

**AMENDED REMEDIAL ACTION PLAN
SOIL REMOVAL
CITY OF PHOENIX PARCEL 308-06-005C
FORMER MANGANESE ORE SITE**

WENDEN, ARIZONA

**Prepared for
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Acronym	Definition
AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
AECOM	AECOM Technical Services, Inc.
bgs	below ground surface
BTEX	Benzene, Toluene, Ethyl-Benzene, and Total Xylenes
COC	Chain of Custody
City	City of Phoenix
DEUR	Declaration of Environmental Use Restriction
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
Four Corners	Four Corners Environmental, Inc.
GPLs	Groundwater Protection Levels
GPS	Global Positioning System
GSA	Government Services Administration
HASP	Health and Safety Plan
IDW	Investigative Derived Waste
NFA	No Further Action
NR-SRL	Non Residential Soil Remediation Level
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
QA/QC	Quality Assurance / Quality Control
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
R-SRL	Residential Soil Remediation Level
SRL	Soil Remediation Level
SS-SRL	Site Specific Soil Remediation Level
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
URS	URS Corporation
USDIBM	United State Department of the Interior, Bureau of Mines
VOCs	Volatile Organic Compounds
VRP	Voluntary Remediation Program
XRF	X-Ray Fluorescent



1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

On behalf of our client, the City of Phoenix (the City), AECOM Technical Services, Inc. (AECOM) has developed this Remedial Action Plan (RAP) to set forth the methods and procedures for a soil removal action to be performed at the McMullen Valley Former Manganese Ore Site (reference Figure 1) located in La Paz County, Arizona (the Site). Specifically, this work plan has been prepared to describe the following:

- Background information including a summary of previous investigations to date;
- Soil removal activities including the proposed excavation boundaries and depths;
- Waste profiling sampling and analysis, transportation and disposal of excavated soil, and backfill of excavations;
- Methods and procedures for field verification and confirmation sampling and analysis;
- Proposed cleanup goals;
- Data collection and analysis to support a Declaration of Environmental Use Restriction (DEUR) for the site;
- Quality Assurance / Quality Control (QA/QC) procedures; and
- Reporting.

Field personnel will be familiar with the contents of this work plan and the health and safety plan (HASp), and are required to have a copy of each document in their possession while conducting the field activities associated with this soil removal action.

1.2 BACKGROUND

As part of a Phase I Environmental Site Assessment conducted on an adjacent property in May 2012, URS Corporation (URS) researched the history of the former manganese ore processing facility located in Tract 26, which comprises a total of 40.4 acres. This area appears to be located in the Artillery Manganese District of west-central Arizona (Spencer, 1991). According to the United States Department of the Interior, Bureau of Mines (USDIBM) document regarding Manganese Deposits of Eastern Arizona (USDIBM, 1961), a manganese ore purchasing depot was established approximately 0.25 mile northeast of Wenden, Arizona in 1953 by the General Services Administration. The purchasing depot was established as a result of steel production increases that occurred during World War II. The facility in Wenden accepted ore containing 15 percent or more of manganese, and from 1953 through 1955, the purchasing facilities in



Wenden, Arizona, and Deming, New Mexico, received 349,521 long tons of ore having a grade of 15 to 35 percent manganese and 17,210 long tons containing over 35 percent manganese from mines in Arizona.

Research (AECOM, 2017) indicates the site is the remnant of a manganese ore mill and sintering plant that the Dasco Mines Corporation operated for less than a year in 1957 and 1958. The ore processing facility was built and operated to concentrate low-grade manganese ore to the 40 percent minimum manganese content specified for subsidized sales under the Government Services Administration (GSA) carlot program that was implemented to purchase manganese for the strategic stockpile that the Federal Government built during the Cold War.

The Dasco Mines Corporation had previously mined and sold \$1.5 million of manganese ore from the Doyle Mine at the Wenden depot, which purchased low-grade ore (minimum of 15 percent) between 1953 and 1955. The Dasco Mines Corporation closed its ore processing facility at Wenden in 1958 when continued mining exhausted the manganese ore at the Doyle Mine. Arizona Ventures Inc. arranged to reopen the ore processing facility but operated it for only about a month in 1959 before GSA met the quota for carlot purchases and terminated the carlot program almost two years earlier than anticipated. All the machinery and equipment at the plant was advertised for sale in 1960, but in 1961 and 1962, the Ampco Engineering Corporation used machinery that remained at the Wenden facility (particularly the sintering plant), probably to a limited extent while researching methods of reducing manganese and iron ore. Operation of the facility left the western portion of the site contaminated and in need of remediation. The Dasco Mines Corporation lost title to the land in 1963 for failure to pay taxes.

2.0 PREVIOUS INVESTIGATIONS

2.1 FOUR CORNERS ENVIRONMENTAL

The Site was included as part of a Phase I Environmental Site Assessment (ESA) conducted by Four Corners Environmental, Inc. (Four Corners) in November, 2005. In 2006, Four Corners performed a limited Phase II ESA at the Site as well as several adjacent sites (Four Corners, 2006). Soil sampling and testing was performed at the Site to assess the potential for metals, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PAHs) related to ore storage and maintenance activities in this area. No TPH, VOCs, or PAHs were identified above laboratory reporting limits. The metals antimony, arsenic, chromium, copper, lead, manganese, nickel, selenium, thallium and zinc were identified at concentrations above laboratory reporting limits but below residential soil remediation levels (R-SRLs) in several samples. In addition, the metals arsenic, lead, and manganese were identified at concentrations above the R-SRLs in several samples. Therefore, Four Corners concluded that the Site had been impacted by historic stockpiling of manganese ore, and that the vertical extent of metals contamination had not been determined.

2.2 URS CORPORATION

In 2011, URS was retained by the City to conduct a Phase I ESA on approximately 13,000 acres of primarily agricultural land known as the McMullen Valley Water Conservation District property. A former manganese ore processing facility was identified within Section 29, Township 6 North, Range 12 West. A debris pile, manganese ore pile, and a landscaping rock pile were observed in this area during the site reconnaissance. URS recommended further assessment of the former manganese ore facility to determine the extent of the impacted area.

At the request of the City, URS performed soil sampling activities within the former manganese ore facility between May 13 and 15, 2013. A total of 146 samples were collected from 46 locations within the Site including an area of piled debris. Samples were collected from the surface (0 to 6 inches below ground surface [bgs]), from a “middle” depth (2.5 to 3 feet bgs) and from a “lower” depth (5.5 to 6 feet bgs).

Surface samples from 20 soil borings within the previous operations area had concentrations of arsenic, lead, manganese, and/or thallium that exceeded the corresponding R-SRLs and/or non-residential soil remediation levels (NR-SRLs). Nineteen of the borings were further analyzed at the middle depth (2.5 to 3 feet bgs). Eight of the nineteen middle-depth samples had concentrations exceeding R-SRLs and/or NR-SRLs for arsenic, lead, manganese, and/or thallium. No benzene, toluene, ethyl-benzene, and total xylene (BTEX), PAHs, polychlorinated biphenyls (PCBs), or organochlorine pesticides were identified above the respective R-SRL or NR-SRL in the debris pile area.



Lead and manganese were identified above the laboratory reporting limits in all seven lower-depth samples; however, concentrations of these metals were below their respective R-SRLs and NR-SRLs. Arsenic and thallium were not detected in any of the seven lower-depth samples above laboratory reporting limits (URS, 2011).

Based on 2013 site observations, the manganese ore pile and the landscape rock pile had been removed from the Site. However, a concrete pad on which both piles were placed remained in place.

In 2015, URS was retained by the City to collect and analyze soil samples for assessment of metals impacts to soil for the purpose of tabulating, mapping, and statistically evaluating the analytical data. In addition, URS performed a limited human health Risk Assessment to develop Site-Specific Soil Remediation Levels (SS-SRLs). The main purpose of the work was to reduce the uncertainty in the cost of a potential soil removal action at the Site.

Soil sampling was performed in March and May 2015 at the former Operations Area, and utilized a 10 row by 7 column grid comprised of 100 foot by 100 foot grid cells. The total grid size covered an area of 70,000 square feet (1.6 acres) of the approximately 16 acre Site. Both surface and subsurface soil samples were collected to characterize the lateral and vertical extent of metals concentrations in soil. Comprehensive field analysis for metals was performed using an x-ray fluorescent (XRF) analyzer, and a limited amount of samples were also analyzed by a fixed-base laboratory using Environmental Protection Agency (EPA) Methods 6010B and 1311 for target metals and Toxicity Characteristic Leaching Procedure (TCLP) metals, respectively. Results are summarized in a Soil Sampling and Risk Assessment Results Report dated April 2016 (URS, 2016).

A Risk Assessment was completed to evaluate the risk to human health posed by the metals-impacted soil for both Teenage Trespasser and Agricultural Worker exposure scenarios at the Site and to develop site-specific soil remediation levels (SS-SRLs) for arsenic, lead, manganese, and thallium, above which the soil may pose a risk to human health under the evaluated exposure scenarios. URS estimated the quantity of soil to be removed for three options: a) remediation to R-SRLs; b) remediation to NR-SRLs; and c) remediation to SS-SRLs (URS, 2016). The City selected the NR-SRL remediation standard for future remedial action at the Site.

