0.623
Dissolved Oxygen(mg/L)	--	--	mg/L	2.46	5	--	3.69
Temperature (°C)	--	--	(°C)	15.54	13.777	--	14.05
Oxidation Reduction Potential (mV)	--	--	(mV)	169	231	--	321
Metals (Dissolved)							
Cadmium	5	5	µg/L	**21.5 (0.5)**	2.9 (0.5)	**6.5 (0.5)**	**6.5 (0.5)**
Copper	1300	1000	µg/L	16.1 (2)	2.3 (2)	13.4 (2)	16.1 (2)
Iron	300	300	µg/L	ND (200)	ND (200)	ND (200)	ND (200)
Lead	15	5	µg/L	0.37 J (1)	ND (1)	0.93 J (1)	1.1 (1)
Manganese	50	50	µg/L	**99.4 (2)**	**65.4 (2)**	**1670 (2)**	**1680 (2)**
Zinc	5000	5000	µg/L	**58900 (750)**	868 (15)	1990 (30)	1960 (30)

Notes:

1 Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration
ND -- Not Detected

Summary of Groundwater Analytical Results
East Plant Area - June 2016
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	Units	RCRA-1 RCRA1-160608 Groundwater Submersible Pump 6/8/2016	RCRA-1 DUP-160608 Groundwater Submersible Pump 6/8/2016 Field Duplicate	RCRA-3 RCRA3-160608 Groundwater Submersible Pump 6/8/2016	RCRA-6 RCRA6-160607 Groundwater Submersible Pump 6/7/2016
General Water Chemistry							
Calcium	--	--	mg/L	134 (0.2)	133 (0.2)	116 (0.2)	128 (0.2)
Hardness (CaCO3)	--	--	mg/L	509 (0.2)	505 (0.2)	292 (0.2)	541 (0.2)
Magnesium	--	--	mg/L	42.3 (0.1)	42 (0.1)	0.688 (0.1)	53.8 (0.1)
Dissolved solids (total)	--	--	mg/L	869 (60)	1120 (60)	546 (60)	1070 (60)
Suspended solids (total)	--	--	mg/L	79.9 (3)	9.5 (3)	18.3 (3)	16.2 (3)
Sulfate	250	250	mg/L	**679 (100)**	68.5 (10)	**259 (100)**	**746 (100)**
pH	--	--	--	5.34	--	10.13	4.89
Conductivity (S/m)	--	--	(S/m)	1.47	--	0.773	1.41
Dissolved Oxygen(mg/L)	--	--	mg/L	4.05	--	0.96	1.88
Temperature (°C)	--	--	(°C)	12.77	--	12.42	14.41
Oxidation Reduction Potential (mV)	--	--	(mV)	277	--	79	294
Metals (Dissolved)							
Cadmium	5	5	µg/L	**53.1 (0.5)**	**53.9 (0.5)**	0.25 J (0.5)	**23.8 (0.5)**
Copper	1300	1000	µg/L	17.3 (2)	17.5 (2)	1.3 J (2)	12.1 (2)
Iron	300	300	µg/L	ND (200)	ND (200)	ND (200)	ND (200)
Lead	15	5	µg/L	0.53 J (1)	0.65 J (1)	0.17 J (1)	0.36 J (1)
Manganese	50	50	µg/L	**3950 (10)**	**3830 (10)**	ND (2)	**2570 (20)**
Zinc	5000	5000	µg/L	**88500 (750)**	**86900 (1500)**	31.5 (15)	**28600 (750)**

Notes:

1 Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration
ND -- Not Detected

Table A-4. – East Cinder Bank March 2014 groundwater sampling results

Summary of Groundwater Analytical Results
RIM Quarterly Monitoring - March 2014
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	IM04W IM04W-140319 Groundwater Submersible 3/19/2014	IM11W IM11W-140318 Groundwater Submersible 3/18/2014	IM12D IM12D-140318 Groundwater Submersible 3/18/2014	IM12D IM12D-140318D Groundwater Submersible 3/18/2014 Field Duplicate	IM12S IM12S-140318 Groundwater Submersible 3/18/2014
General Water Chemistry							
Calcium	--	–	83500 (200)	213000 (200)	363000 (200)	357000 (200)	224000 (200)
Hardness (CaCO3)	--	–	397000 (200)	960000 (200)	1600000 (200)	1560000 (200)	886000 (200)
Magnesium	--	–	45800 (100)	104000 (100)	169000 (100)	164000 (100)	79100 (100)
Dissolved solids (total)	--	–	911000 (60000)	1760000 (120000)	2460000 (240000)	2300000 (240000)	1410000 (120000)
Suspended solids (total)	--	–	ND (3000)	255000 (15000)	218000 (12000)	2620000 (60000)	760000 (30000)
Sulfate	250000	250000	**584000 (250000)**	**1210000 (200000)**	**1550000 (200000)**	**1500000 (200000)**	**973000 (100000)**
Metals (Dissolved)							
Cadmium	5	5	**97.9 (0.5)**	**45.7 (0.5)**	ND (0.5)	ND (0.5)	**124 (0.5)**
Copper	1300	1000	9.8 (2)	1.2 J (2)	ND (2)	ND (2)	34.1 (2)
Iron	300	300	ND (200)	ND (200)	ND (200)	ND (200)	**2670 (200)**
Lead	15	5	0.17 J (1)	ND (1)	ND (1)	ND (1)	0.49 J (1)
Manganese	50	50	**3020 (5)**	**3620 (5)**	ND (5)	ND (5)	**5580 (5)**
Zinc	5000	5000	**91500 (400)**	**43300 (100)**	8.3 J (20)	9.2 J (20)	**17900 (100)**

