

Sampling and Analysis Plan Eureka Smelter Sites

**Assessment
Additional Sampling in May 2013**

Eureka, Eureka County, Nevada

**TDD No.: TO-02-09-12-04-0002
Project No.: EE-002693-2177**

May 2013

Prepared for:

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Superfund Technical Assessment and Response Team

Sampling and Analysis Plan
Eureka Smelter Sites

Assessment
Additional Sampling in May 2013

Eureka, Eureka County, Nevada

TDD No.: TO2-09-12-04-0002
Project No.: EE-002693-2117

May 2013

Approved by: _____
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Ecology and Environment, Inc.

Approved by: _____
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List of Abbreviations and Acronyms (cont.)

List of Abbreviations and Acronyms

bgs	below ground surface
COPC	contaminant of potential concern
CSP	consolidated slag pile
DQI	Data Quality Indicator
DQO	Data Quality Objective
E&E	Ecology and Environment, Inc.
ERS	Emergency Response Section
FOSC	Federal On-Scene Coordinator
GPS	Global Positioning System
HSP	health and safety plan
IDW	investigation-derived waste
LCS	laboratory control sample
MCL	maximum contaminant level
MS/MSD	matrix spike/matrix spike duplicate
mg/kg	milligrams per kilogram
NDEP	Nevada Department of Environmental Protection
PM	Project Manager
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RPD	relative percent difference
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan

List of Abbreviations and Acronyms (cont.)

SOP	standard operating procedure
START	Superfund Technical Assessment and Response Team
TM	Task Monitor
U.S. EPA	United States Environmental Protection Agency
XRF	X-ray fluorescence

1 Introduction

The United States Environmental Protection Agency (U.S. EPA) Region 9 Federal On-Scene Coordinator (FOSC) Tom Dunkelman tasked Ecology and Environment, Inc.'s (E & E's) Superfund Technical Assessment and Response Team (START) to support an assessment of the Eureka Smelter Sites located in Eureka, Eureka County, Nevada. These assessment activities are being conducted under E & E's U.S. EPA Region 9 START Contract number EP-S5-08-01, under Technical Direction Document (TDD) number TO2-09-12-04-0002.

The U.S. EPA's concern about arsenic and lead contamination on public and residential properties within Eureka is associated with the presence of two large exposed consolidated slag piles (CSPs), which are located at the north and south ends of the town, and former ore milling and smelting operations that were conducted within residential areas in the Town of Eureka. These assessment activities are a follow-up to a October 2012 assessment by U.S. EPA and Nevada Department of Environmental Protection (NDEP) personnel that included the collected a total of 1,094 unique soil samples from 108 property parcels, roadways, and the creek bed within the Town of Eureka, and BLM land around the town's perimeter. A total of 68 unique soil samples were also collected from five background locations. This assessment found concentrations of lead that exceed the U.S. EPA's Regional Screening Levels of 400 milligrams per kilogram (mg/kg) for a residential scenario (r-RSL, formerly Preliminary Remediation Goals) in 60 percent of the samples from the area. The assessment found that 65 percent of the samples also exceeded the site-specific screening level (SSL) of 60 mg/kg. Since the first assessment only included approximately 20 percent of the town properties for which access was granted. The U.S. EPA Emergency Response Section (ERS) in coordination with the NDEP has determined that additional data collection on additional properties is needed. This additional assessment will provide additional data on properties not previously sampled in order to identify as many areas as possible where human health or environmental impacts are present and better document whether there is "imminent and substantial endangerment,".

For the assessment, the NDEP has access agreements with an additional 20 properties.

This document serves as the Sampling and Analysis Plan (SAP) required for the removal assessment actions at properties located in and around Eureka, and it will guide the project data collection activities. This SAP describes the project data quality objectives (DQOs), data collection rationale, quality assurance goals, and requirements for sampling and analysis. It also defines the sampling and data collection methods that will be used for this project. The scope of work outlined in this SAP is based on discussions with the U.S. EPA, NDEP, and the START.

The specific field sampling and chemical analysis information in this SAP was prepared in accordance with the following U.S. EPA documents: *Requirements for Quality Assurance Project Plans*, (EPA QA/R5, EPA/240/B 01/003), March 2001 (EPA, 2001); *Guidance for the Data Quality Objectives Process*, (EPA QA/G4, EPA/240/R 02/009), February 2006 (EPA, 2006); *Guidance on Choosing a Sampling Design for Environmental Data Collection*, (EPA

QA/G5S, EPA/240/R 02/005) December 2002 (EPA, 2002); and, *Uniform Federal Policy for Implementing Environmental Quality System*, (EPA/505/F-03/001), March 2005 (EPA, 2005).

1.1 Project Organization

The following is a list of project personnel and their responsibilities:

U.S. EPA Task Monitor: The U.S. EPA Task Monitor is FOOSC Tom Dunkelman. Mr. Dunkelman is the primary decision-maker and will direct the project, specify tasks, and ensure that the project is proceeding on schedule and is within budget. Additional duties include gaining access to the site, and coordination of communication with the START project manager, the U.S. EPA quality assurance (QA) office, the State of Nevada, and Eureka, Nevada, community representatives.

NDEP: Mr. Greg Lovato and Mr. Jeff Collins are assisting the U.S. EPA FOOSC in obtaining access, providing public relations and other with activities to support the assessment.

START Project Manager: The START Project Manager (PM) is Mr. Howard Edwards. The START Project Manager is responsible for developing and implementing the SAP, coordination of project tasks and field sampling, project management, and completion of all preliminary and final reporting.

Principal Data Users: Data generated during the implementation of this SAP will be utilized by the U.S. EPA Task Monitor and NDEP to make decisions regarding removal activities at the site, if necessary.

Analytical Laboratory Support: The U.S. EPA Region 9 Laboratory in Richmond, California, will be utilized for analysis of contaminants of potential concern (COPCs). START will be responsible for data validation activities.

1.2 Distribution List

Copies of the final SAP will be distributed to the following persons and organizations:

- Tom Dunkelman, U.S. EPA Region 9
- Jeff Collins, NDEP
- E & E START field team
- E & E START project files

1.3 Statement of the Specific Problem

There is concern as to whether residents of Eureka may be currently exposed to, or have the potential for exposure to, lead and arsenic contamination in soils from milling and smelting waste generated by former milling and smelting operations in Eureka. Analytical data generated by the U.S. Department of Interior, U.S. Geological Survey (U.S. DOI 1978), U.S. EPA and NDEP sampling from locations throughout Eureka and the vicinity have provided documentation that arsenic and lead concentrations in soil exceed U.S. EPA's respective r-RSLs and SSLs that

area based upon U.S. EPA and NDEP initial cleanup goals. The documented concentrations of arsenic and lead are also considerably greater than the documented background concentrations for arsenic and lead. Contamination has been documented to exist throughout the town on the majority of the sampled properties. Based on this information, the contamination is believed to be present at additional public, residential and commercial properties in and around the Town of Eureka. Arsenic and lead are the primary COPCs for this assessment. Other metals may also be present but are not currently considered by the U.S. EPA to be COPCs.

The exposure pathways of concern for arsenic and lead include direct exposure of human and sensitive populations (i.e., children) and/or environmental receptors to contamination in soil material that is composed of mine waste, and exposure of human and sensitive population receptors through ingestion of soil material that is composed of mine waste. Several blood sampling or area resident was done in 2012, however the analytical results are confidential.

2 Site Background

2.1 Site Location

The Town of Eureka is an unincorporated community located in Eureka County, Nevada (Figure 1). The Town of Eureka occupies approximately 480 acres of land in the southern part of Eureka County, within Diamond Valley, at an elevation of approximately 6,900 feet above sea level. The geographical coordinates for the approximate center of Eureka are 39° 30' 45" Latitude North and 115° 57' 39" Longitude West. State Highway 50 runs through the center of the town.

The major focus of this assessment is all commercial, residential and public properties located in the town of Eureka, Nevada. A secondary focus is on areas outside of town, including downwind surface soil and downstream creek sediment. The U.S. EPA FOOSC and NDEP are preparing a list of properties for which consent for access for sampling purposes will be sought. Information on the property parcels where access was granted and properties that were sampled will be compiled in a separate document.

The location and aerial vicinity of the 20 property parcel in the Town of Eureka are shown in Figures 2-A, 2-B and 2-C.

2.2 Site Description

Eureka is situated in a historical mining district with at least seven known former ore milling and smelter operations located throughout the town. Most of the town's residential, commercial and public properties are situated in a valley and low-lying hills on either side of U.S. Highway 50. Eureka is bisected by U.S. Highway 50 and a narrow intermittent creek, which are oriented north-south through the town. Eureka's creek flows down gradient to the north. The residential and school district properties in Eureka are primarily situated in the hills along the east west sides of U.S. Highway 50. The historic wind direction through the town, as documented by the Western Regional Climate Center based on Eureka Airport data, is predominately from the south to the north (Figure 3). The area directly to the north is hilly terrain that opens into a broad alluvial plain. The creek flows from the south through the town and on into the alluvial plain. There is a large open-pit mining operation located approximately 1 mile north-northwest of the town.

There are two significantly sized CSPs located on both the north and south ends of town, and several smaller CSPs have been identified at other locations around Eureka (refer to Figure 2-A, 2-B and 2-C for locations). Based on a review of Eureka County Tax Assessor parcel information and historical land maps, there are more than 400 residential, public, and commercial parcels in Eureka that are either on, adjacent to, or in close to the sites of the former ore smelters and milling operations.

2.3 Site History

According to information obtained from the United States Bureau of Land Management (BLM) document *A Historic View of the BLM Shoshone-Eureka Resource Area, Nevada, Technical Report 7* (BLM, 1991), between 1866 and 1910, mining for geological deposits of silver and lead

took place in the Ruby Hill area, which is located approximately 2 miles west of Eureka. During this period, over one-million tons of ore was extracted from Ruby Hill primarily by the Eureka Consolidated Mining Company and Richmond Consolidated Mining Company. The ore mined from Ruby Hill was then transported via railcar to various milling and smelter operations historically located throughout Eureka. The following historic ore milling and smelter operations were identified in Eureka and are shown on Figures 2-A, 2-B and 2-C:

- Lemon Mill
- McCoys Mill
- Eureka Consolidated Smelter
- Matamoras Smelter
- Hoosac Smelter
- Atlas Smelter
- Richmond Company Smelter
- Jackson Smelter
- Silver West Smelter
- Lemon Mill
- McCoys Mill
- Taylor Mill

As a result of ore processing at these former mills and smelter sites, waste product known as slag was produced and consolidated into a number of separate piles located throughout the Eureka. The two large CSPs (Eureka Company and Richmond Company) located along the U.S. Highway 50 on the north and south ends of Eureka and several smaller slag piles (Atlas and Matamoras) are shown on Figures 2-A, 2-B, and 2-C.

Due to the extensive amount of historic ore processing operations in Eureka, it has been reported that air pollution lead to health problems among residents and former smelter workers, during the time frame when the smelters were in operation. The documents had also indicated the air pollution killed vegetation in and around Eureka (Paher 1970, BLM 1991). In the book *Nevada Ghost Towns and Mining Camps* by Stanley Paher, 1970, Nevada Publications, page 181 there is the following statement. "On the outskirts of town, 16 smelters with a daily capacity of 745 tons treated ore from over fifty producing mines. Furnaces poured forth dense clouds of black smoke which constantly rolled over the town and deposited soot, scales and black dust everywhere, giving the town a somewhat somber aspect and killing vegetation. The "Pittsburgh of the West," Eureka was indeed the foremost smelting district in the entire West."

There were several flood events, including a major flood event in 1874 that reportedly washed out much of the town and smelter facilities (NJS 1874). The intermittent creek in Eureka, which reportedly flooded in 1874, flows from south to north and eventually discharges to a flat, alluvial plain located approximately 5 miles north of Eureka.

2.4 Previous Investigations

In 1978, the United States Department of Interior Geological Survey collected 593 samples that identified a 3-kilometer (km) by 6-km area of contamination within the Eureka mining district (Figure 4-A and 4-B). The data were published in a 1978 report titled *Geochemical Analyses of Rock and Soil Samples, Eureka Mining District and Vicinity, Eureka and White Pine Counties*

and discussed in a 2004 U.S. Geological Survey publication, *Hydrogeochemical Studies of Historical Mining Areas in the Humboldt River Basin and Adjacent Areas, Northern Nevada*.

In the spring of 2012, U.S. EPA and NDEP personnel collected 38 surface soil samples from publically accessible locations around Eureka for lead and arsenic analysis. Analysis of these 38 samples was performed in the field by the NDEP with a field portable X-ray fluorescence (XRF), by START with an XRF following U.S. EPA method 6200 and by the U.S. EPA regional laboratory by U.S. EPA Method 6010C by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP/AES). The sample analyses results were similar for each method. The analytical laboratory results from these 38 surface soil samples indicated that 10 samples had lead concentrations below 400 mg/kg, 20 samples had lead concentrations between 400 mg/kg and 5,000 mg/kg, and 8 samples had lead concentrations above 5,000 mg/kg. The lead concentration in samples ranged from 44 mg/kg to 45,000 mg/kg (Figure 5). The highest lead soil concentrations were detected at the CSPs located on both the north and south ends of Eureka, and at former smelter site locations. The sample results for arsenic showed a distribution similar to lead. The analytical laboratory results for arsenic indicated that 5 samples had arsenic concentrations below 60 mg/kg, 23 samples had arsenic concentrations between 60 mg/kg and 600 mg/kg, and 10 samples had arsenic concentrations above 600 mg/kg. The arsenic concentrations in samples ranged from 10 mg/kg to 6,700 mg/kg (Figure 5).

From October 15 through October 26, 2012, the U.S. EPA and START conducted removal assessment sampling throughout Eureka, Nevada. The February 2013 report titled *Eureka Smelter Site Removal Assessment Report Eureka, Eureka County, Nevada, E & E* document the collection of 1,162 unique samples and analysis by U.S. EPA method 6200. A total of 283 soil samples were submitted to the U.S. EPA Region 9 Laboratory in Richmond, California, for conformational analysis by U.S. EPA Method 6010B. Forty soil samples were additionally extracted using a bio-accessibility extraction procedure followed by analyses following U.S. EPA Method 6010C. Six specially prepared composite soil samples were submitted to the U.S. EPA National Exposure Research Laboratory (NERL) in Research Triangle Park, North Carolina for a bioavailability and mineralogy study. The results of the NERL studies were not available at the time this SAP was written.

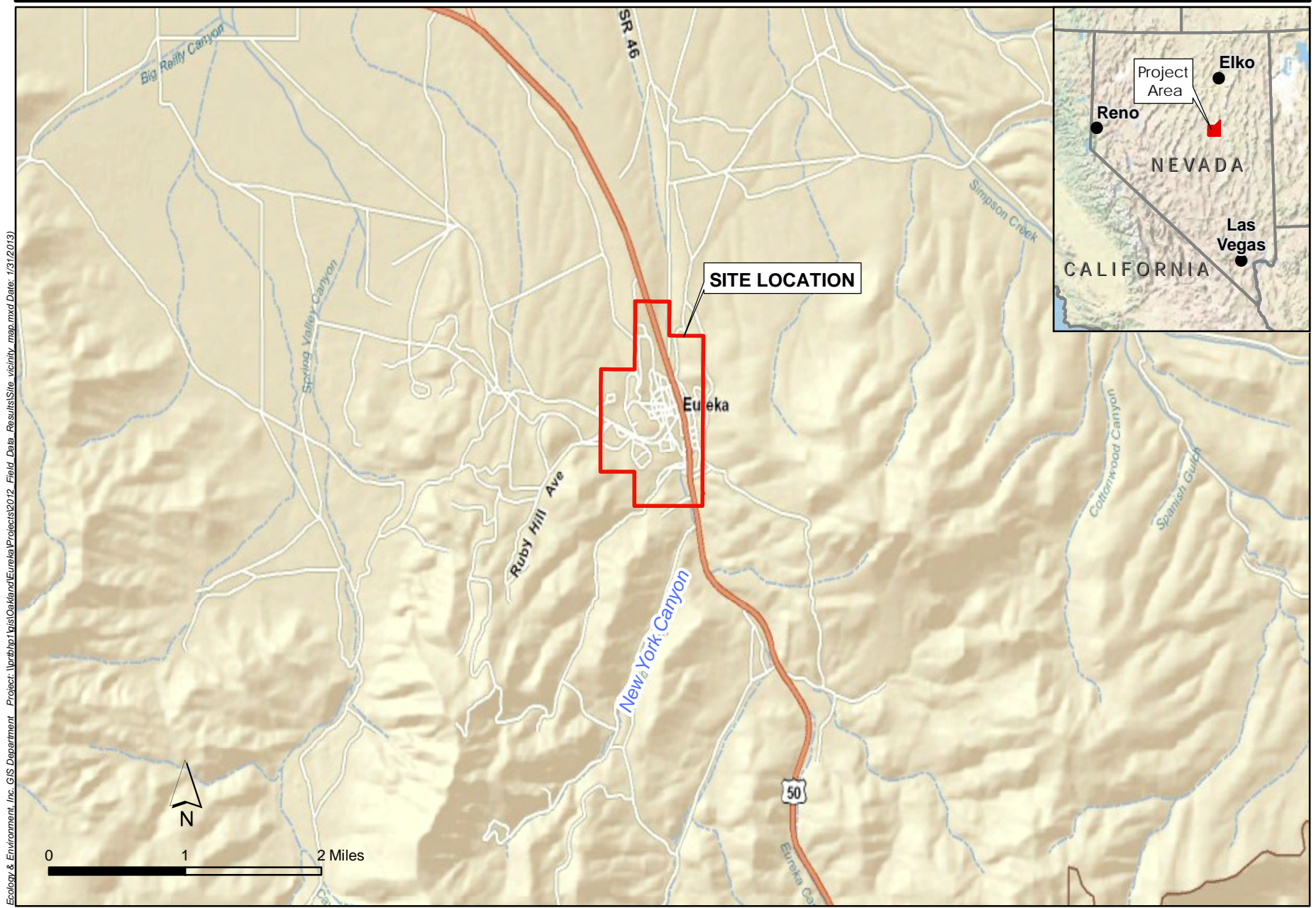
The major conclusions reached from the results of this removal assessment are provided below.