On June 7, 2016, the City submitted an application to the Arizona Department of Environmental Quality (ADEQ) to conduct remedial actions at the Site under the oversight of the Voluntary Remediation Program (VRP). The application was approved on June 29, 2016.



AECOM performed a cultural resources survey at the Site, the field work for which was performed in January 2017. The results of the survey were documented in a report dated April 2017 (AECOM, 2017). The location of historical features and structures identified at the Site are presented in Figure 2.

3.0 REMEDIAL STRATEGY

3.1 REMEDIATION GOALS AND OBJECTIVES

The overall goal of remediation at the Site is to address contamination resulting from historical use of a former manganese ore processing facility and allow for non-residential use of the subject property. To this end, the City has decided to use pre-determined NR-SRLs, as identified in the Arizona Administrative Code (A.A.C). R18-7-Appendix A, as the soil remediation goal(s) for the Site.

The constituents of concern to be addressed via a remedial action and their associated remediation goals are:

Constituent of Concern	Remediation Goal	Remediation Standard
Arsenic	10 mg/Kg in soil	NR-SRL
Lead	800 mg/Kg in soil	NR-SRL
Manganese	32,000 mg/Kg in soil	NR-SRL
Thallium	67 mg/Kg in soil	NR-SRL

Note: Levels are based on standards established in Appendix A of the Arizona Administrative code, Title 18, Chapter 7, revised March 2009.

These pre-determined levels are deemed to be protective of human, and therefore, no additional site-specific human health risk assessment will be performed in support of this RAP. To achieve these goals, soil containing metals at concentrations exceeding the NR-SRL will be excavated and removed from the Site.

In addition, pursuant to A.A.C. R18-7-203, soil remediation activities complying with predetermined remediation standards (i.e., SRLs) must also ensure that any potential residual contamination does not:

- Contaminate or threaten to contaminate groundwater or surface water in excess of water quality standards;
- Exhibit a hazardous waste characteristic of toxicity, ignitability, corrosivity or reactivity; and
- Cause or threaten to cause an adverse impact to ecological receptors.

Centennial Wash is located about one-quarter mile distant from the Site and to the south of railroad tracks adjacent to the property. Depth to groundwater at the Site is estimated to be more



than 400 feet, therefore impacts to groundwater from Site activities are not expected. A total of 41 soil samples were collected by URS in March and May 2015 and analyzed using TCLP to determine if the soil exceeded the regulatory thresholds for the toxicity characteristic. None of the samples exceeded the regulatory levels. Therefore, the soil is not expected to exhibit a hazardous waste toxicity characteristic. The soils are also not expected to be ignitable, corrosive, or reactive. However, sampling will be conducted on the excavated soils to properly characterize them for disposal during remediation.

An ecological assessment has not been performed for this Site.

Additional objectives of the remedial action are to:

- Protect human and environmental receptors from exposure to Site contamination during remedial action implementation;
- Mitigate disturbance to surrounding property users during remedial action implementation;

3.2 SCOPE OF REMEDIAL ACTION

At the direction of the City, AECOM has prepared this RAP for a soil removal remedial action at the Site. No alternative remediation strategies were investigated or evaluated.

Based on direct comparison of observed chemical concentrations in Site soils to SRLs, only Site soils containing concentrations above the associated NR-SRL, of arsenic, lead, manganese, and thallium require remediation. The areas requiring soil removal are depicted in Figure 3. Excavation depths are expected to vary from a minimum of 1 foot to a maximum of 6.5 feet depending on location.

3.3 DATA GAP ANALYSIS

During Site Characterization activities, a southeast flow pattern for drainage was noted across the Site. This was confirmed through review of recent aerial photographs. Although the current sampling grid did not indicate impacted soil is migrating southeast across the Site, additional sampling will be conducted within the drainage pathways during the remediation activities to verify the horizontal extent of impacted soil.

3.4 DECLARATION OF ENVIRONMENTAL USE RESTRICTION

Upon completion of remedial action and achievement of the remedial goals for the Site, the City intends to file a DEUR on the portion of the property that contains impacts above R-SRLs. A description of the DEUR process is presented in Section 11.

4.0 CONTRACTOR SELECTION

The City will use a competitive process to solicit and award a contract to perform soil removal, transportation, and disposal activities at the Site. Contractor selection will consist of the following activities:

- Bid Specifications
- Bid Solicitation
- Contractor Selection

4.1 BID SPECIFICATIONS

The City has contracted with AECOM to develop Technical Specifications for the removal, transportation, and disposal of soil at the Site which will include but not be limited to the following:

- Administrative requirements including schedule, pre-construction meetings, progress meetings and reports;
- Permits required;
- Health and safety requirements;
- Temporary facilities and controls;
- Site controls;
- Earthwork including clearing and grubbing, fill construction, watering, impacted soils excavation, stockpiling, and environmental controls;
- Transportation requirements;
- Disposal requirements;
- Traffic control; and
- Figures.

4.2 BID SOLICITATION

The City will use the Technical Specifications along with their standard contractual documents to issue and advertise the solicitation for a soil removal Contractor. The City and its consultant (AECOM) will conduct a pre-bid meeting at the Site and answer questions regarding the Technical Specifications and the project.



4.3 CONTRACTOR SELECTION

After solicitation and receiving bids, the City will review the bid packages and choose the Contractor providing the best value to the City. The Contractor selection criteria will be based on contractor qualifications including similar project experience, approach, and cost.

5.0 REMEDIATION WORK PLAN

5.1 PROJECT TEAM

The McMullen Valley remedial action project will consist of the following stakeholders:

- Remediation Contractor (to be determined);
- Remediation Consultant (AECOM);
- Waste disposal facility (to be determined);
- Arizona-licensed Analytical Laboratory for confirmation sampling (ESC Lab Sciences; and
- Arizona-licensed Analytical Laboratory for waste profiling (to be determined); and
- City of Phoenix.

5.2 PRE-EXCAVATION ACTIVITIES

5.2.1 Project Initiation

Below is a description of the minimum requirements for the project. Project initiation activities will begin once the remediation Contractor has been selected.

- A **Project Kick-Off Meeting** should be held with all parties involved. The purpose of this meeting will be to discuss remediation details and establish lines of communication for the remediation effort.
- Development of an **Excavation Sequencing Plan**; This will be developed by the Remediation Contractor and approved by the Remediation Consultant (AECOM) and City of Phoenix.
- **Obtain all the necessary Permits.**

The following permits or approvals (organized by regulatory authority) may be required for remedial action activities:

- ADEQ
 - Arizona Pollutant Discharge Elimination System (AZPDES) Notice of Intent for the Construction General Permit
 - Stormwater Pollution Prevention Plan
 - Dust control requirements
 - NESHAP sampling and demolition notification for concrete slab(s)



All appropriate permits must be obtained before site work begins; permits not listed above may also be required and should be obtained before starting work.

- A residential area is located adjacent to the Site, therefore neighborhood notices will be distributed as described in the community involvement plan (Section 9) a contact name and phone number of the City project manager if they have any questions. This is not required, but is recommended to keep the local community informed and involved.

5.2.2 Health and Safety

A site specific Health and Safety Plan (HASP) will be developed for the excavation work. Personal protective equipment required for this work, at a minimum is Level D. Long-sleeved shirts, safety glasses, steel-toed boots, appropriate gloves when sampling or handling soil, and hard hats should be worn when on site and risks are present. The Contractor and AECOM will each prepare a HASP in accordance with their respective company requirements. Each HASP will be prepared in accordance with Title 29 of the Code of Federal Regulations (29 CFR) 1910.

5.2.3 Utility Location

Before initiating excavation activities, Arizona 811 will be notified to mark and clear public utilities within the boundaries of the Site. If subsurface structures or any utilities are encountered, the Contractor will be required to take additional care in these excavation areas.

5.2.4 Site Preparation

The site preparation activities to be performed will include the following:

- A **site pre-survey** will be conducted by AECOM to stake out the proposed extent of excavations, with witness stakes to identify cut depth. A series of supplemental excavation area exterior perimeter stakes (at known setbacks) may be used to allow for intrusive site works without compromising surveyed locations. The pre-survey will be conducted by a land surveyor licensed in the State of Arizona. Acceptable tolerances for the excavation areas will be ± 1.0 foot for lateral distances.
- A **Site Field Meeting** will be held to:
 - Establish and/or review Ingress/Egress (may include temporary removal/relocation of fence and gates)
 - Establish and/or review Site Security
 - Layout Work Zones (Exclusion Zone, Contaminant Reduction Zone, Support Zone, etc.)