Notes:

1 All concentrations are presented in ug/L (ppb). Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration

ND -- Not Detected

Summary of Groundwater Analytical Results
RIM Quarterly Monitoring - March 2014
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	IM16W IM16W-140319 Groundwater Submersible 3/19/2014	IM17D IM17D-140318 Groundwater Submersible 3/18/2014	IM17S IM17S-140318 Groundwater Submersible 3/18/2014	IM50S IM50S-140318 Groundwater Submersible 3/18/2014	IM51S IM51S-140318 Groundwater Submersible 3/18/2014
General Water Chemistry							
Calcium	--	--	444000 (200)	332000 (200)	256000 (200)	303000 (200)	131000 (200)
Hardness (CaCO3)	--	--	2120000 (200)	1060000 (200)	1060000 (200)	1530000 (200)	676000 (200)
Magnesium	--	--	245000 (100)	55300 (100)	102000 (100)	188000 (100)	84800 (100)
Dissolved solids (total)	--	--	3090000 (240000)	1860000 (240000)	1930000 (240000)	2520000 (240000)	1640000 (240000)
Suspended solids (total)	--	--	99200 (12000)	8800 (3000)	2100 J (3000)	636000 (39000)	307000 (21000)
Sulfate	250000	250000	**2570000 (500000)**	**1230000 (250000)**	**1250000 (200000)**	**1850000 (200000)**	**1190000 (200000)**
Metals (Dissolved)							
Cadmium	5	5	**43.8 (0.5)**	**15.4 (0.5)**	**44.7 (0.5)**	**13.3 (0.5)**	**87.7 (0.5)**
Copper	1300	1000	1.8 J (2)	1.1 J (2)	2.3 (2)	4.4 (2)	3.2 (2)
Iron	300	300	ND (200)	ND (200)	ND (200)	177 J (200)	ND (200)
Lead	15	5	0.14 J (1)	ND (1)	ND (1)	0.17 J (1)	ND (1)
Manganese	50	50	**17700 (25)**	**680 (5)**	**451 (5)**	**18700 (25)**	**19000 (25)**
Zinc	5000	5000	**44100 (100)**	**15800 (100)**	**45600 (200)**	**33800 (100)**	**115000 (400)**

Notes:

1 All concentrations are presented in ug/L (ppb). Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration
ND -- Not Detected

Summary of Groundwater Analytical Results
RIM Quarterly Monitoring - March 2014
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	IM52D IM52D-140318 Groundwater Submersible 3/18/2014	IM52S IM52S-140318 Groundwater Submersible 3/18/2014	IM53S IM53S-140318 Groundwater Submersible 3/18/2014	MW11 MW11-140319 Groundwater Submersible 3/19/2014	MWEEC1 MWEEC1-140319 Groundwater Submersible 3/19/2014
General Water Chemistry							
Calcium	--	--	165000 (200)	164000 (200)	68000 (200)	240000 (200)	599000 (1000)
Hardness (CaCO3)	--	--	786000 (200)	627000 (200)	285000 (200)	856000 (200)	1510000 (1000)
Magnesium	--	--	90900 (100)	52800 (100)	27900 (100)	62400 (100)	2700 (100)
Dissolved solids (total)	--	--	1490000 (120000)	1300000 (120000)	528000 (30000)	1300000 (120000)	2280000 (240000)
Suspended solids (total)	--	--	707000 (39000)	213000 (12000)	60100 (3000)	ND (3000)	25600 (3000)
Sulfate	250000	250000	**1060000 (100000)**	**899000 (100000)**	**334000 (50000)**	**819000 (250000)**	**1460000 (500000)**
Metals (Dissolved)							
Cadmium	5	5	**66.6 (0.5)**	**73.7 (0.5)**	**36.3 (0.5)**	**7.6 (0.5)**	ND (0.5)
Copper	1300	1000	1 J (2)	2.5 (2)	1.7 J (2)	0.49 J (2)	0.63 J (2)
Iron	300	300	ND (200)	ND (200)	ND (200)	ND (200)	ND (200)
Lead	15	5	ND (1)	ND (1)	ND (1)	ND (1)	0.62 J (1)
Manganese	50	50	**4140 (5)**	**5020 (5)**	**203 (5)**	**71.7 (5)**	ND (5)
Zinc	5000	5000	**88700 (200)**	**67700 (200)**	**33300 (100)**	**7610 (20)**	58.6 (20)