- The data collected during this removal assessment indicated that arsenic and lead concentrations exceed their respective U.S. EPA site-specific screening levels protective of human health in surface soils (0 to 6 inches) throughout much of the Town of Eureka.
- In general, the majority of sampled residential properties in established town areas had concentration of arsenic and lead that were significantly greater than the SSLs. The mean lead concentration was 1,880 mg/kg, and the mean arsenic concentration was 327 mg/kg.
- Elevated concentration of both arsenic and lead in creek sediments were found nearby and down gradient of the two CSPs located at each end of the town. Arsenic and lead concentrations down gradient of the both CSPs' were 300 to 400 percent higher for both arsenic and lead, than concentrations found up gradient.

2. Site Background

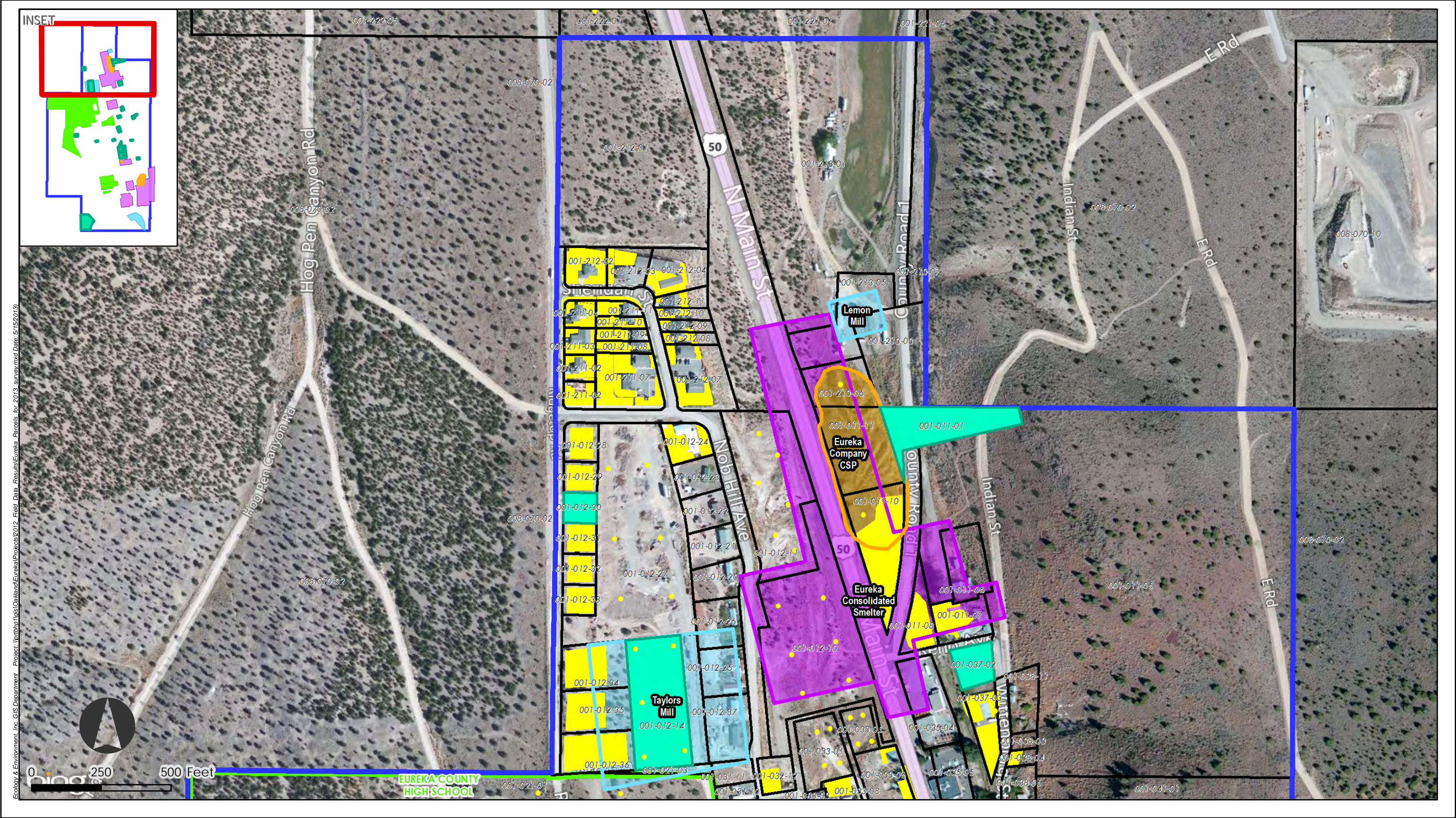
- In the undeveloped area surrounding the Town of Eureka the lead and arsenic concentrations of shallow soil are two to three time greater than the concentration of the underlying soil. The distribution of elevated lead and arsenic concentrations are greater to the north and northeast of historic lead ore processing operations and at locations closest to the historic lead ore processing locations.
- Based on results collected during this removal assessment, a total of 92 of the 109 residential and public properties contained soils with arsenic and/or lead concentrations that exceeded their respective U.S. EPA initial cleanup goals.
- Based on results collected during this removal assessment, a total of 18 occupied residential properties and portions of two Eureka County school district owned properties contained soils with arsenic and/or lead concentrations at ten times the U.S. EPA site-specific screening levels.
- Since one of the principle mechanisms for the deposition of contamination is air dispersion, it is reasonable to assume that similar contamination would be found throughout the town. An estimation of the deposition of contamination based on interpolation of existing data is illustrated in two iso-concentration maps for the Town of Eureka presented in Figure 6-A and 6-B.


The assessment also indicated that about 80 percent of the properties in the town were not sampled and indicated that additional assessment of remaining properties appeared to be necessary in order to fully document the extent and magnitude of the arsenic and lead contamination.



Ecology & Environment, Inc. GIS Department Project: \p\rbp1\gis\Oakland\Eureka\Projects\2012 Field Data Results\Site_vicinity_map.mxd Date: 1/31/2013

Figure 1
Site Location Map
Eureka Smelter Sites
Eureka, Eureka County, Nevada

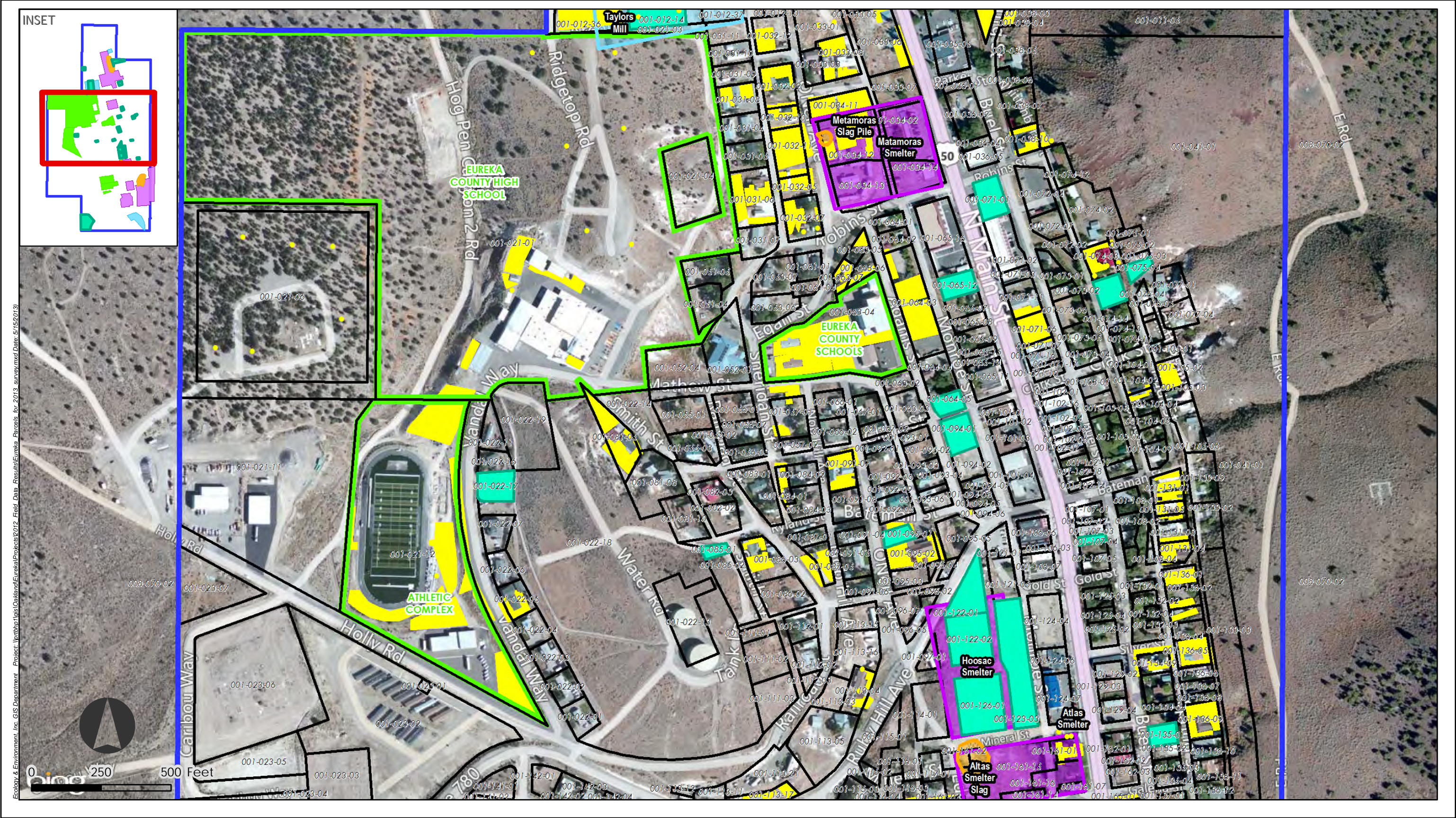


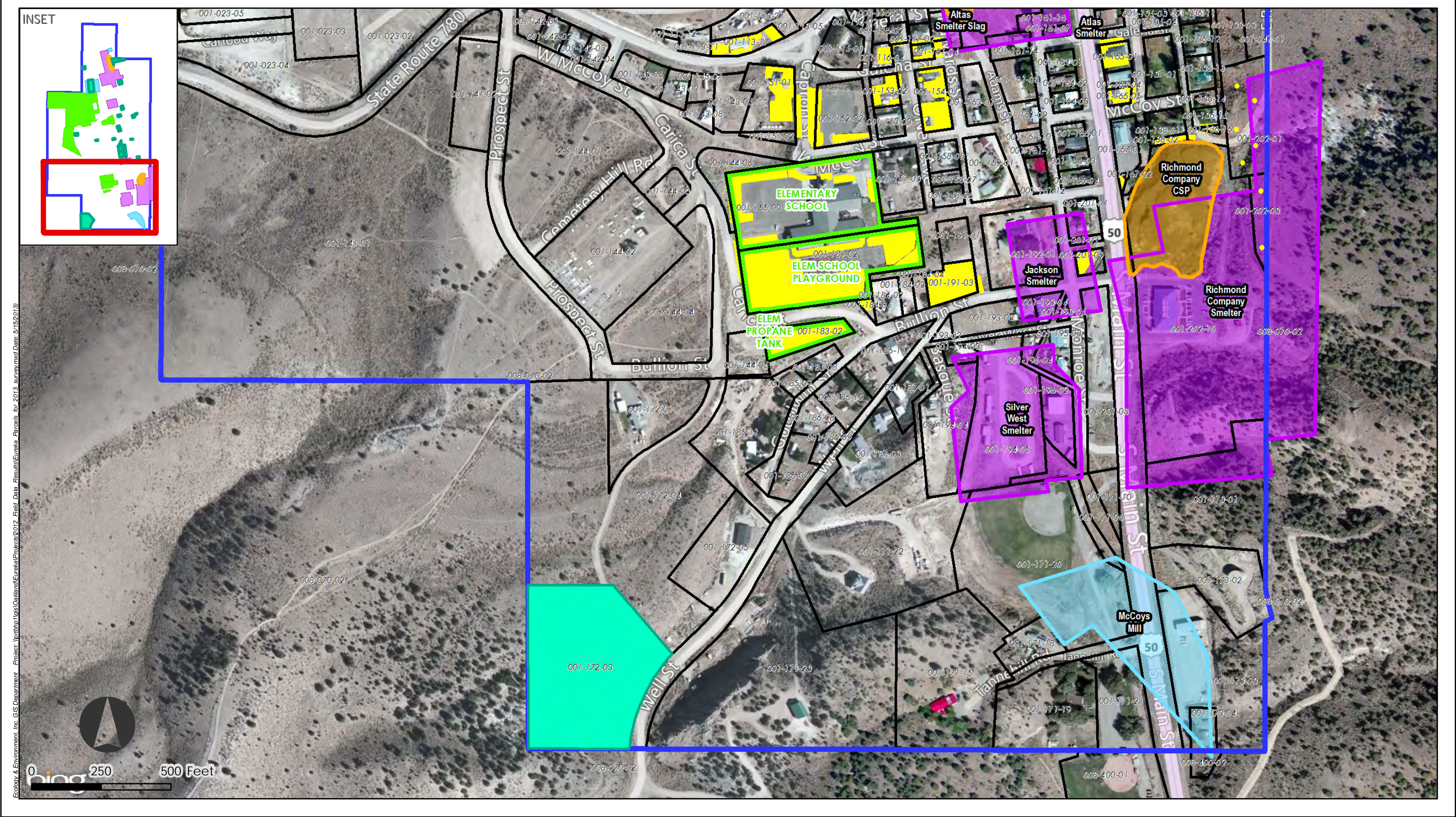



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Figure 2-A
Property Parcels in Eureka, Nevada - North
Eureka Smelters Sites
Eureka, Eureka County, Nevada

Proposed Parcels to be Sampled	Project Boundary
Sampled Area	Historical Facilities
Eureka County School District Property	Mill Facility
Parcel Boundary and Assessors Parcel Number	Consolidated Slag Pile (CSP)
	Smelter Site











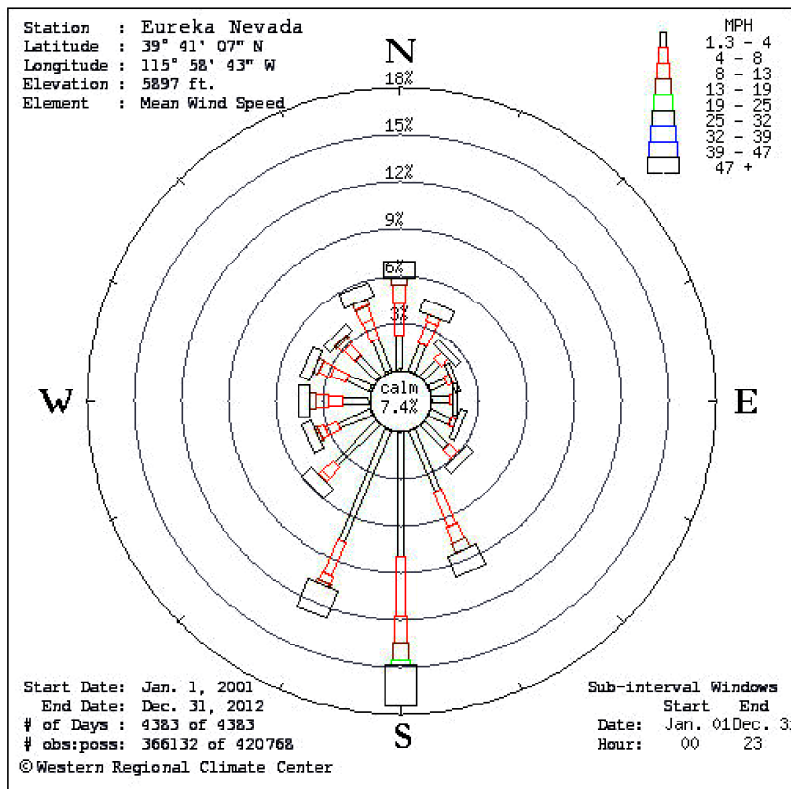




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Figure 2-C
Property Parcels in Eureka, Nevada - South
Eureka Smelters Sites
Eureka, Eureka County, Nevada

 Proposed Parcels to be Sampled	 Project Boundary
 Sampled Area	 Mill Facility
 Eureka County School District Property	 Consolidated Slag Pile (CSP)
 Parcel Boundary and Assessors Parcel Number	 Smelter Site



Eureka Nevada - Wind Frequency Table (percentage)

Latitude : 39° 41' 07" N
Longitude : 115° 58' 43" W
Elevation : 5897 ft.
Element :

Start Date : Jan. 1, 2001
End Date : Dec. 31, 2012
of Days : 4383 of 4383
obs : poss : 366132 of 420768

Sub Interval Windows
Start End
Date Jan. 01 Dec. 31
Hour 00 23

(Greater than or equal to initial interval value and Less than ending interval value.)