- Establish and/or review Soil Stockpiling Plan (including placement of liners, temporary covers, etc.)
- Establish and/or review clearing and grubbing plan (including demolition and removal of concrete pad, where necessary to facilitate excavation)
- Review the requirements of the previously prepared Stormwater Pollution Prevention Plan
- Review Air Monitoring/Dust Control requirements
- Review the Health and Safety Plan(s) and establish protocols for daily safety meetings
- Establish and/or review the decontamination procedures for vehicles exiting the Site
- Establish and/or review the transportation route for hauling soil to the selected disposal facility
- Review bill of lading/manifest requirements for soil disposal
- **Mobilize equipment and materials to the Site**, including decontamination of equipment, prior to arrival at the Site (at a minimum, equipment decontamination will include physical removal of any existing soil adhering to equipment).
- **Conduct clearing and grubbing of excavation areas** (as required) with stockpiling of debris in designated areas (if necessary) and transport to an appropriate disposal facility. Grubbing material should be considered to be impacted by the constituents of concern due to soil adhering to the roots.
- **Remove/Relocate site fencing (if necessary), and remove any other fixed site features (e.g., concrete pads) in excavation areas**, as necessary, with subsequent transport to and disposal at an appropriate waste facility (to be coordinated with the Remediation Consultant).

5.2.5 Potholing and Sampling

Following clearing and grubbing activities, preliminary sampling will be conducted and laboratory analysis performed to provide additional data in areas where XRF analysis indicated a potential exceedance of arsenic and/or thallium NR-SRLs or where samples were not able to be



obtained due to access restrictions. Contractor excavation equipment will be used to pot-hole and collect soil samples at the desired depth(s) at the identified locations on the sampling grid:

Sample Grid Location	Depths to be Sampled (feet)
H8	3, 6
I7	3, 6
J8	3, 6
L4	3, 6
S9	0.5, 3, 6
T4	0.5, 3, 6
P10	3
N6	3
G11	3
R4	0.5

Samples will be analyzed for the target metals arsenic, lead, manganese, and thallium as described in Section 6.0. The laboratory results will be used to evaluate whether to expand excavation boundaries or establish new excavation areas.

Contractor excavation equipment will also be used to pot-hole and collect several soil confirmation samples (those at 3 feet or deeper) in areas where excavation is not planned. These samples are discussed further in Section 5.3.4.

5.2.6 Preparation of Circular Concrete Footing

The circular concrete footing identified in Figure 2 consists of two semi-circular concrete structures that stand about 5 feet above the ground. The two parts are separated by a gap of about 5.5 feet in width. Fifteen wooden beams are set horizontally into the concrete and span the gap between the two semi-circular structures. The structure is believed to be the base of a Dorr thickener and steel tank.

In order to prepare for excavation (see Section 5.3.1), the beams will be removed from the concrete structure and vegetation will be removed.

5.3 SOIL EXCAVATION

The minimum volume of soil (bank or in-place) to be removed has been estimated at 387,160 cubic feet (14,340 cubic yards) of soil (reference Figure 3). This quantity of soil was estimated assuming that soil excavation will proceed to a depth no more than six inches below the depth at which soil exceeds the NR-SRL. The maximum volume of soil to be removed is estimated to be

751,590 cubic feet (27,840 cubic yards) of soil which was estimated based on excavation proceeding to a depth of 2.5 feet below the depth at which soil samples exceeded the NR-SRL. [Note that vertical characterization samples were collected at depths of 6 inches, 3 feet, and 6 feet with no information available regarding the concentration of constituents of concern in the soil between the 6-inch and 3-foot sample or between the 3-foot and 6-foot sample. Therefore, there is uncertainty with regard to the quantity of soil that must be removed to achieve NR-SRLs.]

The Remediation Contractor will remove the soil and stockpile in designated areas prior to loading and transporting the soil to the appropriate disposal area.

The Remediation Consultant will be responsible for overseeing the excavation activities to ensure that the Contractor is performing the project in accordance with the approved Remedial Action Plan and the Technical Specifications for the project.

5.3.1 Excavation Areas and Decision Units

The proposed excavation plan (Figure 3) delineates areas to excavate to 1 foot, 3.5 feet, 4.5 feet, and 6.5 feet based on past laboratory analysis and XRF screening of soil samples. This excavation plan is expected to achieve NR-SRLs for the target metals arsenic, lead, manganese, and thallium.

Figure 4 depicts 23 Decision Units (DUs) located within and surrounding the former process area of the Site including the proposed excavation areas and areas that are not planned for excavation. These DUs range in size from about 400 square feet to 1.68 acres. Two additional larger DUs are proposed for areas outside of the historic processing area that contains native soils. DU 24 encompasses the property to the east of the processing area. DU 25 includes the area to the south of the processing area and north of the railroad tracks.

A summary of the DUs is presented in Table 1. The table includes a list of all sampling performed within each DU, the type of sample analysis (laboratory or XRF), a narrative description of whether the analysis indicated an exceedance of the NR-SRL, flagging of historic sample locations that are not expected to be disturbed by proposed excavation activities, the source of the sampling data, a short description of the activities to be conducted within each DU, and a description of the proposed confirmation sampling for the DU.

With the following exceptions/additions, excavation will follow the plan indicated on Figures 3 and 4:

- Mill Foundation / Concrete Slab (DU 1c) – Soil and/or ore will be scraped, swept, and vacuumed off the surface of the concrete and stockpiled for disposal. An approximately two-foot-wide trench will be excavated around the perimeter of the concrete mill foundation and the concrete slab to a depth equaling the base of the footers (depth unknown) and confirmation soil samples collected (see Section 5.3.3). The soil from the trench excavation will be stockpiled for disposal.
- Circular Concrete Structure (DU 1d) – Soil and/or ore will be scraped, swept, and vacuumed off the surface of the concrete and stockpiled for disposal. A two-foot-wide trench will be excavated around the perimeter of the semi-circular concrete structures to a depth equaling the base of the footers (depth unknown) and confirmation soil samples collected (see Section 5.3.3). Such excavation will also occur in the gap area with collection of confirmation samples from the base of the excavation (see Section 5.3.3). The soil from the trench excavation will be stockpiled for disposal.
- Excavation Area 5, DU 5a –Sampling in this area indicated exceedances of the NR-SRL at 3 foot depths with no exceedances occurring at shallower depths. Following clearing and grubbing in this DU, two feet of soil will be excavated and the soil stockpiled pending sampling and analysis. Excavation will then continue to total depth (3.5 feet as indicated in Figure 3). Should sampling and analysis of the stockpiled surface soil indicate that target metals concentrations in soil are less than NR-SRLs, the stockpiled surface soil may be used as backfill for the excavation within the planned DEUR areas. Should sampling and analysis of the stockpiled surface soil indicate that target metals exceed the NR-SRL, the soil will be transported off-site for disposal.

5.3.2 Soil Stockpiling

The Remediation Contractor will designate areas to stockpile excavated soil. The soil will be placed on impermeable sheeting spread on the ground surface until the soil can be loaded in trucks and transported to the appropriate disposal facility. All stockpiles will be covered with impermeable sheeting waste pile cover or regularly sprayed with potable water to mitigate generation of fugitive dust.

Because of the large volume of soil to be transported to an appropriate disposal facility, excavation and loading may need to be conducted in stages to minimize the volume of stockpiled soil at the Site.

Following final removal of the stockpiles, the soil underlain by the stockpile footprint(s) will be sampled and tested by XRF for target metals arsenic, lead, manganese, and thallium. Should the soil exhibit concentrations of the target metals less than the NR-SRLS, samples will be collected



for laboratory analysis. Should XRF or laboratory analysis indicate soil concentrations greater than the NR-SRLs, surface soil will be excavated and the area re-tested. Excavation and retesting (XRF and laboratory analysis) will be repeated until laboratory results indicate metals concentrations in soils remaining following stockpile removal are less than NR-SRLs.

5.3.3 Proposed Excavation Boundary Soil Screening

If inspection of the excavation work indicates that the boundaries are correct and there are no visual signs of metals impact to soil, the Remediation Consultant will perform field screening of soil samples collected from the floor and sidewalls of the excavation using an XRF analyzer. The process is described below:

- **Collection of at least one soil sample from each wall and floor of each excavation area** – Samples will be collected at a frequency of 1 per 25 linear feet of excavation perimeter and 1 per 625 square feet of the excavation floor. The perimeter samples will be collected at depths corresponding to the exceedance of the NR-SRL observed during Site Characterization activities. The excavation area will be divided into units of equal area (625 square feet) and the perimeter marked in 25 linear foot increments prior to sampling. Perimeter samples will be collected at the center of the 25-linear-foot section and floor samples will be collected at the center of the areal unit.
- **On-site, field screening of soil samples** for analysis of target metals arsenic, lead, manganese, and thallium using a XRF analyzer will be conducted during excavation activities.
- **Evaluation of results** – Individual sample results for target metals will be directly compared to remediation criteria. If all results for a particular excavation area are less than corresponding remediation criteria, the excavated extent of the area will be deemed sufficient to begin collecting laboratory confirmation samples. If any sample result exceeds the corresponding remediation criterion, additional excavation will be performed. In addition, samples may be collected for XRF analysis to determine the extent of the exceedance as explained below.
 - In the event of exceedance along the perimeter, additional XRF analysis will be conducted in both directions along the sidewall (at lengths to be determined in the field) to establish the extent of the exceedance of the remediation criteria. For example, if the adjacent perimeter sample in a given direction also exceeds remediation criteria, no additional samples will be collected and analyzed in between those two perimeter samples. If the adjacent perimeter sample (25-foot distant) indicates target metal concentrations less than the remediation criteria,

then additional samples will be collected at intervals of no less than five feet to establish the length of perimeter to be excavated. The excavation will then be extended outward five feet along the length of sidewall with soil exceeding the remediation criteria and extending to the nearest sample(s) that do not exceed remediation criteria. The new perimeter will then be sampled at a frequency of one sample per 25-linear-foot section.