Notes:

1 All concentrations are presented in ug/L (ppb). Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration
ND -- Not Detected

Summary of Groundwater Analytical Results
RIM Quarterly Monitoring - March 2014
Palmerton Zinc Superfund Site
Palmerton, PA

Location ENVIRON Sample ID Matrix Sample Method Sample Date Comments	Federal Primary and Secondary Drinking Water Standards (MCL)	Pennsylvania MCL	MWEEC2 MWEEC2-140319 Groundwater Submersible 3/19/2014	PR01A PR01A-140319 Groundwater Submersible 3/19/2014	PR09A PR09A-140318 Groundwater Submersible 3/18/2014
General Water Chemistry					
Calcium	--	--	452000 (200)	307000 (200)	197000 (200)
Hardness (CaCO3)	--	--	1150000 (200)	1110000 (200)	883000 (200)
Magnesium	--	--	5260 (100)	83200 (100)	95100 (100)
Dissolved solids (total)	--	--	2240000 (60000)	3060000 (240000)	1610000 (120000)
Suspended solids (total)	--	--	45500 (3000)	63400 (3000)	30500 (3000)
Sulfate	250000	250000	**1210000 (250000)**	**1590000 (500000)**	**1120000 (200000)**
Metals (Dissolved)					
Cadmium	5	5	ND (0.5)	**21.8 (0.5)**	**74.7 (0.5)**
Copper	1300	1000	ND (2)	0.72 J (2)	2.2 (2)
Iron	300	300	ND (200)	79.1 J (200)	ND (200)
Lead	15	5	0.5 J (1)	ND (1)	ND (1)
Manganese	50	50	ND (5)	**8170 (5)**	**3880 (5)**
Zinc	5000	5000	6.5 J (20)	**29900 (200)**	**49200 (200)**

Notes:

1 All concentrations are presented in ug/L (ppb). Detection limits are in parentheses.

2 The Pennsylvania MCL for lead is applicable to "bottled, vended, retail and bulk water hauling systems."

3 The Federal action level for copper and lead is based on a treatment technology derived from the lead and copper rule that applies to first draw samples collected at the customer's taps.

4 Bold concentrations exceed the Federal Primary and/or Secondary Drinking Water Standards (MCL).

5 Underlined concentrations exceed the Pennsylvania Primary and/or Secondary Drinking Water Standards (MCL).

Abbreviations:

J -- Estimated Concentration

ND -- Not Detected

APPENDIX B – Site Photos

View from Stoney Ridge

Metal Tolerant Plants (sandwort) thriving on Phibro property

Trees in Resource Island #2

View of Resource Island #3

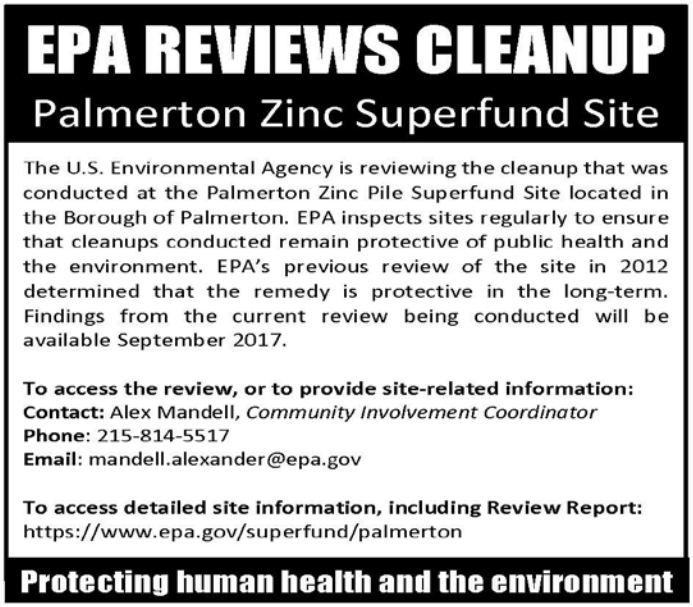
American Chestnut in Resource Island #4

Eastern Diversion Ditch

Wetland Looking Southwest

Wetland Looking Southeast

APPENDIX C – FYR Press Notice


EPA REVIEWS CLEANUP
Palmerton Zinc Superfund Site
The U.S. Environmental Agency is reviewing the cleanup that was conducted at the Palmerton Zinc Pile Superfund Site located in the Borough of Palmerton. EPA inspects sites regularly to ensure that cleanups conducted remain protective of public health and the environment. EPA's previous review of the site in 2012 determined that the remedy is protective in the long-term. Findings from the current review being conducted will be available September 2017.
To access the review, or to provide site-related information:
Contact: Alex Mandell, Community Involvement Coordinator
Phone: 215-814-5517
Email: mandell.alexander@epa.gov
To access detailed site information, including Review Report:
https://www.epa.gov/superfund/palmerton
Protecting human health and the environment