Range (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.3 - 4	2.2	1.8	1.4	1.1	1.1	1.4	2.1	4.2	7.9	7.7	3.7	2.2	1.6	1.6	1.8	2.1	44.1
4 - 8	1.9	1.5	0.6	0.3	0.2	0.4	0.8	2.4	3.8	2.3	0.9	0.8	1.0	1.0	0.9	1.3	20.2
8 - 13	1.3	0.4	0.1	0.0	0.0	0.0	0.1	1.1	1.7	0.5	0.3	0.4	0.8	0.8	0.4	0.9	9.0
13 - 19	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.2	0.2	0.1	0.2	0.4	0.3	0.2	0.4	4.2
19 - 25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.8
25 - 32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
32 - 39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39 - 47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47 -	1.1	0.8	0.4	0.3	0.3	0.4	0.6	1.4	2.6	1.9	0.9	0.7	0.7	0.7	0.6	0.9	14.2
Total(%)	6.9	4.6	2.6	1.8	1.7	2.2	3.7	9.9	17.5	12.7	6.0	4.4	4.6	4.5	3.9	5.7	92.6

Figure 3
Predominant Wind Direction for Eureka, Nevada
Eureka Smelters Sites
Eureka, Eureka County, Nevada

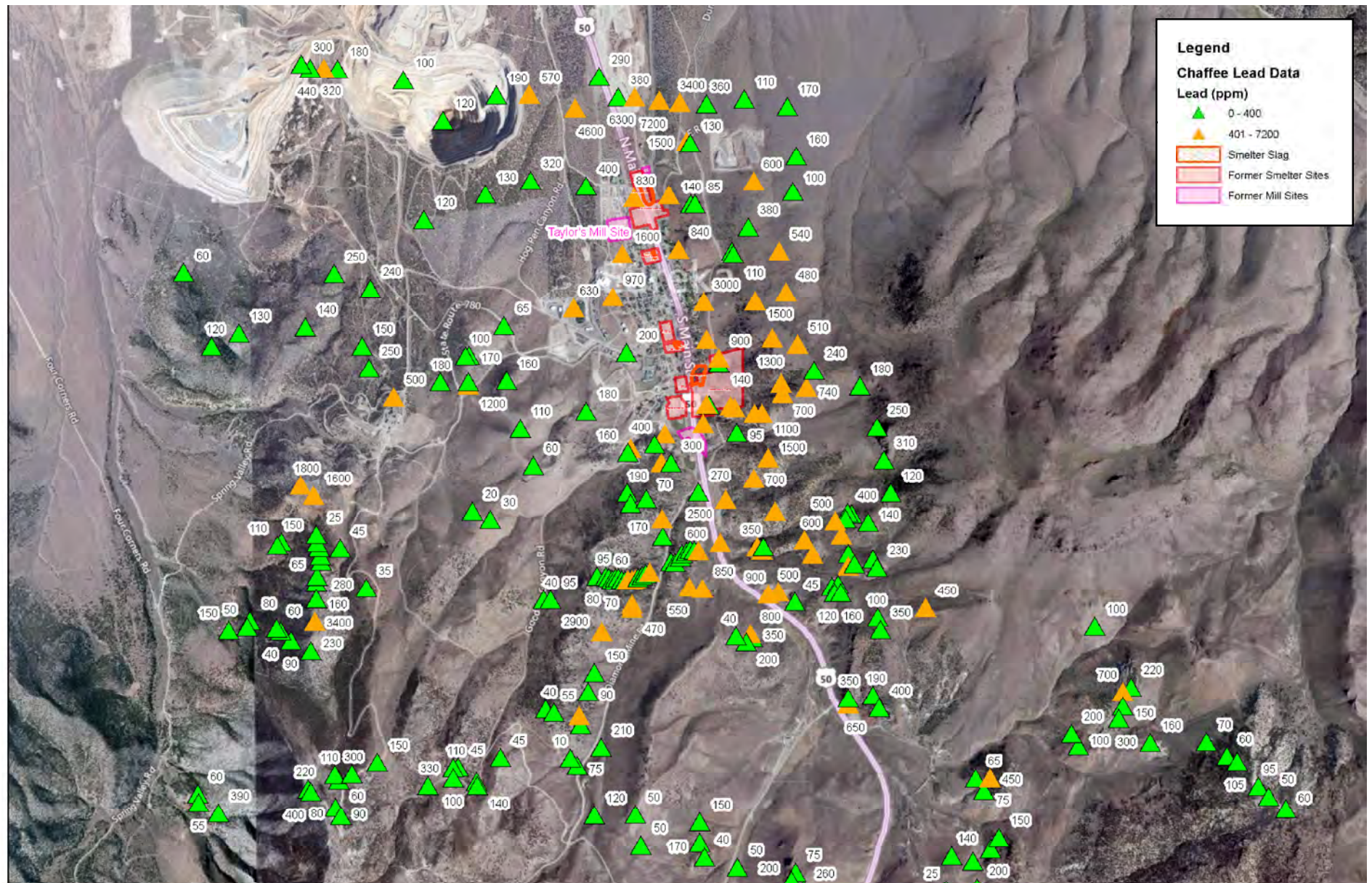


Figure 4A-1
Eureka District with Historic
Sampling Data for Lead-North
Eureka Smelters Sites
Eureka, Eureka County, Nevada

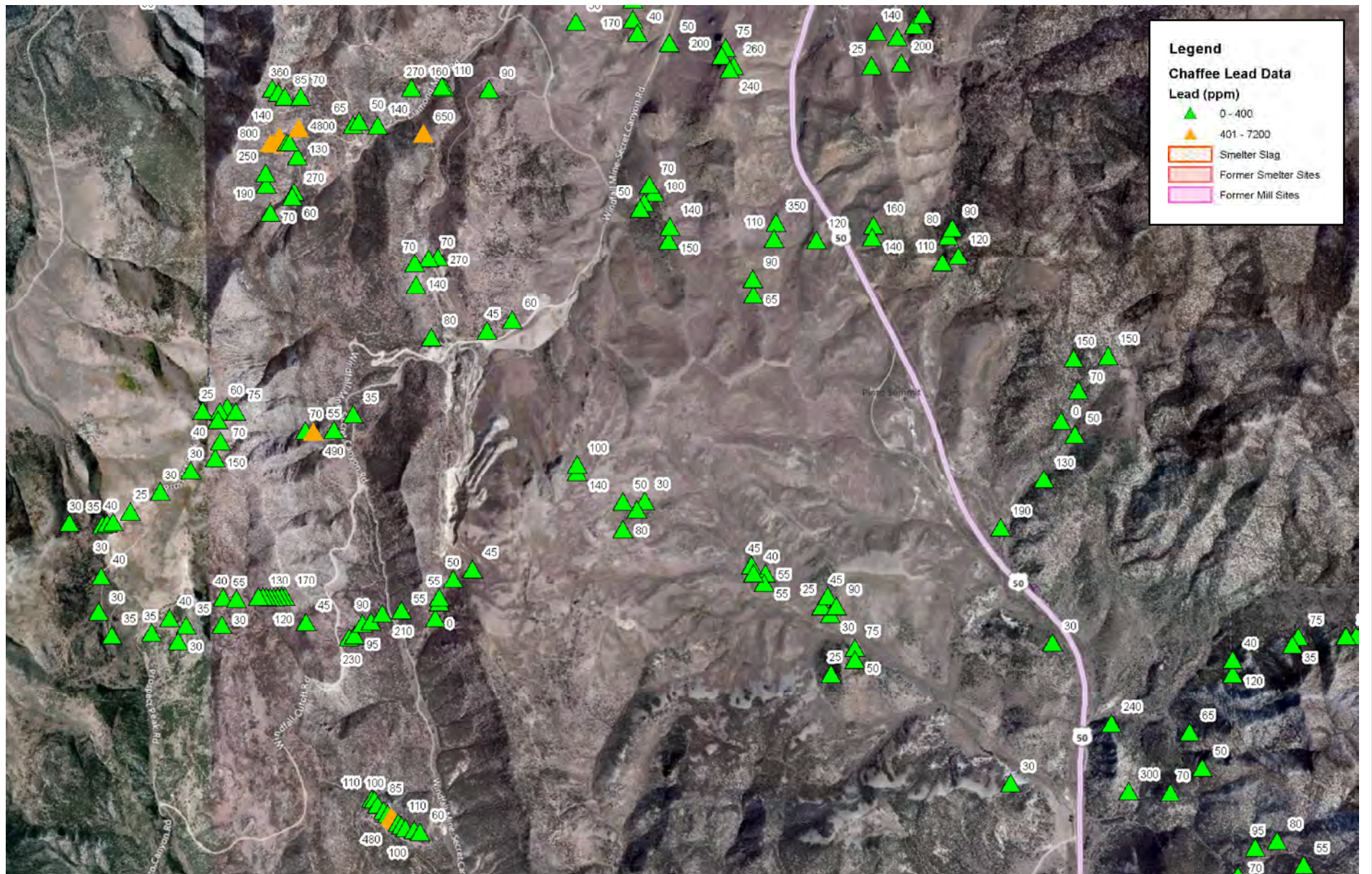


Figure 4A-2
Eureka District with Historic
Sampling Data for Lead-Central
Eureka Smelters Sites
Eureka, Eureka County, Nevada

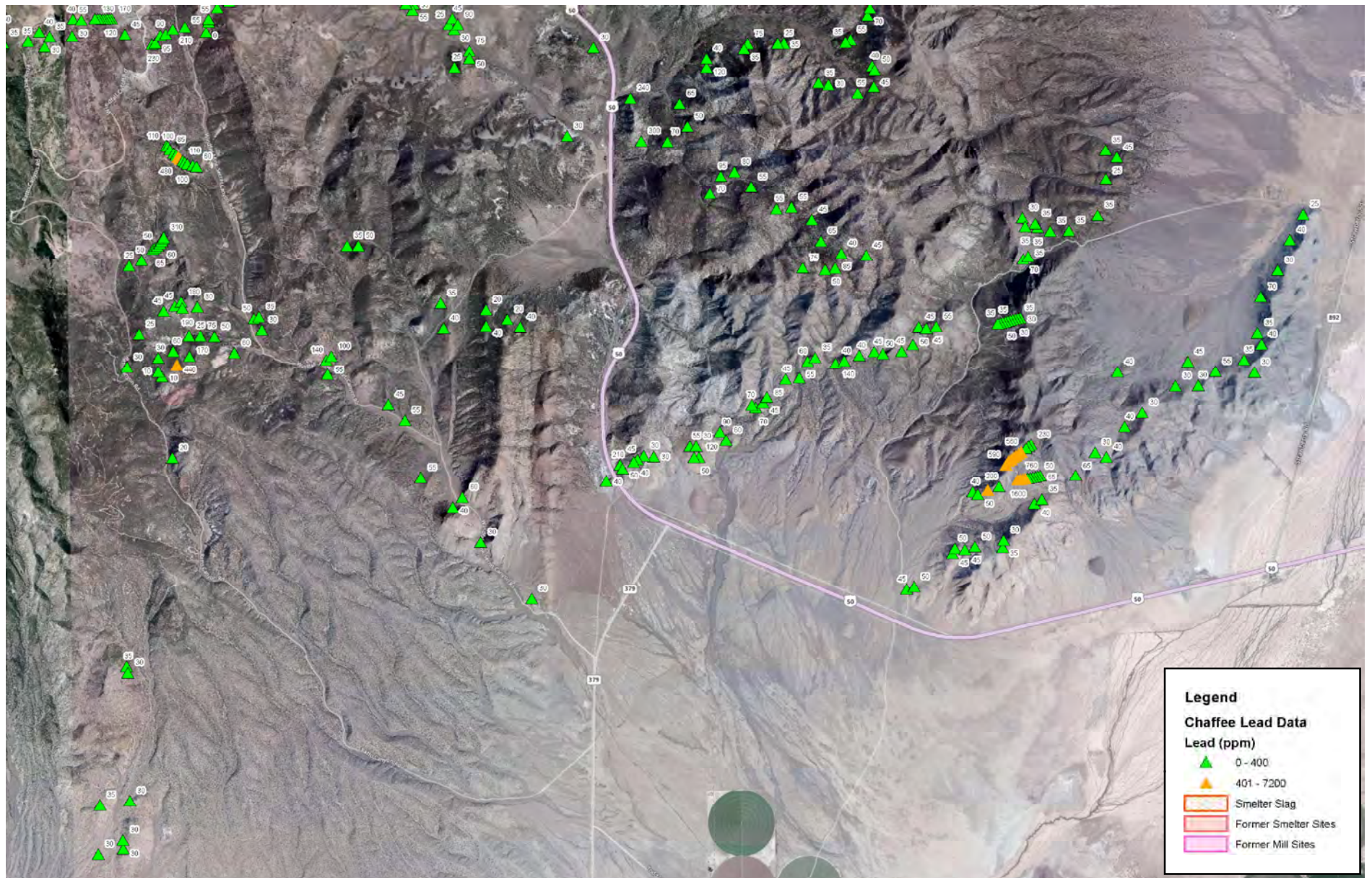


Figure 4A-3
Eureka District with Historic Sampling
Data for Lead-South
Eureka Smelters Sites
Eureka, Eureka County, Nevada

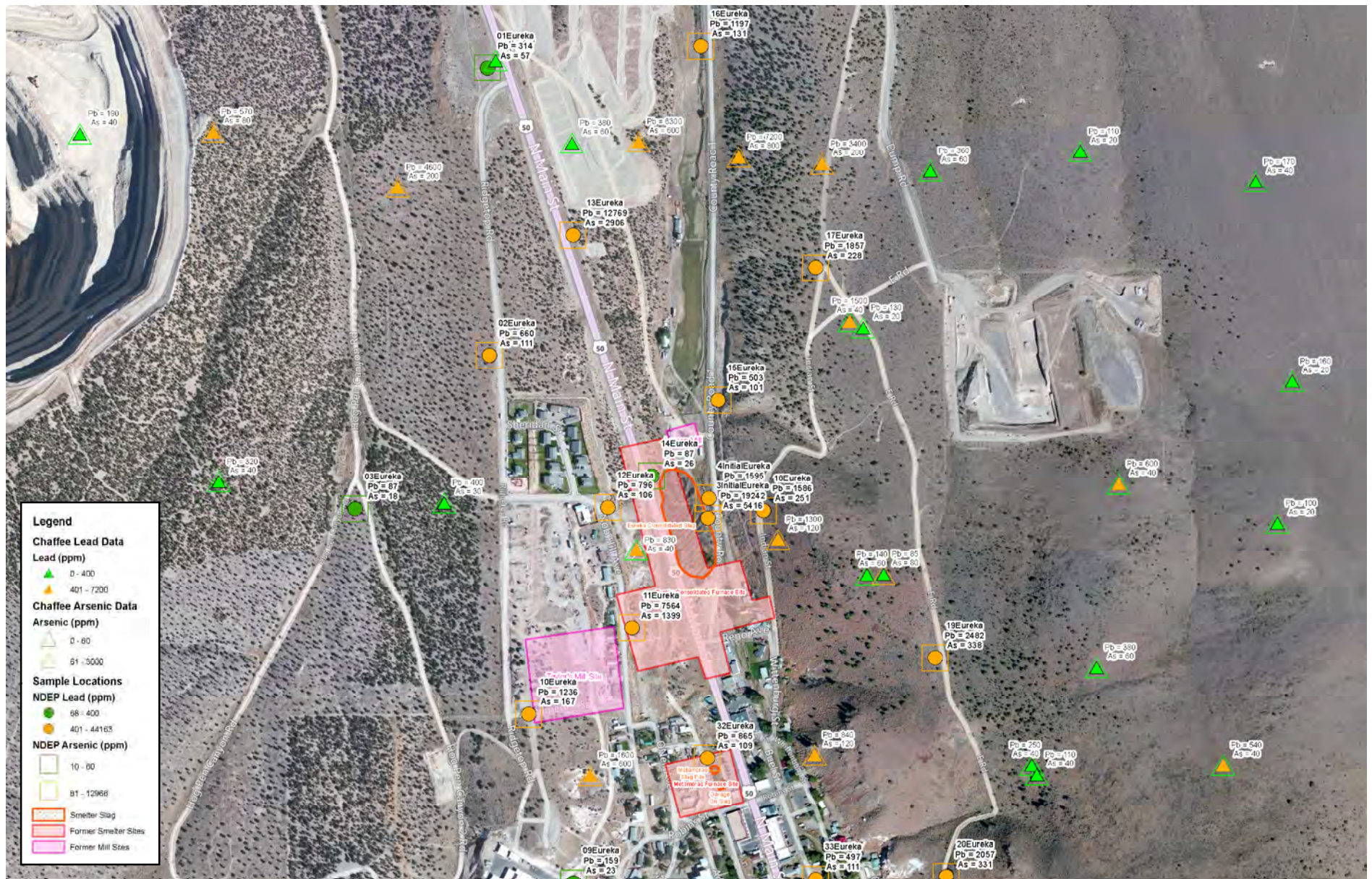


Figure 4B-1
Eureka Area with Historic Sampling
Data For Lead and Arsenic-North
Eureka Smelters Sites
Eureka, Eureka County, Nevada