- In the event that the results of analysis of a floor sample indicates that target metals exceed remediation criteria, XRF analysis will be conducted at intervals to be determined in the field to establish the areal extent of the exceedance in all directions. For example, if an adjacent floor sample in a given direction also exceeds the remediation criteria, no additional samples will be collected between those two samples (that is, the entire area between the two samples will be considered to exceed remediation criteria). If the adjacent floor sample does not exceed remediation criteria, additional floor samples will be collected and analyzed by XRF to delineate the extent of the exceedance in that direction. Delineation samples will be collected at intervals of no less than five feet. The delineated area (including the area up to the nearest sample in each direction that does not exceed remediation criteria) will be excavated an additional 0.5 feet in depth. The new excavation floor will be re-sampled at a rate of one sample per 625 square feet.

5.3.4 Confirmation of Excavation Boundary Soil Sampling

Following verification of the excavation extent with the XRF analyzer, confirmation soil sampling for laboratory analysis will be conducted in each DU by the Remediation Consultant. A summary of the number and location of confirmation samples to be collected in each DU is provided in Table 1 including the depths of the proposed samples below initial grade. Confirmation sampling locations are depicted in Figure 5 for DUs located outside of the former processing area. Figure 6 depicts proposed confirmation sampling locations for DUs within and adjacent to the former ore processing area. Proposed laboratory confirmation samples that are located outside of planned excavation areas and that will be collected at depths of 0.5 feet will be collected using a shovel and/or trowel. Proposed laboratory confirmation samples that are located outside of planned excavation areas and that will be collected at depths of 3 feet or greater will be collected by potholing using Contractor excavation equipment. This subset of deeper confirmation sampling locations is summarized in the table below:

Sample Grid Location	Depths to be Sampled (feet)
D2	0.5, 3
A1	3
E3	3
S1	0.5, 3, 6
Q11	3
U11	6
M11	0.5, 3
H12	0.5, 3
A7	0.5, 3
A9	0.5, 3
B8	0.5, 3

Figure 6 also indicates historic sampling point locations (and depths) for which laboratory data are available and which are not expected to be disturbed by excavation activities. These data may be used along with confirmation sampling results to demonstrate that a DU meets either R-SRLs or NR-SRLs. Note that the depths of wall and floor samples for the excavated areas are described in Table 1, but not indicated on Figure 6. Collected samples will be submitted for analysis of target metals as described in Section 6.0.

Analytical results for each DU will be compared to R-SRLs and NR-SRLs to evaluate whether: a) remedial goals have been achieved for the DU; and b) the DU meets R-SRL or NR-SRL criteria (i.e., whether a DEUR is required for the DU). The analytical data set for a DU may be used to calculate the 95% upper confidence limit (UCL) of the mean. If the 95% UCL is less than remediation criteria, the remedial action will be deemed as compliant with remediation objectives. Non-normal distributions will be addressed using standard statistical methodologies, as appropriate, to yield similar tests of confidence. If the 95% UCL exceeds remediation criteria, then the data will be assessed to evaluate whether additional sampling is warranted or if additional targeted excavation is required.

5.3.5 Excavation Backfill

Excavation backfill will consist of either: a) imported backfill; or b) a combination of on-site soil from DU 5a and imported backfill.

The Remediation Contractor will select an appropriate source of clean fill and forward the location and known history of the fill site to the Remediation Consultant. The Remediation Contractor will sample the fill site at an appropriate frequency based on the fill site location and



historical information. The sample will be collected using standard environmental sample protocols and submitted to a City approved, Arizona-licensed laboratory for analysis of Total Organochlorine Pesticides (via EPA Method 8081), PAHs (via EPA Method 8310), Resource Conservation and Recovery Act (RCRA) 8 Metals (via EPA Method SW6010B), and PCBs (via EPA Method 8082). Sample results must all be less than R-SRLs for concurrence by the Remediation Consultant and the City that the fill is clean. As this process will take a minimum of 1 to 2 weeks to accomplish, the Remediation Contractor will ensure this task is adequately scheduled prior to when the fill is required.

Imported clean fill will be delivered to the Site and unloaded either directly into excavation areas or clean stockpiles for later placement in the excavation areas. In general, compaction of fill in excavation areas will be required.

It is important to note that excavations will not be filled until acceptable results from confirmation soil sampling have been obtained by the Remediation Consultant. Confirmation soil sampling will require that all excavation areas remain exposed until sampling activities demonstrate that remediation objectives have been met.

6.0 ANALYTICAL

6.1 CONFIRMATION SOIL SAMPLING

6.1.1 Analytical Methods

AECOM will ship or transport the confirmation soil samples to ESC Lab Sciences, an Arizona Department of Health Services (ADHS)-certified analytical laboratory (ADHS license number AZ0612) for analysis of arsenic, lead, manganese, and thallium using EPA Method 6010B.

6.1.2 Sample Collection

Soil samples will be collected using a decontaminated trowel or shovel, hand auger, or drive sampler. Samples will be placed into laboratory-supplied containers. One 8-ounce jar should be sufficient for each sample.

6.1.3 Sample Preservation and Handling

AECOM will place the confirmation soil sample in a cooler immediately following collection and pending transportation to the laboratory for chemical analysis. Field preservation is not required for metals analysis. The holding time for the samples is 28 days. All samples will be handled and shipped using standard chain-of-custody (COC) procedures.

6.1.4 Sample Labels

AECOM will label each sample container with the unique identifier assigned to the sample location, which will also be recorded in the field logbook as it is collected. The sample identification will also be documented on the COC form. Data pertinent to each sample such as sample identification, location, time, and date will be recorded in the field documents.

6.1.5 Chain of Custody

All samples will be accompanied by a COC, which will be completed AECOM field personnel collecting the sample(s). One COC will accompany each sample cooler or shipping container. Whenever a sample is transferred to another responsible party in an unsealed cooler, the receiving party must sign off on the COC form. The original COC accompanies the samples to the laboratory, a copy is retained by Remediation Consultant, and a final copy is returned with the analytical results.

6.2 WASTE CHARACTERIZATION SAMPLES

The Remediation Contractor will collect samples of excavated soil for characterization, profiling, and disposal considerations. The samples will be analyzed for 8 RCRA total metals and TCLP metals. Additional analysis may be requested at the direction of the disposal facility.



7.0 QUALITY ASSURANCE AND QUALITY CONTROL

7.1 EQUIPMENT DECONTAMINATION

Excavation equipment will be decontaminated prior to entering the Site. All vehicles exiting the Site will be decontaminated prior to exit by brushing soil off of the vehicles.

Hand spades, shovels, and other sampling equipment will be decontaminated to prevent cross contamination between sampling locations. Decontamination of soil sampling equipment will include rinsing or spraying the equipment with water and Alconox followed by rinsing the equipment with deionized or distilled water.

7.2 DUPLICATE SAMPLES

AECOM will collect duplicate soil samples, which will be analyzed for the same parameters as the original soil samples to evaluate sampling and analytical precision. The field duplicates will be collected and analyzed in the same manner as the primary sample, but submitted to the laboratory blind. Field duplicates are typically collected at a frequency of 10 percent of the primary samples collected, with a minimum of one duplicate collected. To prepare the duplicate samples, a sufficient quantity of soil will be placed within a plastic bag and mixed thoroughly. The field original and field duplicate sample will then both be collected from the mixed soil.

7.3 EQUIPMENT BLANKS

Field equipment blanks are samples that are prepared in the field by pouring deionized water over decontaminated sampling equipment and collecting the water in laboratory provided sampling containers. The field equipment blank gives an indication of contamination from field procedures (for example, improperly cleaned sampling equipment). AECOM will collect one field equipment blank sample at the start of each day in which sampling activities are being conducted.

7.4 DATA VERIFICATION

The laboratory will provide a minimum of a Level II Quality Control laboratory data package. Following receipt of the data package from the laboratory, AECOM will perform data verification to evaluate the reliability and defensibility of the analytical data. This process involves reviewing the data against a known set of criteria to verify data quality. A copy of the data verification report will be included with the Remedial Action Completion Report (See Section 10).



8.0 REMEDIATION WASTE AND INVESTIGATION DERIVED WASTE

This section describes the methods used to manage the remediation waste and investigation-derived waste (IDW) generated during the excavation activities at the McMullen Valley Former Manganese Ore Processing Facility. This will require the management of the following waste streams:

- Cleared/grubbed material
- Concrete demolition waste
- Excavated/stockpiled soil (remediation waste)
- Decontamination water (IDW); and
- Sampling supplies and personal protective equipment.

8.1 CLEARED/GRUBBED MATERIAL

Grubbing material should be considered to be impacted by the constituents of concern due to soil adhering to the roots and will be profiled for disposal in a manner similar to excavated soil (Section 8.3)

8.2 CONCRETE DEBRIS

Concrete will be sampled prior to demolition to verify that no asbestos-containing material is present. Sampling will be performed as required by US Environmental Protection Agency (USEPA) regulation 40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAP) in general accordance with the protocols of USEPA regulation 40 CFR Part 763, Asbestos Hazard Emergency Response Act (AHERA). Because soil may adhere to concrete debris, the concrete will be profiled for disposal in a manner similar to excavated soil. (Section 8.3). Chip sampling of the concrete to be removed for disposal will be conducted to determine if the concrete should be considered characteristically hazardous for arsenic and lead.

8.3 EXCAVATED AND STOCKPILED SOIL (REMEDIATION WASTE)

The existing analytical data for soil at the Site will be provided to the Remediation Contractor for preparation of a waste profile for excavated soil. Based on previous TCLP analysis of soil at the Site, the soil is not expected to be characterized as non-hazardous waste and may be disposed as metals-impacted non-hazardous soil at a municipal solid waste landfill to be selected by the Remediation Contractor and approved by the City.



Based on the requirements of the disposal facility, additional sampling of excavated and stockpiled soil may be required. The frequency of sampling and required analyses will be determined by the disposal facility. The Remediation Contractor will be responsible for additional profile or operational sampling prior to or during soil removal activities.

8.4 DECONTAMINATION WATER

Decontamination water generated from equipment decontamination will be segregated and placed into 55-gallon drums on site for temporary storage pending receipt of the waste profile analyses. The drums will be labeled with the contents and the generation start date. Disposal will be dependent upon results of analysis. If analysis indicates that the concentration of target metals in water are less than Aquifer Water Quality Standards, the water will be surface discharged on Site. If metals exceed Aquifer Water Quality Standards, the water will be transported in drums to an appropriate disposal facility.

8.5 SAMPLING SUPPLIES AND PERSONAL PROTECTIVE EQUIPMENT

Gloves, other personal protective equipment, and other disposable equipment used for sampling will be double bagged in plastic trash bags and disposed of as non-hazardous solid waste.



9.0 COMMUNITY INVOLVEMENT

The City proposes to comply with the Community Involvement requirements under the ADEQ Voluntary Remediation Program (VRP) as follows:

- Neighborhood notices will be mailed or distributed to homes within one-quarter mile of the project Site prior initiation of Site work;
- A sign will be posted at the project Site notifying the public of remediation activities; and
- Public notice will be issued of the No Further Action request.

The notice(s) and sign will provide the name and telephone number for Ms. Elizabeth Zima, Environmental Quality Specialist, as the City contact person for additional information regarding project activities. Contact details will also be provided for the current ADEQ VRP Project Manager.

10.0 REPORTING

Following completion of remediation activities, AECOM will document soil removal activities in a Remedial Action Completion Report for submission to the ADEQ VRP. The Remedial Action Completion Report will include:

- Introduction and background
- Summary of required permits (copies of permits may be included in appendices to the report)
- A summary of dust control and dust monitoring activities
- Results of waste characterization sampling
- Copies of waste profiles
- Weight of non-hazardous soil transported and disposed (including copies of weight tickets)
- Summary of excavation extent (planned versus actual)
- Results of XRF field analysis verification sampling
- A summary of confirmation samples collected including the depth of the sample below original ground surface (i.e., depth of excavation plus depth of sample in undisturbed soil) and date and time collected
- Results of laboratory analysis for confirmation sampling
- Data verification documentation
- Weight of backfill imported
- Site closeout activities
- Photographic documentation
- Conclusions and recommendations

The report will contain a summary of the verification and confirmation data in tabular format, as well as a map indicating sample locations and analytical results for each sample location and depth. Each sample location on the map will be marked with the sample identification number. Metals concentrations will be posted next to each sampling location. Analytical results for target metals in soil confirmation samples will be compared to their respective Arizona R-SRLs and NR-SRLs.



11.0 POST-REMEDATION ACTIVITIES

Upon acceptance of the Remedial Action Completion Report by the ADEQ VRP, the City will initiate the process of filing a DEUR on the portion of the property (based on DUs) that contains impacts above R-SRLs. The remediation consultant will perform a survey of the area of the project site to be restricted, and prepare a legal description of the area containing soil exceeding R-SRLs. The legal description and accompanying figure will be sealed by an Arizona-licensed surveyor and will be included in a DEUR application. The DEUR application will be submitted to the ADEQ for review and approval along with a no further action (NFA) request report per ARS 49-181. After the public comment period has ended and ADEQ has approved the DEUR and conditionally approved the NFA, the City will record the DEUR and submit it to ADEQ for final approval of the NFA.



12.0 SCHEDULE

The following is a list of activities planned as part of this work plan and the anticipated approximate schedule as to when they will begin and end.

Activity	Start Date	End Date
Submit Remedial Action Plan to ADEQ for Review and Comment	9/14/2016	10/24/2016
Submit Revised Remedial Action Plan to ADEQ for Review and Comment	-	5/17/2017
Receive Comments from ADEQ on Remedial Action Plan	-	6/21/2017
Submit Revised Remedial Action Plan (if necessary) to ADEQ for Approval	-	7/12/2017
Receive Approval from ADEQ on Remedial Action Plan	-	7/17/2017
Prepare Technical Specifications for Contractor Solicitation	-	6/2/2017
Soil Removal Action Solicitation Issued	-	6/29/2017
Conduct Bid Walk at Site	-	7/7/2017
Remedial Contractor Evaluation and Award	-	7/24/2017
Remedial Contractor Notice to Proceed	-	10/24/2017
Conduct Remedial Action	11/1/2017	12/29/2017
Prepare Remedial Action Completion Report	1/2/2018	2/9/2018
Submit Remedial Action Completion Report to ADEQ for Review and Comment	-	2/9/2018
Receive Comments from ADEQ on Draft Remedial Action Completion Report	-	3/26/2018
Submit Final Remedial Action Completion Report to ADEQ for Approval	-	4/13/2018
Submit DEUR and Request for NFA Report	4/16/2018	4/16/2018

It should be noted that there are many variables that can affect schedules, including unforeseen field conditions, document review time, and equipment breakdown.



13.0 REFERENCES

- AECOM, 2017. Cultural Resource Survey for the City of Phoenix, McMullen Valley Remediation Project, La Paz County, Arizona. April.
- Arizona Administrative Code (AAC), 2009a. Title 18, Environmental Quality. Chapter 7, Department of Environmental Quality. Remedial Action. March 31.
- EPA, ProUCL Version 5.1, May 2016
- Four Corners Environmental, Inc., 2006. *Final Letter Report for Limited Phase II Environmental Site Assessment, Sites 4, 5, 6, 7 and 8 of the 11 City of Phoenix, McMullen Valley Property Sites, Salome and Wenden, Arizona*. Prepared for the City of Phoenix (Project No. 8429100000). Four Corners Project No. 06067. September 14.
- Spencer, Jon E. 1991. The Artillery Manganese District in West-Central Arizona. Arizona Geological Survey.
- URS, 2011. *Phase I Environmental Site Assessment McMullen Valley Water Conservation District Property, Approximately 13,000 Acres, La Paz County, Arizona*. July
- URS, 2016. *Soil Sampling and Risk Assessment Results Report McMullen Valley Former Manganese Ore Site, La Paz County, Arizona*. April.
- USDIBM, 1961. *Manganese Deposits of Eastern Arizona*.

TABLES

Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) <i>see notes</i>	Analysis Type	Results <small>(As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)</small>	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU	
1a (1.145)	PO-4	0.5	Lab	No exceedances	URS, 2013 Phase II ESA	Re-locate concrete saddles to site area not impacted by site activities. Excavate as indicated on Figure 3. Decision Units 2, 7, and 8 are also located within this DU. Collect confirmation samples from sidewalls at 0.5 feet and floor of excavation.	Floor	8	24 Plus 10 existing Plus confirmation samples from DU 7, 8, and 2 See Figure 6	
	SB-1	2, 15	Lab	No exceedances	URS, 2012 Manganese Ore Area Letter		West Wall	5		
	DS-8	0.5, 3	Lab	Exceed As, Pb NR-SRL at 0.5 feet Exceed Tl R-SRL at 0.5 feet	URS, 2013 Phase II ESA		North Wall	3		
	DS-9	0.5, 3	Lab	Exceed As, Pb, Mn, Tl NR-SRL at 0.5 feet			Northeast Wall	4		
	PO-2	0.5	Lab	No exceedances			Southeast Wall	3		
	PO-3	0.5	Lab	No exceedances			South Wall	1		
	A5	<i>0.5, 3, 6</i>	XRF	No exceedances			URS, 2016 Soil Sampling and Risk Assessment Results Report			
	A5	3	Lab	As equals NR-SRL at 3 feet						
	B4	<i>0.5, 3, 6</i>	XRF	No exceedances						
	B6	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 0.5 feet						
	B6	3	Lab	No exceedances						
	B8	0.5, 3, 6	XRF	No exceedances						
	C5	0.5, 3, 6	XRF	No exceedances						
	C7	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 0.5 feet Exceed Mn R-SRL at 3 and 6 feet						
	C9	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet						
	C9	3	Lab	No exceedances						
	D4	<i>0.5, 3, 6</i>	XRF	No exceedances						
	D6	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 0.5 feet						
	D6	6	Lab	No exceedances						
	D8	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 0.5 feet						
	E5	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet						
	E7	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet						
	E9	0.5, 3, 6	XRF	No exceedances						
	E9	6	Lab	No exceedances						
SS-4	2, 4	Lab	See DU 7	URS, 2012 Manganese Ore Area Letter						
SS-5	2, 4	Lab	See DU 8							
SS-15	2, 4	Lab	See DU 2							