Ecology & Environment, Inc. GIS Department Project: Northridge/Oakland/Eureka Projects 2012 Field Data Results/Eureka 4B-2 Non-GIS Historic Lead Samples Central.mxd Date: 3/13/2013



Figure 4B-2

Eureka Area with Historic Sampling
Data For Lead and Arsenic-Central
Eureka Smelters Sites
Eureka, Eureka County, Nevada

Ecology & Environment, Inc. GIS Department Project: Northridge/Oakland/Eureka/Proctor 2012 Field Data Results/Figure 4B-3 Non-GIS HistoricLeadSamples_South.mxd Date: 3/13/2013

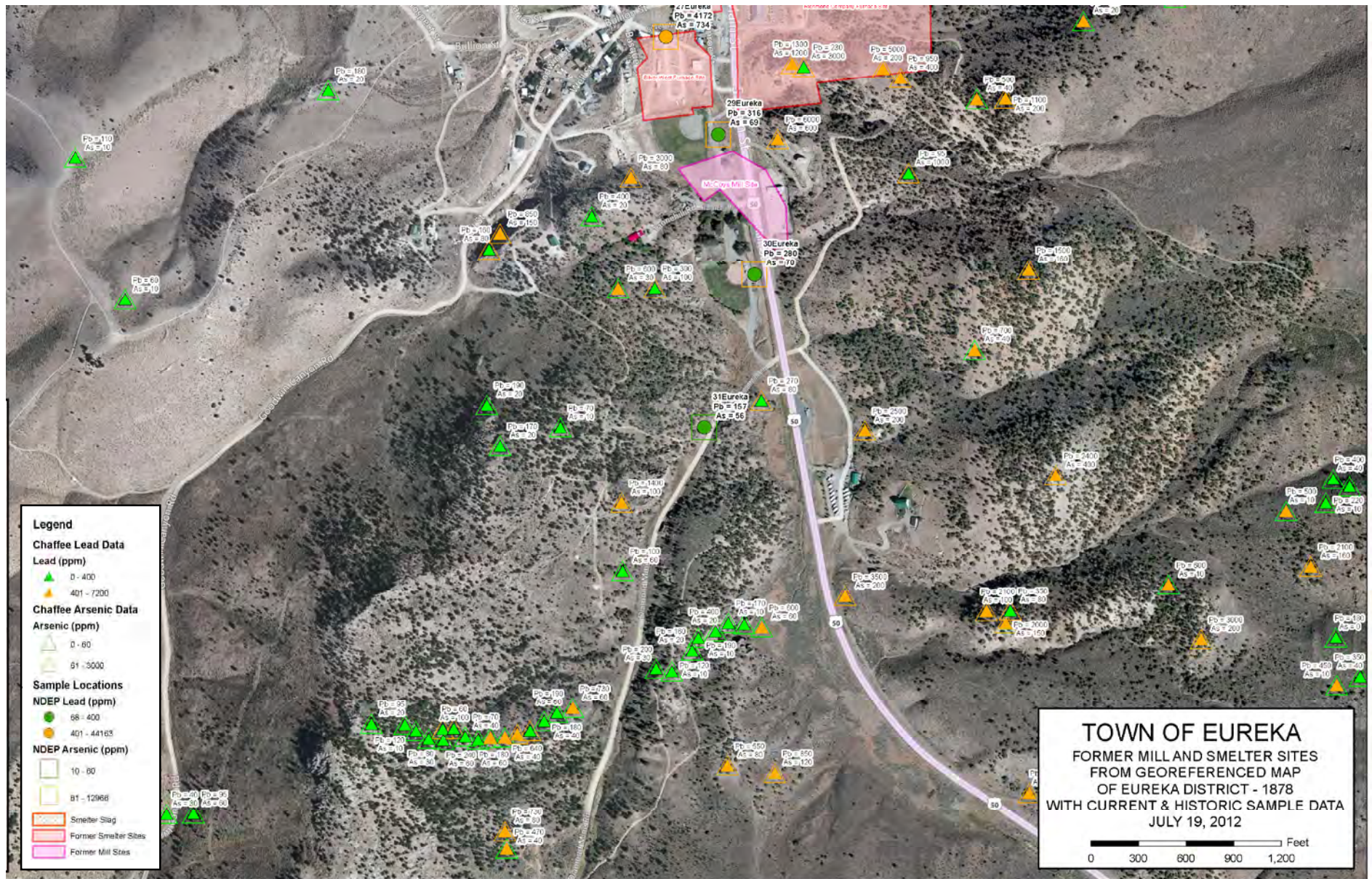


Figure 4B-3

Eureka Area with Historic Sampling
Data For Lead and Arsenic-South
Eureka Smelters Sites
Eureka, Eureka County, Nevada

Ecology & Environment, Inc. GIS Department Project: Northridge/Oakland/Eureka Projects 2012 Field Data Results Figure 5-1 NonGIS Spring Sampling Data North.mxd Date: 3/13/2013

Analysis Results by US EPA Method 6010C		
Sample Number	Arsenic mg/kg	Lead mg/kg
Eureka01	64	310
Eureka02	140	610
Eureka03	20	73
Eureka04	120	690
Eureka05	13	44
Eureka06	330	1,900
Eureka07	350	1,900
Eureka08	87	480
Eureka09	26	120
Eureka10	210	1,200
Eureka11	1,800	7,900
Eureka12	170	800
Eureka13	2800	13000
Eureka14	39	98
Eureka15	130	530
Eureka16	200	1,100
Eureka17	300	1,700
Eureka18	370	1,600
Eureka19	450	2,500
Eureka20	430	2,100
Eureka21	1,500	6,600
Eureka22	570	2,200
Eureka23	790	4,300
Eureka24	1,500	8,100
Eureka25	2900	17000
Eureka26	260	1,300
Eureka27	990	4,100
Eureka28	74	340
Eureka29	73	290
Eureka30	89	260
Eureka31	72	170
Eureka32	180	990
Eureka34	47	240
1InitialEureka	12000	45000
2InitialEureka	6700	32000
3InitialEureka	6100	24000
4InitialEureka	500	1900

Legend

- Sample Locations
- Eureka Town or County Property
- Bureau of Land Management
- Smelter Slag
- Former Smelter Sites
- Former Mill Sites

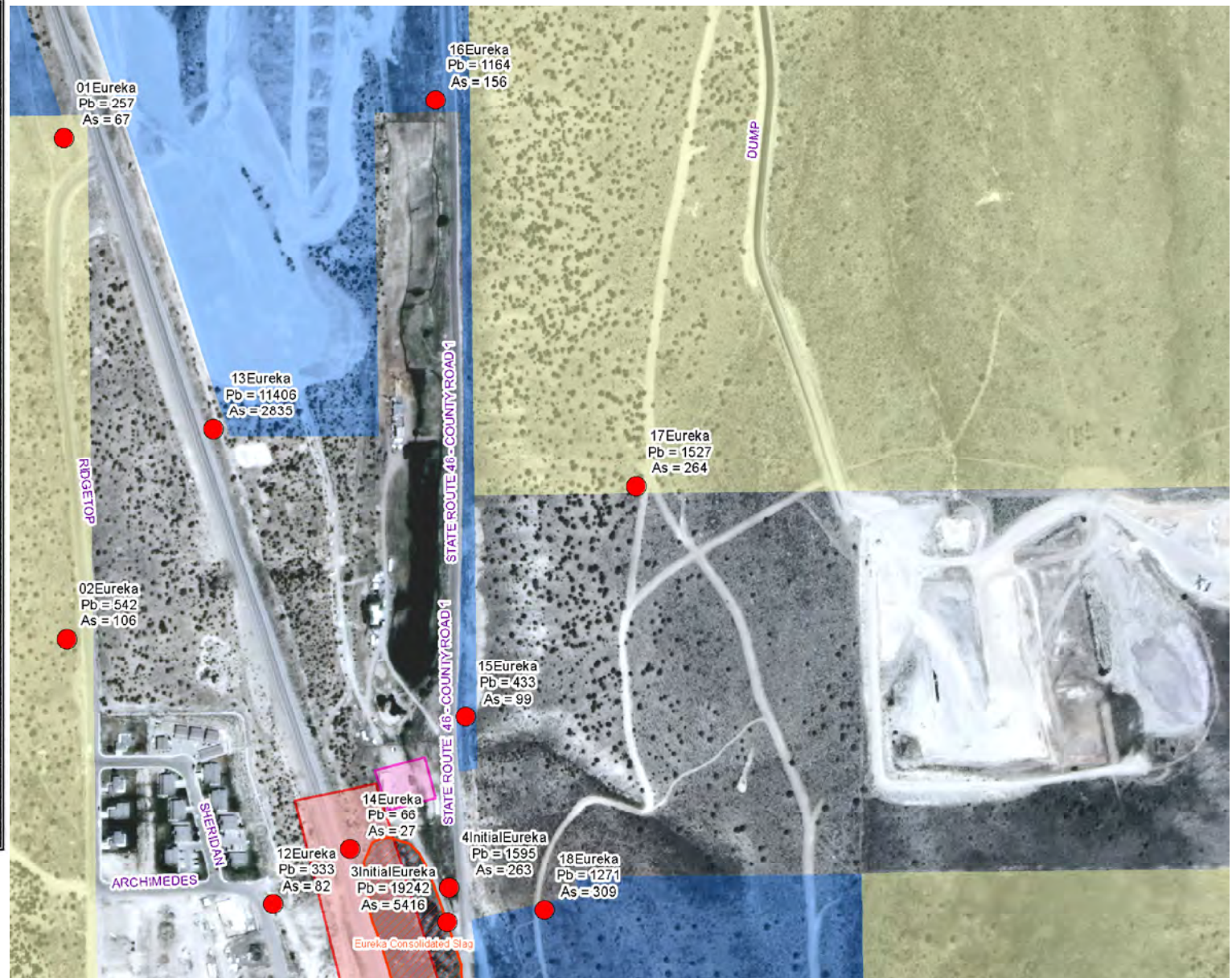


Figure 5-1
Spring 2012 Sampling Data Map-North
Eureka Smelters Sites
Eureka, Eureka County, Nevada

Analysis Results by US EPA Method 6010C		
Sample Number	Arsenic mg/kg	Lead mg/kg
Eureka01	64	310
Eureka02	140	610
Eureka03	20	73
Eureka04	120	690
Eureka05	13	44
Eureka06	330	1,900
Eureka07	350	1,900
Eureka08	87	480
Eureka09	26	120
Eureka10	210	1,200
Eureka11	1,800	7,900
Eureka12	170	800
Eureka13	2800	13000
Eureka14	39	98
Eureka15	130	530
Eureka16	200	1,100
Eureka17	300	1,700
Eureka18	370	1,600
Eureka19	450	2,500
Eureka20	430	2,100
Eureka21	1,500	6,600
Eureka22	570	2,200
Eureka23	790	4,300
Eureka24	1,500	8,100
Eureka25	2900	17000
Eureka26	260	1,300
Eureka27	990	4,100
Eureka28	74	340
Eureka29	73	290
Eureka30	89	260
Eureka31	72	170
Eureka32	180	990
Eureka34	47	240
1InitialEureka	12000	45000
2InitialEureka	6700	32000
3InitialEureka	6100	24000
4InitialEureka	500	1900

Legend

- Sample Locations
- Eureka Town or County Property
- Bureau of Land Management
- Smelter Slag
- Former Smelter Sites
- Former Mill Sites

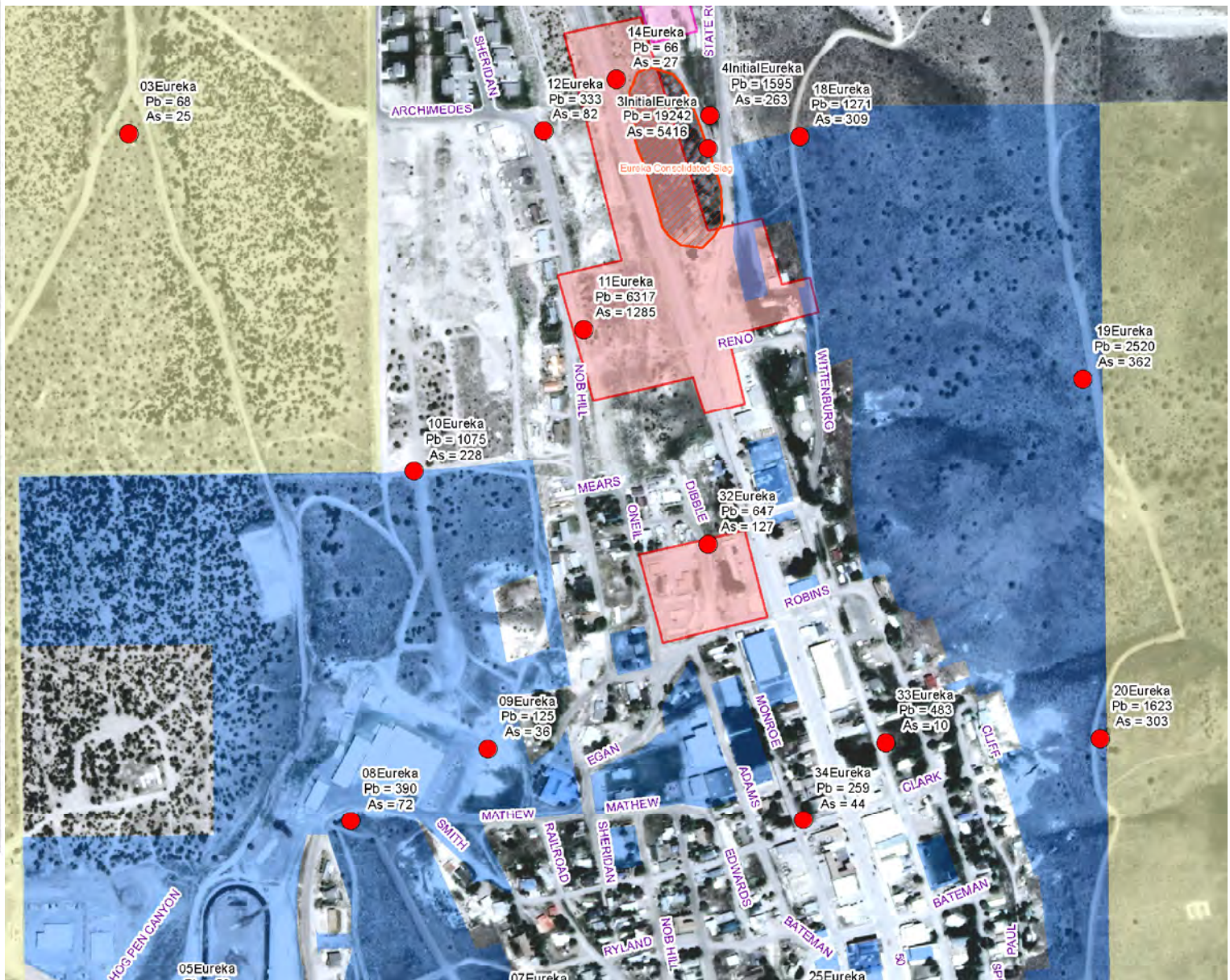


Figure 5-2
Spring 2012 Sampling Data Map-Central
Eureka Smelters Sites
Eureka, Eureka County, Nevada

Ecology & Environment, Inc. GIS Department Project: Northridge/Oakland/Eureka Projects 2012 Field Data Results Figure 5-3 Non-GIS Spring Sampling Data South.mxd Date: 3/13/2013

Analysis Results by US EPA Method 6010C		
Sample Number	Arsenic mg/kg	Lead mg/kg
Eureka01	64	310
Eureka02	140	610
Eureka03	20	73
Eureka04	120	690
Eureka05	13	44
Eureka06	330	1,900
Eureka07	350	1,900
Eureka08	87	480
Eureka09	26	120
Eureka10	210	1,200
Eureka11	1,800	7,900
Eureka12	170	800
Eureka13	2800	13000
Eureka14	39	98
Eureka15	130	530
Eureka16	200	1,100
Eureka17	300	1,700
Eureka18	370	1,600
Eureka19	450	2,500
Eureka20	430	2,100
Eureka21	1,500	6,600
Eureka22	570	2,200
Eureka23	790	4,300
Eureka24	1,500	8,100
Eureka25	2900	17000
Eureka26	260	1,300
Eureka27	990	4,100
Eureka28	74	340
Eureka29	73	290
Eureka30	89	260
Eureka31	72	170
Eureka32	180	990
Eureka34	47	240
1InitialEureka	12000	45000
2InitialEureka	6700	32000
3InitialEureka	6100	24000
4InitialEureka	500	1900

Legend

- Sample Locations
- Eureka Town or County Property
- Bureau of Land Management
- Smelter Slag
- Former Smelter Sites
- Former Mill Sites

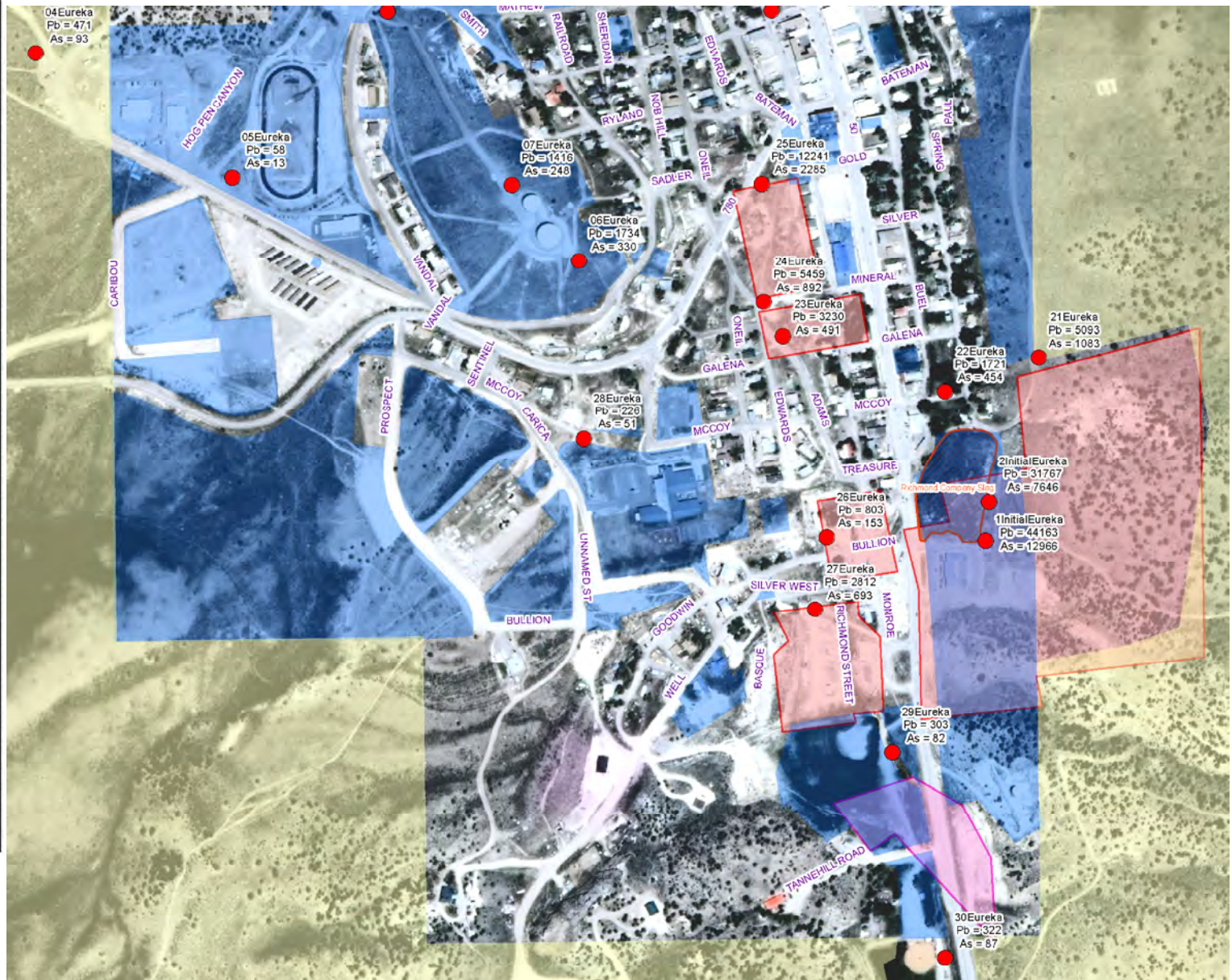
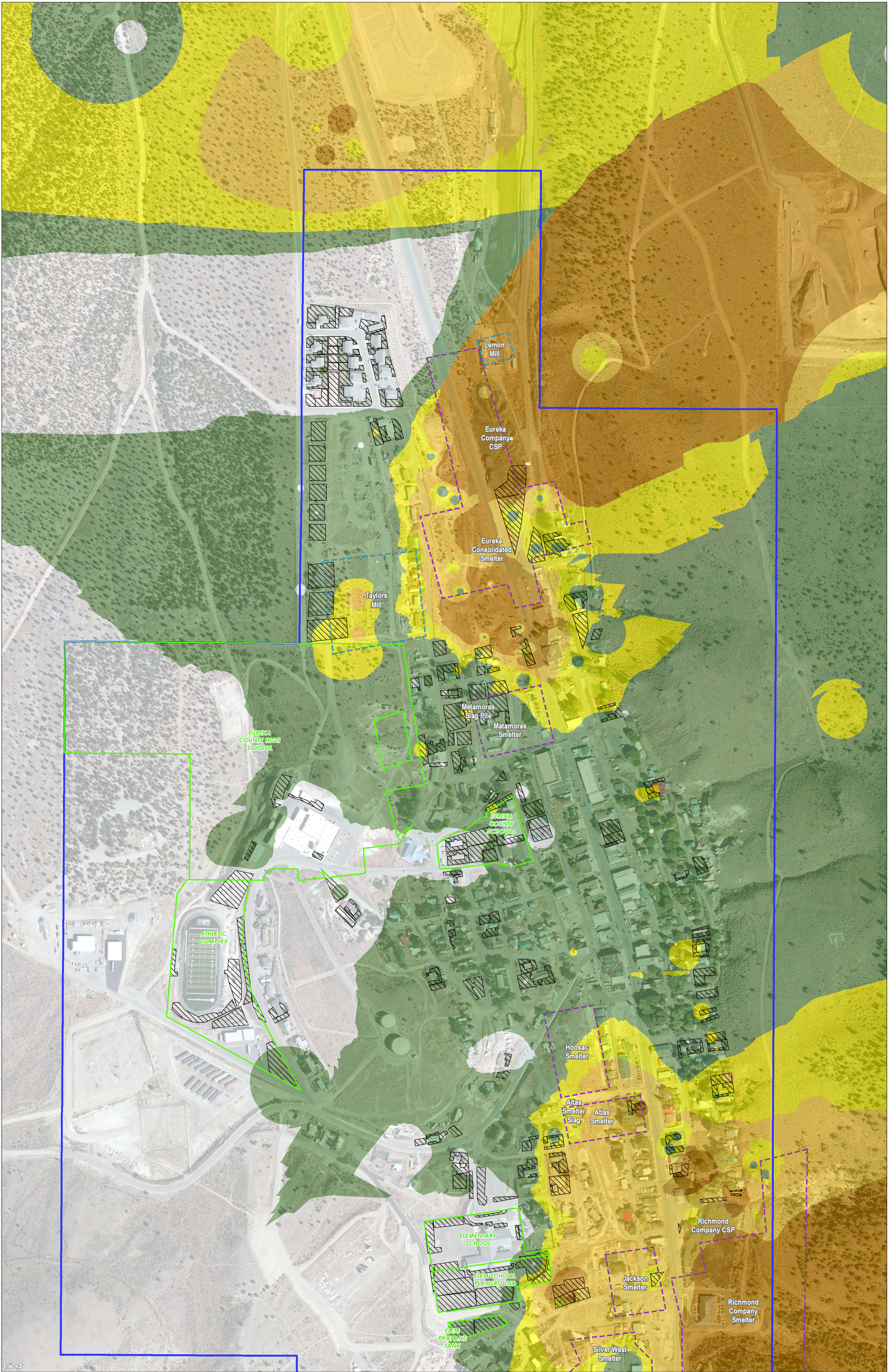


Figure 5-3
Spring 2012 Sampling Data Map-South
Eureka Smelters Sites
Eureka, Eureka County, Nevada



Legend

- Arsenic Concentration (mg/kg)

 - Non detect to 60
 - 60 to 300
 - 300 to 600
 - 600 to 1,200
 - greater than 1,200
- Historical Facilities

 - Historic Mill Facility
 - Historic Smelter Site
 - Consolidated Slag Pile (CSP)
- Project Site

 - Eureka County School District Property
 - Sampled Areas
- Levels of arsenic in soil are measured in units of milligrams per kilogram (mg/kg)

Surface Creation: GIS Analysis

ESRI ArcGIS v10.1 Inverse distance weighted (IDW) interpolation determines cell values using a linearly weighted combination of a set of sample points. The weight is a function of inverse distance. The surface being interpolated should be that of a locationally dependent variable. This method assumes that the variable being mapped decreases in influence with distance from its sampled location.

For each surface/contour map created for Eureka Pb or As levels, the nearest 12 concentration values were used.

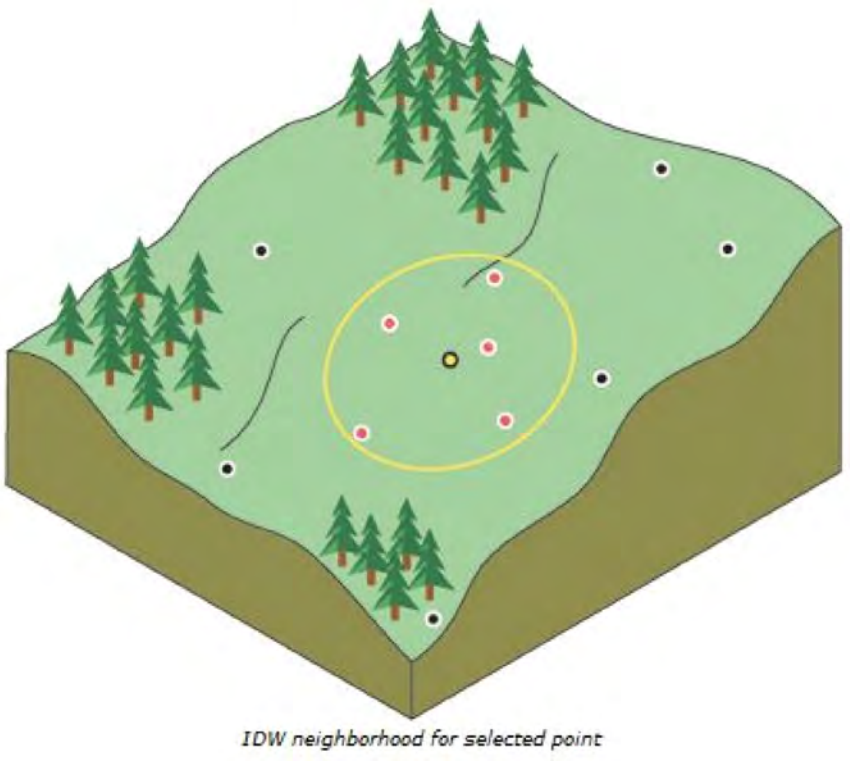
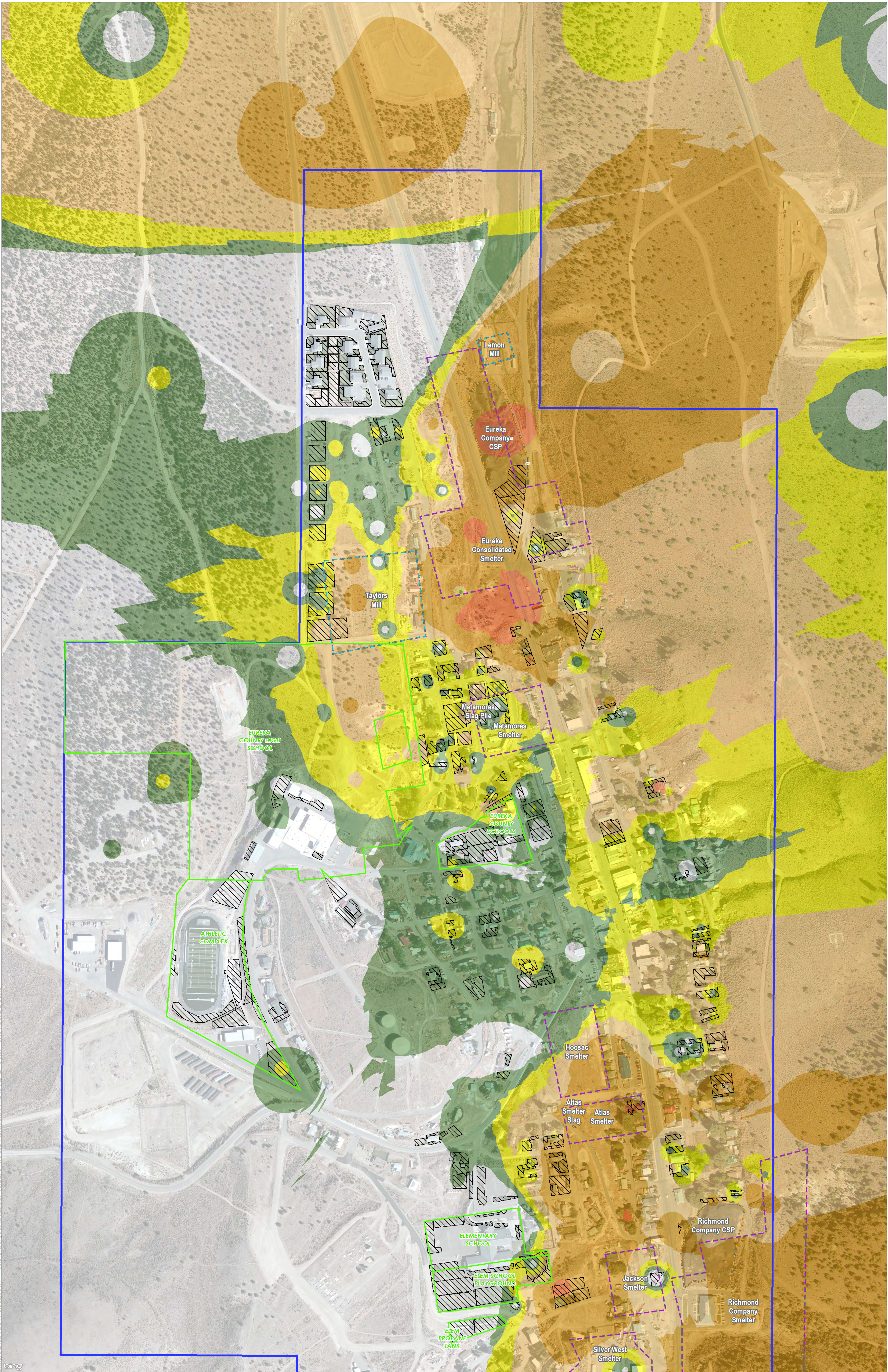


Figure 6-A
Town of Eureka
Iso-Concentration Map
For Arsenic



Legend

- Lead Concentration (mg/kg)

 - Non detect to 400
 - 400 to 800
 - 800 to 1,500
 - 1,500 to 3,000
 - 3,000 to 10,000
 - greater than 10,000
- Historical Facilities

 - Historic Mill Facility
 - Historic Smelter Site
 - Consolidated Slag Pile (CSP)
- Project Site

 - Eureka County School District Property
 - Sampled Areas
- Levels of lead in soil are measured in units of milligrams per kilogram (mg/kg)

Surface Creation: GIS Analysis

ESRI ArcGIS v10.1 Inverse distance weighted (IDW) interpolation determines cell values using a linearly weighted combination of a set of sample points. The weight is a function of inverse distance. The surface being interpolated should be that of a locationally dependent variable. This method assumes that the variable being mapped decreases in influence with distance from its sampled location.

For each surface/contour map created for Eureka Pb or As levels, the nearest 12 concentration values were used.