Notes:
Bold = lab sample location that will remain following planned excavation
Italic = XRF sample location that will remain following planned excavation

Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) see notes	Analysis Type	Results (As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU		
1b (1.684)	DS-7	0.5, 3	Lab	Exceed As, Pb, Tl NR-SRL at 0.5 feet	URS, 2013 Soil Investigation Additional Analyses - Selected Lower Depth Samples Correspondence		Floor	11	27		
	DS-6	0.5, 3	Lab	Exceed As, Pb NR-SRL at 0.5 feet Exceed Tl R-SRL at 0.5 feet			West Wall(s)	9			
	PO-6	0.5	Lab	No exceedances			South Wall(s)	6			
	DS-3	0.5, 3	Lab	Exceed As, Pb NR-SRL at 0.5 feet			East Wall	1			
	DS-4	0.5	Lab	No exceedances			North Wall	NA			
	DS-5	0.5, 3	Lab	Exceed As NR-SRL at 0.5 feet Exceed Mn, Tl R-SRL at 0.5 feet			URS, 2012 Manganese Ore Area Letter				Plus 11 existing Plus confirmation samples from DU 1c, 1d, 6, and 10 See Figure 6
	PO-8	0.5, 3	Lab	Exceed As, Pb, Mn, Tl NR-SRL at 0.5 feet							
	SB-2	2, 15	Lab	No exceedances							
	SS-16	2	Lab	No exceedances							
	F4	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet							
	F6	0.5, 3, 6	XRF	Exceed Pb NR-SRL at 0.5 feet Exceed Mn R-SRL at 0.5 feet							
	F6	0.5	Lab	Exceed Pb NR-SRL at 0.5 feet Exceed Mn R-SRL at 0.5 feet As, Tl RLs above NR-SRL							
	G5	0.5, 3, 6	XRF	Exceed Tl R-SRL at 0.5 feet							
	H4	0.5, 3, 6	XRF	Exceed Tl R-SRL at 0.5 feet							
	H4	3	Lab	No exceedances							
	H6	0.5, 3, 6	XRF	Exceed Pb, Mn NR-SRL at 0.5 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Excavate as indicated on Figure 3. Decision Units 1c, 1d, 6, and 10 are also located within this DU. Collect confirmation samples from sidewalls at 0.5 feet and floor of excavation. Confirmation samples to be collected east of PO-8 in excavation sidewalls (DU 17)					
	H6	0.5	Lab	Exceed Pb, Mn NR-SRL at 0.5 feet As, Tl RLs above NR-SRL							
	I3	0.5, 3, 6	XRF	Exceed Pb, Mn R-SRL at 0.5 feet Exceed Tl R-SRL at 0.5 feet							
	I5	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet							
	J4	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet							
	J6	0.5	XRF	Exceed Pb, Mn NR-SRL at 0.5 feet							
	K3	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet							
	K5	0.5, 3, 6	XRF	Exceed As NR-SRL at 0.5 feet Exceed Mn R-SRL at 0.5 feet							
	K7	0.5, 3, 6	XRF	Exceed As NR-SRL at 0.5 feet Exceed Mn R-SRL at 0.5 feet							
	K7	3	Lab	No exceedances							
	L4	0.5, 3, 6	XRF	See DU 10							
	L6	0.5, 3, 6	XRF	No exceedances							
	L8	0.5, 3, 6	XRF	Exceed As, Pb, Mn NR-SRL at 0.5 feet							
	M3	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet							

Notes:
Bold = lab sample location that will remain following planned excavation
Italic = XRF sample location that will remain following planned excavation

Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) see notes	Analysis Type	Results (As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU
1b (cont) (1.684)	M5	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet Exceed Tl R-SRL at 3 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report				
	M7	0.5, 3, 6	XRF	Exceed As, Pb, Mn NR-SRL at 0.5 feet					
	M9	0.5, 3, 6	XRF	Exceed Mn R-SRL at 6 feet					
	N8	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet					
	RE-M9	8	XRF	No exceedances					
	Re-PO-8	8	XRF	No exceedances					
1c (0.101)	H6	0.5, 3, 6	XRF	Exceed Pb, Mn NR-SRL at 0.5 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Vactor soil/processed ore off of concrete surface. Excavate soil around the edge of the concrete to base of footer and collect samples. Sample base of excavation around the concrete	Floor	6	6 See Figure 6
	H6	0.5	Lab	Exceed Pb, Mn NR-SRL at 0.5 feet As, Tl RLS above NR-SRL					
	J6	0.5	XRF	Exceed Pb, Mn NR-SRL at 0.5 feet					
1d (0.013)	None					Grub between semi-circular concrete structures. Evaluate if soil is present between semi-circular structures. If soil is present, collect samples for laboratory analysis. Excavate soil, if above NR-SRLs. Vactor soil/processed ore off of concrete surface. Excavate soil around the edge of the concrete to the depth of the footer. Sample base of excavation around the concrete	Floor	4	4 see Figure 6
2 (0.009)	SS-15	2, 4	Lab	Exceed As, Pb, Mn, Tl NR-SRL at 2 feet	URS, 2012 Manganese Ore Area Letter	Excavate as shown on Figure 3. Collect confirmation samples from side walls at 3 feet and floor of excavation	Floor	2	6 Plus 1 existing See Figure 6
							West Wall	1	
							South Wall	1	
							East Wall	1	
							North Wall	1	
3 (0.170)	DS-2	0.5, 3, 6	Lab	Exceed As, Mn NR-SRL at 0.5 feet Exceed Tl R-SRL at 0.5 feet Exceed Mn R-SRL at 3 feet	URS, 2013 Phase II ESA	Demolish concrete as necessary. Excavate as shown on Figure 3. Collect confirmation samples from side walls at 0.5 feet and floor of excavation.	Floor	4	10 Plus 2 existing See Figure 6
							West Wall	2	
	Q7	0.5, 3, 6	XRF	Exceed As, Mn, Pb NR-SRL at 0.5 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report		South Wall	1	
							East Wall	2	
							North Wall	1	

Notes:
Bold = lab sample location that will remain following planned excavation
Italic = XRF sample location that will remain following planned excavation

Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) see notes	Analysis Type	Results (As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU	
4 (0.115)	SB-3	2, 3	Lab	Exceed As, Mn NR-SRL at 2 feet Exceed As, Pb, Mn NR-SRL at 3 feet Exceed TI R-SRL at 2 and 3 feet Exceed Sb R-SRL at 3 feet	URS, 2012 Manganese Ore Area Letter	Demolish concrete as necessary. Excavate as shown on Figure 3. Collect confirmation samples from side walls and floor of excavation to confirm below NR-SRLs. Sidewall sample locations to include 3 depths at each location (0.5, 3, and 6)	Floor	4	22	
	SB-4	2, 15	Lab	No Exceedances			Northwest Wall	3		
	DP-7	0.5, 2, 4	Lab	No Exceedances	Southwest Wall		6			
	DP-8	0.5, 2	Lab	Exceed As, Mn, TI NR-SRL at 0.5 Exceed Sb, Pb R-SRL at 0.5 feet	URS, 2013 Phase II ESA		Southeast Wall	3	Plus 1 existing See Figure 6	
	Re-SB-3	8, 10	XRF	Exceed Mn R-SRL at 8 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report		Northeast Wall	6		
	O7	0.5, 3, 6	XRF	Exceed Mn R-SRL at 3 feet Exceed As NR-SRL at 6 feet Exceed Mn R-SRL at 6 feet						
	O7	6	Lab	Exceed Mn R-SRL at 6 feet As high RL above NR-SRL						
5a (1.039)	G9	0.5, 3, 6	XRF	No Exceedances	URS, 2016 Soil Sampling and Risk Assessment Results Report	Following grubbing, sample location H8 at 3 feet and 6 feet and analyze for target compounds. (Goal is to verify the excavation depth - 0.5 feet vs 3 feet.) Remove top 2 feet of soil, stockpile, and sample for target compounds. Pending results of analysis, soil will either be transported and disposed, or used as backfill. Complete excavation to depth indicated on Figure 3 unless field changes are made based on sampling results at H8. Collect confirmation samples from side walls (at depth of 3 feet) and floor of excavation.	Floor	8	19	
	H8	0.5	XRF	No Exceedances			Southwest Wall	2		
	H10	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 3 feet			Southeast Wall	3		
	I9	0.5, 3, 6	XRF	Exceed Pb NR-SRL at 3 feet Exceed Mn R-SRL at 3 feet			East Wall(s)	6		
	I9	3	Lab	Exceed Pb NR-SRL; As, Tl high RLs above NR-SRLs; Exceed Mn R-SRL			No north or northwest walls - adjacent to excavation in DU 5b			No existing lab samples remain following excavation See Figure 6
	I11	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet						
	J8	0.5	XRF	Exceed Mn, Pb R-SRL at 0.5 feet						
	J8	0.5	Lab	Exceed Pb NR-SRL As, Tl high RL above NR-SRLs						
	J10	0.5, 3, 6	XRF	Exceed Mn R-SRL at 3 feet						
	J12	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 3 feet						
	J12	3	Lab	Exceed Mn, Pb NR-SRL; As, Tl high RLs above NR-SRLs						
	K9	0.5, 3, 6	XRF	Exceed Pb NR-SRL at 3 feet Exceed Mn R-SRL at 3 feet						
	K11	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 3 feet						
	K11	3	Lab	Exceed As NR-SRL Exceed Mn, Pb R-SRL						
	L10	0.5, 3, 6	XRF	Exceed Pb NR-SRL at 3 feet Exceed Mn R-SRL at 3 feet and 6 feet						
	L10	3	Lab	Exceed Mn, Pb NR-SRL; As, Tl RL > NR-SRL						
	ReH10	0.5	XRF	No Exceedances						
Re-I9	0.5	XRF	No Exceedances							
Re-J12	0.5	XRF	No Exceedances							
Re-L10	8	XRF	No Exceedances							