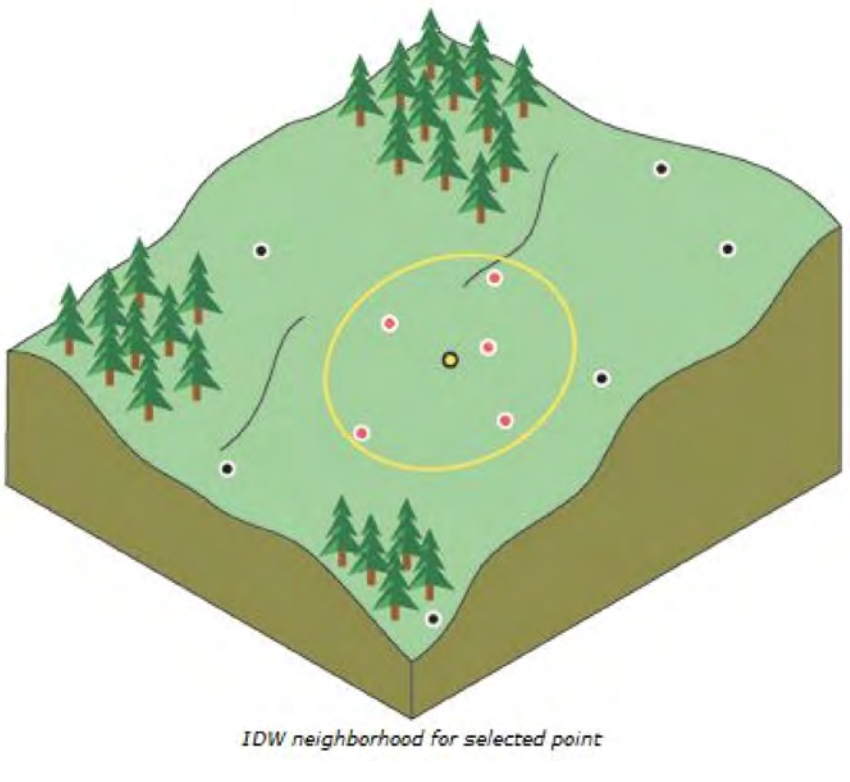


Figure 6-B
Town of Eureka
Iso-Concentration Map
For Lead

3 Project Objectives

3.1 Data Use Objectives

The data generated by implementing this SAP will be used to evaluate arsenic and lead concentrations in the Town of Eureka area with a focus on currently occupied areas where there may be a concern about potential current exposure. The lead and arsenic data generated by this assessment will be specifically used to:

- Determine average concentrations of lead and arsenic in the shallow soil at 20 additional locations within the Town of Eureka.
- Determine the vertical spatial distribution between shallow ground surface soil and the soil at depth between 2 to 12 inches below ground surface (bgs) for arsenic and lead on at 20 additional properties.
- Determine whether unacceptable risks to human health or the environment are present at the 20 additional properties within the Town of Eureka due to elevated lead and arsenic concentrations.

In general, all sampling results will be reviewed by the U.S. EPA, NDEH and START to identify specific areas where arsenic and lead concentrations exceed their respective initial cleanup goal. Additionally the soil sampling data will be reviewed to determine which commercial, residential and public properties require further assessment or remediation and whether they may be candidates for a U.S. EPA removal action

3.2 Project Sampling Objectives

The sampling for this assessment is intended to generate shallow soil samples that will support the lead and arsenic screening of properties in the Town of Eureka. The soil sampling, followed by field analysis with a portion of the samples being submitted for definitive laboratory sample analysis, will be performed to accomplish the project objectives.

The number of properties to be sampled is expected to be 20 properties for which the NDEP has obtain signed access agreements. Specific sampling objectives are to collect samples that can be used for the following:

- Obtain data regarding lead and arsenic concentrations in soil
- Determine the extent and volume of lead and arsenic in the 20 properties

3.3 Initial Cleanup Goal

Site-specific action levels have not yet been developed for this site; however, the U.S. EPA has identified initial cleanup goals which will be used as SSLs. These cleanup goals are based on human health threats and exposures resulting from lead and arsenic in contaminated soil. The cleanup goals for this assessment were developed to identify maximum concentrations of lead and arsenic at the site that would not adversely impact humans. Eventually, the U.S. EPA will identify site-specific action levels that would be relied on to determine whether a removal action is necessary. These site-specific action levels will also consider the bioavailability of lead and arsenic and may be different than the initial cleanup goals identified here.

For lead, the U.S. EPA has identified an initial screening goal of 400 mg/kg in residential soil and 800 mg/kg in industrial soil. These numbers are based on the May 2012 U.S. EPA RSLs. Secondary screening values of 1,200 mg/kg and 3,000 mg/kg have also been identified for lead.

For arsenic, the U.S. EPA uses an acceptable risk range of 0.39 - 39 mg/kg, which is based on an acceptable excess cancer risk range of one in a million to one in a hundred thousand. The U.S. EPA also may adjust arsenic cleanup standards based on bioavailability calculations. Based in previous sampling, the U.S. EPA may assume that arsenic is approximately 60% bioavailable and adjust the cleanup goal appropriately. For arsenic, the U.S. EPA may also compare arsenic contaminant levels to background arsenic levels in order to determine a cleanup goal. The U.S. EPA has set a screening goals of 60 mg/kg. Secondary screening values of 180 mg/kg and 600 mg/kg have also been identified for arsenic.

Table 1 and Table 2 present the SSLs and initial screening goals for soil sample data that will be generated for this assessment.

3.4 Data Quality Objectives (DQO)

The DQO process as set forth by the U.S. EPA (EPA, 2006) was followed to establish objectives for this assessment. An outline of the DQO process and the given outputs related to this assessment are included as Appendix A.

3.5 Data Quality Indicators (DQIs)

Data Quality Indicator (DQI) goals for this assessment were developed in accordance with guidelines set forth by the U.S. EPA (EPA, 2001a). All sampling procedures detailed in Section 6.2 and standard operating procedures (SOPs) in Appendix B will be followed to ensure representativeness of sample results by obtaining characteristic samples. Approved U.S. EPA methods and standard reporting limits will be used. All data not rejected will be considered complete. Tables 1 and 2 summarize the project's DQI goals for arsenic and lead.

3.6 Schedule of Sampling Activities

This SAP amendment will be submitted to the U.S. EPA FOSC in early May of 2013 and should be reviewed and revised prior to the first day of proposed work. Sample collection will take place following approval of the SAP by the U.S. EPA FOSC. The field sampling activities are anticipated to begin on May 28, 2013.

3. Project Objectives

**Table 1 Benchmarks and Data Quality Indicator Goals for Soil and Sediment
Definitive Data for EPA Method 6010B
Eureka Smelter Sites**

Assessment

Eureka, Eureka County, Nevada

Project No. EE-002693-2177

TDD No. TO2-09-12-04-0002

COPC	U. S. EPA Residential RSL (mg/kg)	U. S. EPA Industrial RSL (mg/kg)	Site-Specific Screening Level (mg/kg)	Secondary Site-Specific Screening Levels (mg/kg)	RL for U.S. EPA Method 6010B (mg/kg)	Accuracy (Percent Recovery for MS/ MSD)	Precision (RPD from MS/MSD and Duplicates)	**Percent Completeness
Lead	400	800	400	1,200 3,000	3	75 – 135	<35%	> 90%
Arsenic	0.39	1.6	60*	180 600	2	75 – 135	<35%	> 90%

Notes:

RL = Reporting Limit

SSL = Site-Specific Screening Level

mg/kg = milligrams per kilogram

RSL = U.S. EPA Regional Screening Level (May 2012)

MS/MSD = Matrix Spike/Matrix Spike Duplicate

RPD = Relative Percent Difference

* = Recent Nevada Department of Environmental Protection and U.S. EPA removal goals for arsenic have ranged up to 60mg/kg.

* = The percent completeness is defined as the percentage of measurements that are judged to be valid.

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3. Project Objectives

**Table 2 Benchmarks and Data Quality Indicator Goals for Soil and Sediment
Non-Definitive Data by EPA Method 6200
Eureka Smelter Sites**

**Assessment
Eureka, Eureka County, Nevada**

Project No. EE-002693-2177

TDD No. TO2-09-12-04-0002

COPC	U. S. EPA Residential RSL (mg/kg)	U. S. EPA Industrial RSL (mg/kg)	Site-Specific Screening Level (mg/kg)	Secondary Site-Specific Screening Levels (mg/kg)	RL for U.S. EPA Method 6200 (mg/kg)	Accuracy (Check Standards)	Precision (RPD for Duplicates)	Percent Completeness**
Lead	400	800	400	1,200 3,000	2	75 – 125	<35%	> 90%
Arsenic	0.39	1.6	60*	180 600	10	75 – 125	<35%	> 90%

Notes:

RL = Reporting Limit

SSL = Site-Specific Screening Level

mg/kg = milligrams per kilogram

RSL = U.S. EPA Regional Screening Level (May 2012)

RPD = Relative Percent Difference

* = Recent Nevada Department of Environmental Protection (NDEP) and U.S. EPA removal goals for arsenic have ranged up to 60mg/kg.

** = The percent completeness is defined as the percentage of measurements that are judged to be valid.

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3.7 Special Training Requirements/Certifications

Data validation requires specialized training and experience. The START PM will ensure that a qualified START chemist will perform a Tier 2 validation of 100 percent of the data (EPA, 2001). Specific data validation requirements are discussed in Section 9.4.

Field sampling personnel should be trained and have experience with soil sampling at hazardous waste sites while wearing appropriate protective equipment. One field sampler should be trained and familiar with Global Positioning System (GPS) data collection. All sampling personnel must have appropriate training that complies with 29 Code of Federal Regulations 1910.120. The site-specific health and safety plan (HSP) for this project's field work will be developed prior to initiation of the field work. The HSP will be available and kept on-site during field work and kept on in the E & E project file.

4 Sampling Rationale and Design

The scope of work outlined in this SAP is based on available site information and project objectives as determined by the U.S. EPA, NDEP, and START. The principal objective of sampling is to determine whether or not former smelting and milling operations have impacted properties by causing elevated levels of arsenic and/or lead in soils. This sampling is being conducted to better characterize and provide the necessary data for detection of arsenic and lead contamination in soil above the initial screening goals.

Sampling will include the collection of surface and shallow subsurface soil samples from 20 properties that could be potentially impacted by former ore smelting and milling operations and associated waste. The numbers of samples to be collected and the analyses to be performed are shown in Table 3. After collection, samples will be handled and analyzed according to Sections 5.1, 5.2, 6.2, and 6.3 of this SAP. Sample locations will be recorded in the field logbook as sampling is completed. Individual sample locations will be recorded using GPS equipment.

For each property parcel, soil samples will be collected at depths between the ground surface and 2 inches bgs, 2 inches and 6 inches bgs, and 6 inches and 12 inches bgs.

4.1 Selection of Decision Units

Soil under structures and engineered surfaces will not be sampled. The sampling will be confined to areas of exposed soil, grassy areas, and areas that are vegetated. The sampling rationale and design within a property's boundary is based upon property use and location. A property will be classified as one of four area of concern (AOC) types. The AOC type is dependent upon the use of the property and is described in detail in the next subsections.

4.1.1 Developed Residential Properties (AOC 1)

Each developed residential property parcel will be divided into one or more separate decision unit. The vertical boundaries for most properties will be determined in the field during sampling but are initially estimated to be no greater than 1 foot bgs. There are expected to be at least 10 developed residential properties to assess. There are expected to be approximately 30 decision units.

4.1.2 Undeveloped Residential Properties (AOC 2)

Each undeveloped property parcel, regardless of its size, will be divided into at least one separate decision unit. There are expected to be at least 5 undeveloped residential properties to assess. There are expected to be approximately 5 decision units.

4.1.3 Developed Non-Residential Properties (AOC 3)

Each developed non-residential (commercial and industrial) property parcel will be divided into separate decision units. Commercial and industrial properties of less than 1 acre may be evaluated as a single decision unit. Larger developed properties will be divided into several decision units. The vertical boundaries for most properties will be determined in the field during sampling but are initially estimated to be no greater than 1 foot bgs. There are expected to be at

4. Sampling Rationale and Design

least 2 developed non-residential properties to assess. There are expected to be approximately 4 decision units.

4.1.4 Undeveloped Non-Residential Properties (AOC 4)

Each undeveloped non-residential property parcel, regardless of its size, will be divided into five or six sampling locations. Each location may be considered a separate decision unit. Large properties that have both developed and undeveloped areas may be separated into an undeveloped decision unit and a developed decision unit. There are expected to be at least 3 undeveloped properties to assess. There are expected to be approximately 15 unique sampling locations.

4.2 Sampling Design Details

4.2.1 Sampling in Residential Areas (AOC 1 and AOC 2)

Both developed and undeveloped property in residential areas will be sampled following the sampling design guidance outlined in the U.S. EPA *Superfund Lead-Contaminated Residential Sites Handbook* (Lead Handbook). The Lead Handbook is located in Appendix C. Decision units and residential property parcels will be divided into from one to four sampling sectors, depending upon the size of the property. The number of sampling sectors will depend upon the size of the property parcel. The Lead Handbook guidance for sampling in yards less than or equal to 5,000 feet recommends, at a minimum, two sampling sectors, one that encompasses the front and the other that encompasses the back yard. For properties greater than 5,000 square feet, the Lead Handbook recommends that, at a minimum, composite samples should be collected from each of the sectors of the yard surrounding a residential structure. The Lead Handbook also recommends that play areas and gardens should be separate sampling sectors.

A sampling sector will not exceed $\frac{1}{4}$ acre in area. Each sampling sector will be sampled by creating a five-point composite sample in accordance with the Lead Handbook. The sampling points will be distributed randomly within the sampling sector, with a bias toward equal distribution within the entire sampling sector. The structure dripline areas and run-off areas will be excluded from the sampling sectors. The dripline and gutter runoff areas around a structure, if sampled, will be considered an additional sampling sector. The typical sampling design for a property as indicated in the Lead Handbook is shown in Figure 7.

At each individual sampling location within a sampling sector, samples will be collected from the exposed soils at the shallow surface 0 to 2 inch bgs and at 2 to 6 inches bgs, and 6 to 12 inches bgs. The Lead Handbook recommends the collection of 0 to 2 inch bgs surface soil samples for human health risk assessment purposes.

Composite samples will be generated from the unique samples within each sampling sector at the surface and at depth (i.e., soil samples from the same property sampling sector and depth interval will be composited together. There will be no mixing of samples from other depth profiles or property sampling sectors). Prior to compositing or analysis, the field sampling team will homogenize all soil samples by thoroughly mixing the collected soil for an interval. All samples will be placed in coolers for storage and shipping.

The sample will be prepared and analyzed in the field using the procedure and X-ray fluorescence (XRF) methods described in Section 6.2 immediately following sample collection.

4. Sampling Rationale and Design

Field analysis will be conducted in order to rapidly provide data to assist the U.S. EPA in determining if contamination above the initial cleanup goal is present in the study area, and it will help reduce the cost of the investigation. Furthermore, the relationship of field data to laboratory data will be evaluated prior to performing any removal or remedial action where the field data would be used to support real-time decision making.

The use of composite sampling to determine an average concentration representing an entire sampling sector area may introduce errors that result in the data not meeting the decision error limit goals for accepting or rejecting the null hypothesis (Appendix A Section 6, Table 6-2). Of greatest concern for this assessment is the potential for large errors resulting in a determination that the decision unit is not contaminated when it is (i.e. false rejection of the null hypothesis).

4.2.2 Sampling in Non-Residential Areas (AOC 3 and AOC 4)

4.2.2.1 Developed Property in Non-Residential Areas (AOC 3)

Developed properties in non-residential areas will be sample in the same manner as developed properties in residential area.

4.2.2.2 Undeveloped Urban Property in Non-Residential Areas (AOC 4)

The sampling design for undeveloped property in non-residential areas will be a systematic grid. Undeveloped properties that have an area of greater than 5 acres will be sampled with a 200-foot by 200-foot or larger grid, which will generate a statistically adequate number of sampling locations of 6 or more samples. A 5-acre property will have no less than 5 sample locations.

For undeveloped property that is less than 5 acres, a 175-foot by 175-foot or smaller grid will usually generate a statistically adequate number of sampling locations (approximately 6) that will uniformly covering the entire property parcel. Undeveloped property of less than 0.5 acres should be accessed with an adjoining property so that the area exceeds 0.5 acres.

4.3 Contaminants of Concern

The primary COPCs are arsenic and lead. All samples will be field analyzed for arsenic and lead using the field portable XRF unit in accordance with U.S. EPA Method 6200. Ten percent of all samples will be sent to the U.S. EPA Region 9 Laboratory for arsenic and lead analysis by U.S. EPA Method 6010B. Ten percent of the samples submitted to the regional laboratory will also be analyzed for the entire California list of metal.

The bioavailability of arsenic and lead in soil is also of concern. A representative portion of the collected samples submitted for analysis by U.S. EPA Method 6010B will undergo a bio-accessibility extraction followed by U.S. EPA SW-846 Method 6010B analysis for lead and arsenic.