Notes:
Bold = lab sample location that will remain following planned excavation
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Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) see notes	Analysis Type	Results (As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU
5b (0.544)	PO-7	0.5, 3, 6	Lab	Exceed As NR-SRL at 0.5 and 3 Exceed Mn, Pb, Tl R-SRL at 0.5 feet and Tl R-SRL at 3 Exceed Pb, Mn NR-SRL at 3 feet	URS, 2013 Soil Investigation Additional Analyses - Selected Lower Depth Samples Correspondence	Following grubbing, sample locations I7 and J8 at 3 and 6 feet and analyze for target compounds. (Goal is to verify the excavation depth - 0.5 feet vs 3 feet.) Complete excavation to depth indicated on Figure 3 unless field change are made based on laboratory results. Collect confirmation samples from side walls and floor of excavation. Wall samples will be collected at two depths (0.5 feet and 3 feet) at each sampling location.	Floor	6	28
	F6	0.5, 3, 6	XRF	Exceed Pb NR-SRL at 0.5 feet Exceed Mn R-SRL at 0.5 feet			Southwest Wall	8	
	F6	0.5	Lab	Exceed Pb NR-SRL; As, Tl high RL above NR-SRL Exceed Mn R-SRL	Northwest Wall		6		
	F8	0.5, 3, 6	XRF	Exceed Pb NR-SRL at 0.5 feet Exceed Mn R-SRL at 0.5 feet	North Wall		4		
	F8	6	Lab	No Exceedances	East Wall		4		
	G7	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 0.5 feet Exceed Mn, Pb NR-SRL at 3 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report		No south wall - excavation depth equals excavation depth in DU 5a at this location		Plus 2 existing See Figure 6
	G7	3	Lab	Exceed Pb, Mn NR-SRL at 3 feet As, Tl high RLs above NR-SRLs					
	G9	0.5, 3, 6	XRF	No Exceedances					
	H6	0.5, 3, 6	XRF	Exceed Mn, Pb NR-SRL at 0.5 feet					
	H6	0.5	Lab	Exceed Mn, Pb NR-SRL; As, Tl high RLs above NR-SRLs					
	H8	0.5	XRF	No Exceedances					
	I7	0.5	XRF	Exceed Mn, Pb NR-SRL at 0.5 feet					
	I7	0.5	Lab	Exceed Mn, Pb NR-SRL; As, Tl high RLs above NR-SRLs					
	J8	0.5	XRF	Exceed Mn, Pb R-SRL at 0.5 feet					
J8	0.5	Lab	Exceed Pb NR-SRL; As and Tl high RLs above NR-SRLs Exceed Mn R-SRL						
6 (0.111)	OP-1	0.5, 3, 6	Lab	Exceed As NR-SRL at 0.5 and 3 Exceed Mn, Pb, Tl R-SRL at 0.5 feet Exceed Mn R-SRL at 3 feet	URS, 2013 Phase II ESA and URS, 2013 Soil Investigation Additional Analyses - Selected Lower Depth Samples Correspondence	Excavate to depth shown in Figure 3. Perform confirmation sampling on excavation floor and sidewalls. Sidewall samples will be collected at a depth of 3 feet.	Floor	3	13
	OP-2	0.5	Lab	No Exceedances			Northwest Wall	2	
	OP-3	0.5, 3, 6	Lab	Exceed As NR-SRL at 0.5 and 3 feet Exceed Pb NR-SRL at 3 feet Exceed Mn, Tl R-SRL at 0.5 and 3 feet			Southwest Wall	4	
	OP-4	0.5, 3	Lab	Exceed MN R-SRL at 0.5 and 3 feet			Southeast Wall	1	
	OP-5	0.5, 3	Lab	Exceed As NR-SRL at 0.5 feet Exceed Mn, Tl R-SRL at 0.5 feet			Northeast Wall	3	
	OP-6	0.5, 3, 6	Lab	Exceed As NR-SRL at 0.5 and 3 feet Exceed Mn R-SRL at 0.5 and 3 feet			Plus 5 existing		
	OP-7	0.5, 3	Lab	Exceed As, Mn, Pb, Tl NR-SRL at 0.5			See Figure 6		
	OP-8	0.5, 3	Lab	Exceed As, Mn, Pb, NR-SRL at 0.5 Exceed Tl R-SRL at 0.5 feet					

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Italic = XRF sample location that will remain following planned excavation

Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) see notes	Analysis Type	Results (As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU
6 (cont) (0.111)	DS-1	0.5, 3, 6	Lab	Exceed As NR-SRL at 0.5 feet Exceed As, Mn, Pb NR-SRL at 3 feet Exceed Mn R-SRL at 0.5 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report				
	DS-10	0.5, 3, 6	Lab	Exceed As, Pb NR-SRL at 0.5 feet Exceed As NR-SRL at 3 feet Exceed Mn R-SRL at 0.5 and 3 feet					
	K7	0.5, 3, 6	XRF	Exceed As NR-SRL at 0.5 feet Exceed Mn R-SRL at 0.5 feet					
	K7	3	Lab	No Exceedances					
	L6	0.5, 3, 6	XRF	No Exceedances					
	L8	0.5, 3, 6	XRF	Exceed As, Mn, Pb NR-SRL at 0.5 feet					
7 (0.009)	SS-4	2, 4	Lab	Exceed As, Pb, Mn, Tl NR-SRL at 2 feet Exceed As NR-SRL at 4 feet Exceed Mn R-SRL at 4 feet	URS, 2012 Manganese Ore Area Letter	Excavate as shown on Figure 3. Collect confirmation samples from side walls at 4 feet and floor of excavation.	Floor West Wall South Wall East Wall North Wall	2 1 1 1 1	6 See Figure 6
8 (0.009)	SS-5	2, 4	Lab	Exceed As, Pb, Mn, Tl NR-SRL at 2 feet Exceed As NR-SRL at 4 feet Exceed Mn R-SRL at 4 feet	URS, 2012 Manganese Ore Area Letter	Excavate as shown on Figure 3. Collect confirmation samples from side walls at 4 feet and floor of excavation.	Floor West Wall South Wall East Wall North Wall	2 1 1 1 1	6 See Figure 6
9 (0.009)	O3	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Excavate as shown on Figure 3. Collect confirmation samples from side walls at 0.5 feet and floor of excavation.			
	O3	0.5	Lab	Exceed As NR-SRL at 0.5 feet					
						Floor West Wall South Wall East Wall North Wall	2 1 1 1 1	6 See Figure 6	

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Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) see notes	Analysis Type	Results (As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU
10 (0.009)	L4	0.5, 3, 6	XRF	Exceed As NR-SRL at 0.5 feet Exceed As NR-SRL at 6 feet (1 of 5 readings) Exceed Mn R-SRL at 0.5 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Pothole this location and collect samples at 3 and 6 feet for laboratory analysis of target compounds. Pending results, excavate to depth as shown on Figure 3 or to 6 inches beyond the deepest exceedance of the NR-SRL. Collect confirmation samples from side walls at 0.5 feet and floor of excavation	Floor	2	6 If excavation depth exceeds 1 foot, collect multiple depths of sidewall samples See Figure 6
							West Wall	1	
							South Wall	1	
							East Wall	1	
							North Wall	1	
11 (1.158)	PO-5	0.5	Lab	No Exceedances	URS, 2016 Soil Sampling and Risk Assessment Results Report	Five existing laboratory-analyzed samples. Collect additional soil samples for laboratory analysis to confirm soils less than R-SRLs	D2 at 0.5 and 3 feet	2	6 Plus 5 existing See Figure 6
	A1	<i>0.5, 3, 6</i>	XRF	Exceed Tl R-SRL at 3 feet			C3 at 0.5 feet	1	
	A1	0.5	Lab	No Exceedances			G3 at 0.5 feet	1	
	A3	<i>0.5, 3, 6</i>	XRF	No Exceedances			A1 at 3 feet	1	
	B2	<i>0.5, 3, 6</i>	XRF	No Exceedances			E3 at 3 feet	1	
	B4	<i>0.5, 3, 6</i>	XRF	No Exceedances					
	C1	<i>0.5, 3, 6</i>	XRF	No Exceedances					
	C3	<i>0.5, 3, 6</i>	XRF	No Exceedances					
	D2	<i>0.5, 3, 6</i>	XRF	Exceed Hg R-SRL at 3 feet					
	D2	6	Lab	No Exceedances					
	D4	<i>0.5, 3, 6</i>	XRF	No Exceedances					
	E1	<i>0.5, 3, 6</i>	XRF	No Exceedances					
	E3	<i>0.5, 3, 6</i>	XRF	Exceed Tl R-SRL at 3 feet					
	E3	0.5	Lab	No Exceedances					
	F2	<i>0.5, 3, 6</i>	XRF	No Exceedances					
	F2	0.5	Lab	No Exceedances					
	G1	<i>0.5, 3, 6</i>	XRF	No Exceedances					
G3	<i>0.5, 3, 6</i>	XRF	No Exceedances						
H2	<i>0.5, 3, 6</i>	XRF	No Exceedances						