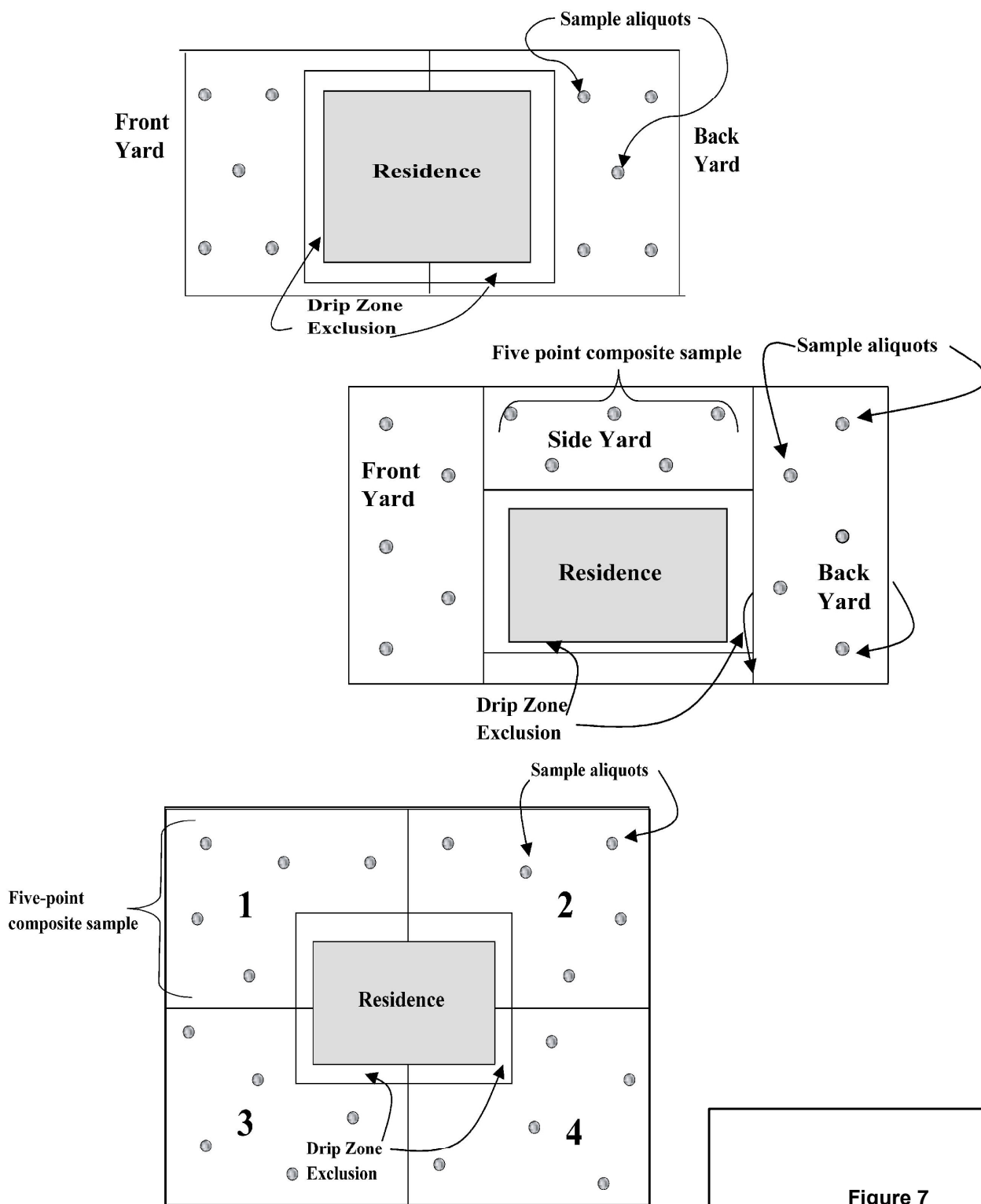


Figure 7
Typical Property Sampling Designs

Eureka Smelter Sites
Eureka, Eureka County, Nevada

5 Request for Analyses

5.1 Field Analysis

All soil samples collected during this assessment will be analyzed in the field by START using the XRF. The manufacturer's guidance and EPA SW-846 Method 6200 (Appendix C) will be used to conduct analysis.

To provide analytical quality control for the field analytical effort, the following measures will be utilized:

- The analytical precision and sensitivity of the XRF instrument utilized for determination of arsenic and lead concentrations in site-specific samples will be identified during the initial days of field analysis.
- A minimum of 10 percent of soil samples analyzed by XRF will be submitted to the U.S. EPA Region 9 Laboratory for confirmation analysis of arsenic and lead concentrations. At least 20 samples collected during this assessment will be submitted to the laboratory. The selected samples will represent the following ranges of arsenic and lead concentrations for correlation purposes: samples just below the site screening level, samples with concentration between site screening level and the secondary screening level, and samples with concentration above secondary screening level.

5.2 Laboratory Analysis

Soil samples that require confirmation of XRF results and water samples collected during this assessment will be submitted to the U.S. EPA Region 9 Laboratory in Richmond, California, and analyzed by EPA SW-846 Method 6010B for arsenic and lead. The concentrations of antimony, barium, beryllium, cadmium, chromium, cobalt, copper, molybdenum, nickel, selenium, silver, thallium, vanadium and zinc will also be determined to supplement the lead and arsenic data.

To provide analytical quality control for the analytical program, the following measures will be utilized:

- Laboratory blind duplicate split samples will be collected from 10 percent of the sampling locations and submitted for soil analysis for both field and definitive analytical methods. A duplicate split sample is a 50/50 split of a unique sample after collection.
- For definitive EPA Method 6010B, additional sample volume will be collected for at least 5 percent of soil samples, to be utilized for matrix spike/matrix spike duplicate (MS/MSD) analysis.

The estimated soil sample quantities are for each AOC summarized in Table 3. Sample containers, preservatives, holding times, estimated number of initial assessment samples, and QA/QC samples are summarized in Table 4.

5. Request for Analyses

Table 3
Estimated Soil Sampling Summary
Eureka Smelter Sites

Assessment
Eureka, Eureka County, Nevada

Project No. EE-002693-2177

TDD No. TO2-09-12-04-0002

Area of Concern	Estimated Parcels	Estimated Sampling Sectors / Decision Units	Estimated 0-2 inch depth aliquots or discrete samples	Estimated 2-6 inch depth aliquots or discrete samples	Estimated 6-12 inch depth aliquots or discrete samples	Unique samples for analysis	Field Duplicates Samples	Samples for Field Analysis
AOC 1 Developed Residential Property	10	20*	100	100	100	60	6	66
AOC 2 Undeveloped Residential Property	5	5**	25	25	25	15	2	17
AOC 3 Developed Non-Residential Property	2	4*	20	20	20	4	1	5
AOC 4 Undeveloped Non-Residential Properties	3	18***	18	18	18	18	2	20
Total	20	47	163	163	163	97	11	108

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* = Based upon 2 sampling sectors/ decision unit per property.

** = Based upon 1 sampling sector/ decision unit per property.

*** = Based upon 6 sample locations a each property. Each sample location potentially represents a decision unit.

5. Request for Analyses

Table 4
Estimated Soil Analysis Summary
Eureka Smelter Sites

Assessment
Eureka, Eureka County, Nevada

Project No. EE-002693-2177

TDD No. TO2-09-12-04-0002

Method	16 Metals by U.S. EPA 6010B	Lead and Arsenic by XRF Field Analysis
Sample Size and Container Submitted for Preparation and Analysis	Five grams of soil from a 250 micron sieved soil sample in a prepared 5-gram XRF sample cup	100 grams of soil in plastic sample bag, glass jar or plastic jar.
Preservation	4°C	N/A
Preparation	U.S. EPA 3050B	Sieved through a 250 micron sieve and stored in a 5-gram XRF sample cup
Analysis Holding Time	6 months	6 months (if transferred to glass jar)
Estimated Number of Unique Composite Samples or Discrete Samples for Analysis	(Minimum of >10% of XRF Field Analysis Samples) 16	97
Estimated Number of Split Duplicate Samples	4	11
Minimum Total Initial Analyses	20	108
Field Analysis Duplicates		
An analysis duplicate run in same batch (same XRF cup, run twice)		(1 per 20 samples) 6
Preparation duplicate run in same batch (2 XRF cups prepared from same sample collection bag)		(1 per 20 samples) 6
Blanks run in same batch		(1 per 10 samples) 12
Control Sample (field analysis only)		(Initial and final and after every 10 th samples) 12
Performance Evaluation Sample (daily)		3
Total Initial Analyses including control samples		147
Matrix Spike/Matrix Spike Duplicates	1 (1 per 20 samples Submit three sample cups)	N/A

Note:

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A field analysis duplicate or a preparation duplicate for XRF will be prepared once every 10 samples. The type of duplicate, field analysis or preparation, will be alternated every 10 samples.

Table 4 (continued) Estimated Soil Analysis Summary Eureka Smelter Sites Assessment Eureka, Eureka County, Nevada	
Method	Total CAM-17 Metals by U.S. EPA 6010B
Sample Type	Equipment Blank
Sample Container	500 milliliter plastic bottle
Preservation	4 degree/HNO ₃
Analysis Holding Time	6 months
Number of Samples	1 per day (5)
Number of Field Duplicate Samples	0
Total Number of Samples	5
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5.3 Additional Analysis

The arsenic and lead concentrations based upon field XRF results and laboratory results will be evaluated. A representative selection of soil samples collected during this assessment will be submitted to the U.S. EPA Region 9 Laboratory in Richmond, California for a bio-accessibility extraction using a bio-accessibility extraction procedure U.S. EPA 9200.2-86 followed by U.S. EPA SW-846 Method 6010B analysis for lead and arsenic. The selected samples will be spatially diverse, will have representative samples from each of the AOCs and will represent the entire concentration range of both arsenic and lead.

6 Field Methods and Procedures

6.1 Field Procedures

The following sections describe the field procedures and equipment that will be used during the site activities.

6.1.1 Standard Operating Procedures and Equipment

The equipment listed below may be utilized to obtain environmental samples from the respective media in accordance with the following sampling SOPs or their equivalent:

- Environmental Response Team SOP #2012 Soil Sampling
- Ecology and Environment Inc. SOP # ENV 3.13: Soil Sampling
- Ecology and Environment Inc. SOP# ENV 3.15: Sampling Equipment Decontamination

SOPs are found in Appendix B. The following is a partial list of equipment that is anticipated to come in contact with samples:

- Shovels, trowels, scoops
- Stainless steel buckets or glass containers
- Dedicated plastic baggies and disposable trowels

6.1.2 Equipment Maintenance

Field instrumentation for the collection of soil samples will be operated, calibrated, and maintained by the sampling team in accordance with the SOPs listed in Section 6.1.1 or their equivalent. Field instrumentation utilized for health and safety purposes will be operated, calibrated, and maintained by the sampling team according to the manufacturer's instruction. Calibration and field use data will be recorded in the instrument log books.

6.1.3 Inspection/Acceptance Requirements for Supplies and Consumables

There are no project-specific inspection/acceptance criteria for supplies and consumables. It is standard operating procedure that personnel will not use broken or defective materials; items will not be used past their expiration date; supplies and consumables will be checked against order and packing slips to verify the correct items were received; and the supplier will be notified of any missing or damaged items.

6.1.4 Field Documentation

Field logbooks, field sheet or electronic field data devices will document where, when, how, and from whom any vital project information was obtained. Entries will be complete and accurate enough to permit reconstruction of field activities. Field documentations should include information not already specified in this plan. The specific field information requirements are document in the project's data management plan in Appendix E.

6. Field Methods and Procedures

Several START team members will be on site performing different duties related to sample collection, processing, and analysis. Separate field logbooks will be maintained for each sampling team. Each logbook will document the information relevant to the site activity, and at a minimum will include:

- Team members and their responsibilities
- Description of activities initiated and completed
- Time of activities
- List of samples collected
- Deviations from sampling plans, site safety plans, and SAP procedures
- Levels of safety protection

The logbook of a field analysis team should also include

- List of samples received
- List of samples shipped
- List of samples analyzed

6.1.5 Photographs

Photographs will be taken at representative sampling locations and at other areas of interest on site. They will serve to document field operations. When a photograph is taken, the following information will be written in the logbook or will be recorded in a separate field photography log:

- Time, date, location, and, if appropriate, weather conditions
- Description of the subject photographed
- Name of person taking the photograph

6.1.6 Electronic Sample Logging

The sampling team may utilize field management software to prepare sample labels and chain-of-custody forms.

The following information should be entered for each sample after collection:

- Sample name
- Sample date and time
- Number of sample bottles
- Type of preservation
- Analyses

In addition to these items, the software may also be used to keep track of other information such as sample depth, field measurements, and split samples.

The field team will generate chain-of-custody forms for each cooler of samples packaged and sent to a laboratory. Each chain-of-custody form will refer to the shipping method and tracking number. Printed chain-of-custody forms will be submitted to the laboratory with the samples.

The use of field management software will require that the field team have access to a computer, a printer, computer paper, and labels while in the field. Field team members will have received specific training in use of the software.

6.1.7 Mapping Equipment

Sample points and site features will be located and documented with a GPS unit. The GPS will be used to assign precise geographic coordinates to sample locations on the site. GPS mapping will be done by personnel trained in the use of the equipment and will be completed in accordance with the manufacturer's instructions. Expected output from the use of GPS mapping will be site maps with sample locations and major site features.

6.2 Soil Sampling Procedures

Soil sampling methodology will be employed for areas that have not previously been sampled. All sample locations will be recorded in the field logbook as sampling is completed. Each field sampling team will document each individual sampling location in a field logbook, which will include: the site address, area sample was collected with a quick representative sketch of the area, photographs taken, date, time, and sampling team members.

6.2.1 Discrete Sampling

At each unique sample location or composite aliquot location, samples will be collected from the exposed soils at 0 to 2 inches bgs, 2 to 6 inches bgs, and at 6 to 12 inches bgs at most locations. If a location is covered with grass or similar covering, then the grass and organic material will be removed prior to collecting the 0 to 2 inches bgs interval sample.

Discrete surface and subsurface samples will be collected from individual sample locations using a disposable plastic scoop or stainless steel trowel (for surface samples) or a hand auger or

shovel (for subsurface samples) and will be placed in a plastic baggie, homogenized, and then placed in a sample jar.

If discrete samples are to be collected from an undeveloped non-residential property (AOC-4) using a six point grid, then the grid spacing will be determined by dividing the square footage of the property by six and then determining the square root of that number. The resultant number should be rounded to a workable measurement. Thus a 315,000 square foot property should be sampled with at 6 grid location situated approximately 230 feet apart.

6.2.2 Composite Sampling

Composite samples will be comprised of five discrete soil aliquots located with a bias to equal distribution within each sampling sector. In most situations, the dripline area around any structure will be excluded from the sampling sectors. Approximately two ounces of soil will be collected from each soil aliquot location and placed into a plastic sealable lock sampling bag; the soil will then be homogenized. A portion of each sample point to be composited will be kept separate for potential future analysis. A portion of the homogenized soil may be placed in a sample jar soil.

6.3 Field Analytical Procedures

Soil samples will be field analyzed by using XRF technology for total arsenic and lead. All XRF analyses will be completed in accordance with manufacturer's guidance and the EPA Method 6200 (Appendix C). Additionally, field duplicate samples, second source control samples, and blanks will be analyzed and evaluated as quality control checks as described in Section 9.1.

Samples will be delivered to the field laboratory in heavy-duty sealable plastic bags. Upon receipt the samples will be logged into the analytical logbook. Twigs, other organic matter and rocks or pebbles will be removed from the samples. Samples will be homogenized while in the sample bag by kneading, crushing, and shaking the sample until mixing of the soil is complete. If the sample is wet, the sample will be placed in a sample boat or on a coffee filter to air dry. Once the aliquot has dried, it will be placed in a clean bag and homogenized. After homogenization, all samples will be passed through a size 250 micron sieve (#60 mesh) to remove large particles. The remaining aliquot will be transferred to a pre-labeled polyethylene cup and covered with Mylar film to be analyzed by XRF.

At the beginning of the project and prior to analysis of samples, the START will perform quality control checks including energy calibration, resolution check, background check, and a precision sample analysis. Daily quality control checks to be performed include resolution check, background check, initial calibration verification, method blank, continuing calibration verification, and an instrument blank analysis. Initial and continuing calibration verifications will be completed using standards at and below the site initial cleanup goal. Once calibrated and at the end of each set of 20 samples, a source control standard and blank will be analyzed to determine instrument performance. One out of every 10 samples will be selected for a 50/50 split duplicate. One out of every 20 samples will be selected for an analysis duplicate.

After XRF field analysis has been completed, samples selected for definitive analytical confirmation analysis will be processed for shipment to the laboratory. All samples selected for

6. Field Methods and Procedures

laboratory analysis will be submitted to the laboratory as the same pre-labeled polyethylene cup with Mylar film analyzed by XRF.

In addition to the cup that was analyzed using the XRF, the remaining portion of all samples selected for laboratory analysis will be transferred from the sealable holding bag to 4 or 8-ounce clean glass sample containers. Sample containers will be filled to the top, taking care to prevent soil from remaining in the threads prior to being closed to prevent potential contaminant migration to or from the sample. Sample containers will be closed as soon as they are filled, chilled, and also processed for shipment to the laboratory. The cup and sample jar will be chilled pending shipment to the laboratory. All remaining sample volume will be returned to its point of origin.

6.4 Field Decontamination Procedures

Decontamination activities will be conducted by the START in accordance with E & E SOP #3.15. All non-dedicated sample handling devices will be decontaminated according to the following procedure:

- Non-phosphate detergent and tap water wash using a brush to scrub solids from the surface
- Tap water rinse
- Triple deionized/distilled water rinse

The soil sieves, used during preparation of a sample for analysis, will be decontaminated by brushing out the excess soil with coarse-hair brushes and wiping out with a paper towel and a small amount of rubbing alcohol. Decontamination procedures for the soil sieves deviate from E & E SOP #3.15 due to the drying time that would be required for the fine mesh sieve.

7 Disposal of Investigation-Derived Waste

In the process of collecting environmental samples at this site, several different types of potentially contaminated investigation-derived wastes (IDW) will be generated, including the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids

The EPA's National Contingency Plan requires that management of IDW generated during site investigations comply with all relevant or appropriate requirements to the extent practicable. This sampling plan will follow the U.S. EPA Office of Emergency and Remedial Response *Management of Investigation-Derived Wastes during Site Inspections* (Directive 9345.3-02), May 1991 (EPA, 1991), which provides the guidance for management of IDW during site investigations. Listed below are the procedures that will be followed for handling IDW. The procedures are flexible enough to allow the site investigation team to use its professional judgment on the proper method for the disposal of each type of IDW generated at each sampling location.

- Used PPE and disposable sampling equipment will be double bagged in plastic trash bags and disposed of in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE or dedicated equipment that is to be disposed of that can still be re-used will be rendered inoperable before disposal.
- Decontamination fluids will consist of a very small volume of water that potentially has residual arsenic and lead and non-phosphate detergent. Water will be collected and properly disposed.

8 Sample Identification, Documentation and Shipment

8.1 Sample Nomenclature

A unique, identifiable name will be assigned to each sample.

Samples from Eureka Smelter Sites properties will have a prefix of ESS. The ESS will be followed by a hyphen and the last six digits of the eight-digit parcel number (e.g., 111111 for the property with that APN).

The APN number will be followed by a hyphen and the letter S, G or P (S for sampling sector locations, G for grid location and P for any other sampling location that is neither (slag pile). The letter will be followed by a sequential number assigned to each sampling sector or grid node sampling point. Sampling sectors for residential properties will have the general convention of front yard (01), back yard (02), side yards (03 and 04) and other areas such as gardens and play areas (05 and up). Sampling sectors for non-residential properties and grid node sampling point will be assigned sequentially from left to right and north to south.

The sampling sector/grid node identifier will be followed by hyphen and then a number representing either the surface sample (i.e., “0” for 0 to 2 inches bgs) or the termination depth of the shallow subsurface sample in inches (e.g., “6” for 2 to 6 inches bgs, and “12” for 6 to 12 inches).

Field duplicate samples will have the same designations as their originals except the sequential sample number will have 5000 added to it; thus, the field duplicate of ESS-111111-S01-0 will be of ESS-111111-S01-5000-X.

The sample names will be recorded in the field log book and tablets. However each sample will be assigned a two to four digit sample number. The prepared sample identification number will be comprised of a letter sequentially assigned each day a sequentially assigned number that will start at 01. Thus the first prepared sample will be “A01” and the 100th prepared sample on day seven will be “G100”. The sample bag will be identified with the sample number, sample date and sample time. During XRF preparation and analyses the sample number will be used as well.

The XRF preparation duplicate samples will have the same designations as their originals except the sample number will be followed with a “PD”; thus, the preparatory duplicate of G100 will be G100-PD.

Equipment rinsate samples will be labeled with the date of collection followed by a hyphen, then the letters “EB” (e.g., ESS-041513-EB for an equipment blank collected following sampling on April 15, 2013).

A summary of this sample naming system is shown in Table 5.

8. Sample Identification, Documentation and Shipment

Table 5 Sample Nomenclature Eureka Smelter Sites Assessment at Public and Commercial, and Residential Properties Eureka, Eureka County, Nevada		
Project No. EE-002693-2177		TDD No. TO2-09-12-04-0002
Sample Location	Property	Sample ID
Front yard surface soil sample composite at 0-2 inches bgs	Parcel 001-111-11	ESS-111111-S01-0
Back yard surface soil sample composite at 6-12 inches bgs		ESS-111111-S02-6
A surface sample collected from garden located at property:	Parcel 001-111-15	ESS-111115-P1-0
Surface soil sample (2-6 inches bgs) at the 5 th grid nodes at undeveloped area at property:	Parcel 001-222-22	ESS-122222-G5-2
Field Duplicate of ESS-111111-S01-0 sample	Parcel 001-111-11	ESS-111111-S01-5000
Equipment Blanks after sampling on April 9, 2013:	Parcel 00222222	ESS- 040913-EB
Sample Type	Sample ID	Sample Number
Second collected sample on second day of collection	any	B02
Field duplicate of B03 and third collected sample on second day of collection	any	B03
Preparation duplicate for U. S. EPA Method 6200 of above sample	any	B02-PD
Preparation sand blank on 3 rd day	none	C-BLK
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8.2 Container, Preservation, and Holding Time Requirements

All sample containers will have been delivered to the START in a pre-cleaned condition. Container, preservation, and holding time requirements are summarized in Table 4.

8.3 Sample Labeling, Packaging, and Shipping

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Sample labels will be affixed to the sample containers and will contain the following information:

- Sample number
- Date and time of collection
- Site name
- Analytical parameter and method of preservation

Samples will be stored in a secure location on site pending on-site analysis and shipment to the laboratory. Sample coolers will be retained in the custody of site personnel at all times or secured so as to deny access to anyone else.

8. Sample Identification, Documentation and Shipment

The procedures for shipping soil samples are:

- If ice is used then it will be packed in double zip-lock plastic bags.
- The drain plug of the cooler will be sealed with tape to prevent melting ice from leaking.
- The bottom of the cooler will be lined with bubble wrap to prevent breakage during shipment.
- Screw caps will be checked for tightness.
- Containers will have custody seals affixed so as to prevent opening of the container without breaking the seal.
- All glass sample containers will be wrapped in bubble wrap.
- All containers will be sealed in zip-lock plastic bags.

All samples will be placed in coolers with the appropriate chain-of-custody forms. All forms will be enclosed in plastic bags and affixed to the underside of the cooler lid. If samples require refrigeration during shipment then bags of ice will be placed on top of and around samples. Empty space in the cooler will be filled with bubble wrap or similar material. to prevent movement and breakage during shipment. Each ice chest will be securely taped shut with strapping tape, and custody seals will be affixed to the front, right, and back of each cooler.

Samples will be shipped for immediate delivery to the contracted laboratory. Upon shipping, the laboratory will be notified of:

- Sampling contractor's name.
- The name of the site.
- Shipment date and expected delivery date.
- Total number of samples, by matrix and the relative level of contamination for each sample (i.e., low, medium, or high).
- Carrier; air bill number(s), method of shipment (e.g., priority).
- Irregularities or anticipated problems associated with the samples.
- Whether additional samples will be sent; whether this is the last shipment.

8.4 Chain-of-Custody Forms and QA/QC Summary Forms

A chain-of-custody form will be maintained for all samples to be submitted for analysis, from the time the sample is collected until its final disposition. Every transfer of custody must be noted and a signature affixed. Corrections on sample paperwork will be made by drawing a single line through the mistake and initialing and dating the change. The correct information will be entered above, below, or after the mistake. When samples are not under the direct control of the individual responsible for them, they must be stored in a container sealed with a custody seal. The chain-of-custody form must include the following:

- Sample identification numbers

8. Sample Identification, Documentation and Shipment

- Identification of sample to be used for MS/MSD purposes
- Site name
- Sample date
- Number and volume of sample containers
- Required analyses
- Signature and name of samplers
- Signature(s) of any individual(s) with control over samples
- Note(s) indicating special holding times and/or detection limits

The chain-of-custody form will be completed and sent with the samples for each laboratory and each shipment. Each sample cooler should contain a chain-of-custody form for all samples within the sample cooler.

A QA/QC sample summary form will be completed for each method and each matrix of the sampling event. The sample number for all blanks, reference samples, laboratory QC samples (MS/MSDs), and duplicates will be documented on this form. This form is not sent to the laboratory. The original form will be sent to the reviewer who is validating and evaluating the data; a photocopy of the original will be made for the project manager master file.

9 Quality Assurance and Control (QA/QC)

9.1 Field Quality Control Samples

The QA/QC samples described in the following subsections, which are also listed in Tables 3, 4 and 5 will be collected during this investigation.

9.1.1 Assessment of Field Contamination (Blanks)

9.1.1.1 Equipment Blank Samples

If non-dedicated equipment, such as stainless steel trowels or hand augers, is used to collect samples, equipment rinsate blanks will be collected at a rate of one per day to evaluate field sampling and decontamination procedures.

9.1.1.2 Field Blanks

Field blanks will not be collected to evaluate whether contaminants have been introduced into the samples during soil sampling procedures.

9.1.2 Assessment of Sample Variability (Field Duplicate or Co-located Samples)

Duplicate soil samples will be collected at selected sample locations. These locations will be chosen randomly in the field and will be collected at a rate of 1 for every 10 field samples. The duplicate of a composite sample from a decision unit will be comprised of creating a separate split from one of the five sampling sector aliquots. The duplicate of a grid sample will be comprised of sample split.

9.1.3 Laboratory Quality Control (QC) Samples

A laboratory QC sample, also referred to as an MS/MSD, is not an extra sample; rather, it is a sample that requires additional QC analyses and therefore may require a larger sample volume. The chain-of-custody records for these samples will identify them as laboratory QC samples. The location of laboratory QC samples will be selected at random. A minimum of one laboratory QC sample will be submitted per 20 samples (or one per delivery group), per matrix, to be analyzed for each analytical parameter. If the DQIs for analytical parameters are not achieved, further data review will be conducted to assess the impact on data quality. Laboratory QC samples, including laboratory MS/MSD and field duplicate samples, will be selected randomly.

Additional sample volume will be submitted for all lead and arsenic samples designated as laboratory QC samples and will be designated as MS/MSD samples on the chain-of-custody to the fixed-base laboratory.

9.2 Analytical and Data Package Requirements

It is required that all samples be analyzed in accordance with the U.S. EPA Method listed in Tables 3 and 4. The laboratory is required to supply documentation to demonstrate that their data meet the requirements specified in the method. A preliminary data summary is expected within 20 working days after submission of samples for analysis. A full validation data package will be

9. Quality Assurance and Control (QA/QC)

required five weeks after submission of samples. The laboratory will also provide all data electronically in a Microsoft Excel-compatible format or delimited text file.

Deliverables for this project must meet the guidelines in *Laboratory Documentation Requirements for Data Evaluation* (EPA Region IX R9/QA/00.4.1, March 2001). The following deliverables are required. Note that the following data requirements are included to specify and emphasize general documentation requirements and are not intended to supersede or change requirements of each method.

- A copy of the chain-of-custody, sample log-in records, and a case narrative describing the analyses and methods used.
- Analytical data (results) for up to three significant figures for all samples, method blanks, MS/MSD, Laboratory Control Samples (LCS), duplicates, Performance Evaluation samples (if applicable), and field QC samples.
- QC summary sheets/forms that summarize the following:
 - MS/MSD/LCS recovery summary
 - Method/preparation blank summary
 - Initial and continuing calibration summary (including retention time windows)
 - Sample holding time and analytical sequence (i.e., extraction and analysis)
 - Calibration curves and correlation coefficients
 - Duplicate summary
 - Detection limit information
- Analyst bench records describing dilution, sample weight, percent moisture (solids), sample size, sample extraction and cleanup, final extract volumes, and amount injected.
- Standard preparation logs, including certificates of analysis for stock standards.
- Detailed explanation of the quantitation and identification procedure used for specific analyses, giving examples of calculations from the raw data.
- The final deliverable report consisting of sequentially numbered pages.

9.3 Data Management

Data collected during the assessment will consist of field information on properties and occupants, sample collection information, physical description, and analytical data. Field activities and sample information will be documented in a logbook as discussed in Section 6.1.4 and digitally documented as specifically described in the data management plan in Appendix E.

In general, field information will be collected digitally with Scribe software application or Microsoft Access database software application using field computers or tablets. All other electronic data, such as GPS sampling location coordinates, digital photography and video, digital field analytical data, and laboratory generated data will be managed with Scribe software application as described in the data management plan.

9. Quality Assurance and Control (QA/QC)

All data including logbook, complete analytical and validation data packages, photographs, and electronic data and databases will be archived by START. The laboratory data summary and validation reports will be included in the final report submitted to EPA.

9.4 Data Validation

Data validation of all data will be performed by the START or their subcontractor in accordance with U.S. EPA Region IX Superfund Data Evaluation/Validation Guidance R9QA/006.1, December 2001.

The standard data quality review requirements of a Tier 2 validation of 100 percent of the data (as defined in the U.S. EPA document, *Requirements for Quality Assurance Project Plans*, March 2001) will satisfy the data quality requirements for this project. Upon completion of validation, data will be classified as one of the following: acceptable for use without qualifications, acceptable for use with qualifications, or unacceptable for use.

If during or after the evaluation of the project's analytical data it is found that the data contain excess QA/QC problems or if the data do not meet the DQI goals, then the independent reviewer may determine that additional data evaluation is necessary. Additional evaluation may include U.S. EPA Region IX Superfund Data Evaluation/Validation Guidance R9QA/006.1 for evaluation Tier 3.

To meet evaluation and project requirements, the following criteria will be evaluated during a Tier 2 evaluation:

- Data package completeness
- Laboratory QA/QC summaries
- Holding times
- Blank contamination
- Matrix related recoveries
- Field duplicates
- Random data checks
- Preservation and holding times
- Initial and continuing calibration
- Blank analyses
- Interference check samples
- Laboratory control samples
- Duplicate sample analysis

9. Quality Assurance and Control (QA/QC)

- Matrix spike sample analyses
- Sample serial dilution
- Field duplicate/replicate
- Overall assessment of data.

Upon completion of evaluation, an analytical data evaluation Tier 2 review report will be delivered to the project manager, and the data will be classified within the report as one of the following:

- acceptable for use without qualifications
- acceptable for use with qualifications
- unacceptable for use

The data with applicable qualifications will be attached to the report. Unacceptable data may be more thoroughly examined to determine whether corrective action could mitigate data usability.

9.5 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to this plan. When appropriate, the START QA Coordinator and U.S. EPA FOSC will be notified of the modifications and a verbal approval obtained before implementing the modifications. Modifications to the original plan will be recorded in site records and documented in the final report.

9.6 Assessment of Project Activities

9.6.1 Assessment Activities

The following assessment activities will be performed by the START:

- All project deliverables (SAP, Data Summaries, Data Validation Reports, Investigation Report) will be peer reviewed prior to submission to the U.S. EPA. In time critical situations, the peer review may be concurrent with the release of a draft document to the U.S. EPA. Errors discovered in the peer review process will be reported by the reviewer to the originator of the document, who will be responsible for corrective action.
- The QA Coordinator will review project documentation (logbooks, chain-of-custody forms, etc.) to ensure the SAP was followed and that sampling activities were adequately documented. The QA Coordinator will document deficiencies, and the PM will be responsible for corrective actions.

9.6.2 Project Status Reports to Management

It is standard procedure for the START PM to report to the U.S. EPA Task Monitor (TM) any issues, as they occur, that arise during the course of the project that could affect data quality, data use objectives, the project objectives, or project schedules.

9. Quality Assurance and Control (QA/QC)

As requested, the START will provide XRF results to the U.S. EPA TM daily, and unvalidated data will be provided as the data are received from the laboratory.

9.6.3 Reconciliation of Data with DQOs

Assessment of data quality is an ongoing activity throughout all phases of a project. The following outlines the methods to be used by the START for evaluating the results obtained from the project.

Review of the DQO outputs and the sampling design will be conducted by the START QA Coordinator prior to sampling activities. The reviewer will submit comments to the START PM for action, comment, or clarification. This process will be iterative.

A preliminary data review will be conducted by the START. The purpose of this review is to look for problems or anomalies in the implementation of the sample collection and analysis procedures and to examine QC data for information to verify assumptions underlying the DQOs and the SAP. When appropriate to sample design, basic statistical quantities will be calculated and the data will be graphically represented. When appropriate to the sample design and if specifically tasked to do so by the U.S. EPA TM, the START will select a statistical hypothesis test and identify assumptions underlying the test.

10 References

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