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Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) see notes	Analysis Type	Results (As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU
12 (1.104)	H2	0.5, 3, 6	XRF	No Exceedances	URS, 2013 Phase II ESA	Two existing laboratory-analyzed samples. Collect additional soil samples for laboratory analysis to confirm soils less than R-SRLs. DU 9 is also located within this DU.	I1 at 0.5 feet	1	5
	I1	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet			I3 at 0.5 feet	1	
	I1	3	Lab	No Exceedances			K3 at 0.5 feet	1	
	I3	0.5, 3, 6	XRF	Exceed Mn, Pb R-SRL at 0.5 feet			M3 at 0.5 feet	1	
	J2	0.5, 3, 6	XRF	No Exceedances			O1 at 0.5 feet	1	
	J2	3	Lab	No Exceedances					
	K1	0.5, 3, 6	XRF	No Exceedances					
	K3	0.5, 3, 6	XRF	No Exceedances					
	L2	0.5, 3, 6	XRF	No Exceedances					
	M1	0.5, 3, 6	XRF	No Exceedances					
	M3	0.5, 3, 6	XRF	No Exceedances					
	N2	0.5, 3, 6	XRF	No Exceedances					
	N4	0.5, 3, 6	XRF	No Exceedances					
	O1	0.5, 3, 6	XRF	Exceed Tl R-SRL at 0.5 feet					
O3	0.5, 3, 6	XRF	See DU 9						
13 (1.031)	P2	0.5, 3, 6	XRF	No Exceedances	URS, 2016 Soil Sampling and Risk Assessment Results Report	Two existing laboratory-analyzed sample. Collect additional soil samples for laboratory analysis to confirm soils less than R-SRLs. DU 23 is also located within this DU.	P2 at 0.5 feet	1	5
	P4	0.5, 3, 6	XRF	No Exceedances			Q3 at 0.5 feet	1	
	P4	6	Lab	No Exceedances			S1 at 0.5, 3, and 6 ft	3	
	Q1	0.5, 3, 6	XRF	No Exceedances					
	Q3	0.5, 3, 6	XRF	No Exceedances					
	R2	0.5, 3, 6	XRF	No Exceedances					
	R4	0.5, 3, 6	XRF	See DU 23					
	S1	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet					
	S3	0.5, 3, 6	XRF	No Exceedances					
	T1	0.5, 3, 6	XRF	No Exceedances					
	U1	0.5, 3, 6	XRF	No Exceedances					
U1	3	Lab	No Exceedances						
14 (0.831)	SB-3	2, 3	Lab	See DU 4	URS, 2012 Manganese Ore Area Letter	One existing laboratory-analyzed sample (outside of DU 3 and DU 4). Collect additional soil samples for laboratory analysis to confirm soils less than NR-SRLs. Samples from DU 3, 4, and 21 within this area will provide additional information.	O5 at 0.5 feet	1	3
	SB-4	2, 15	Lab		URS, 2013 Phase II ESA		P6 at 0.5 feet	1	
	DP-7	0.5, 2, 4	Lab				P8 at 0.5 feet	1	
	DP-8	0.5, 2	Lab						
	Re-SB-3	8, 10	XRF						
	M5	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet Exceed Tl R-SRL at 3 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report				Plus 1 existing sample and samples from DUs 3, 4, and 21 See Figure 6
	N6	0.5, 3, 6	XRF	See DU 21					
	N8	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet					
	O5	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet					
	O7	0.5, 3, 7	XRF	See DU 4					
	O7	6	Lab						
	O9	0.5, 3, 6	XRF	Exceed Tl R-SRL at 0.5 feet					
	P6	0.5, 3, 6	XRF	No Exceedances					
P8	0.5, 3, 6	XRF	No Exceedances						
Q5	0.5, 3, 6	XRF	Exceed Tl R-SRL at 3 feet						

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Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) <i>see notes</i>	Analysis Type	Results <small>(As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)</small>	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU	
14 (cont) (0.831)	Q7	0.5, 3, 7	XRF	See DU 3	URS, 2016 Soil Sampling and Risk Assessment Results Report					
	Q9	0.5, 3, 6	XRF	Exceed TI R-SRL at 0.5 and 3 feet						
	Q9	6	Lab	No Exceedances						
15 (0.951)	SS-17	2	Lab	No Exceedances	URS, 2012 Manganese Ore Area Letter	Three existing laboratory-analyzed samples. Prior to excavation, pothole at S9 and T4 to collect soil samples at three depths for laboratory analysis to evaluate for As. Collect five additional soil samples at 0.5 feet for laboratory analysis to confirm soils less than NR-SRLs.	S9 at 0.5, 3, and 6	3	11 Plus 3 existing lab samples See Figure 6	
	R6	0.5, 3, 6	XRF	No Exceedances	URS, 2016 Soil Sampling and Risk Assessment Results Report		T4 at 0.5, 3, and 6	3		
	R8	0.5, 3, 6	XRF	Exceed Pb, Mn R-SRL at 0.5 feet			R6 at 0.5 feet	1		
	S5	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet			S5 at 0.5 feet	1		
	S5	6	Lab	No Exceedances			T8 at 0.5 feet	1		
	S7	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet			U5 at 0.5 feet	1		
	S9	0.5, 3, 6	XRF	Exceed As NR-SRL at 6 feet Exceed TI R-SRL at 0.5 feet			URS, 2016 Soil Sampling and Risk Assessment Results Report	U9 at 0.5 feet		1
	Re-S9	8	XRF	No Exceedances						
	T4	0.5, 3, 6	XRF	Exceed As NR-SRL at 6 feet						
	Re-T4	8	XRF	No Exceedances						
	T6	0.5, 3, 6	XRF	Exceed Pb, Mn R-SRL at 0.5 feet						
	T8	0.5, 3, 6	XRF	Exceed Mn R-SRL at 0.5 feet						
	T8	6	Lab	No Exceedances						
	U3	0.5, 3, 6	XRF	No Exceedances						
	U5	0.5, 3, 6	XRF	No Exceedances						
U7	0.5, 3, 6	XRF	No Exceedances							
U9	0.5, 3, 6	XRF	No Exceedances							
16 (1.280)	O11	0.5, 3, 6	XRF	No Exceedances	URS, 2016 Soil Sampling and Risk Assessment Results Report	Two existing laboratory-analyzed samples. Collect additional soil samples for laboratory analysis to confirm soils less than R-SRLs. Sample at Q11 and U11 to verify TI concentration.	Q11 at 3 feet	1	5 Plus 2 existing lab samples Plus DU 20 See Figure 6	
	O13	0.5, 3, 6	XRF	No Exceedances			T10 at 0.5 feet	1		
	O13	3	Lab	No Exceedances			U11 at 6 feet	1		
	P10	0.5, 3, 6	XRF	See DU 20			P12 at 0.5 feet	1		
	Q11	0.5, 3, 6	XRF	Exceed TI R-SRL at 3 feet			URS, 2016 Soil Sampling and Risk Assessment Results Report	S11 at 0.5 feet		1
	R10	0.5, 3, 6	XRF	No Exceedances						
	S11	0.5, 3, 6	XRF	No Exceedances						
	T10	0.5, 3, 6	XRF	Exceed TI R-SRL at 0.5 feet						
				Exceed TI R-SRL at 3 feet (lab data <R-SRL))						
	U11	0.5, 3, 6	XRF	Exceed TI R-SRL at 6 feet						
U11	3	Lab	No Exceedances							

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Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) <i>see notes</i>	Analysis Type	Results <small>(As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)</small>	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU
17 (1.185)	K13	0.5, 3, 6	XRF	No Exceedances	URS, 2016 Soil Sampling and Risk Assessment Results Report	Three existing laboratory-analyzed samples. Collect additional soil samples for laboratory analysis to confirm soils less than R-SRLs. Sample at M11 to verify that TI does not exceed the R-SRL.	M11 at 0.5 and 3 ft	2	6 Plus 3 existing Plus sidewall samples from DU 5a See Figure 6
	L12	0.5, 3, 6	XRF	No Exceedances			N12 at 0.5 feet	1	
	M11	0.5, 3, 6	XRF	Exceed TI R-SRL at 0.5 feet and 3 feet			K13 at 0.5 feet	1	
	M13	0.5, 3, 6	XRF	Exceed As NR-SRL at 3 feet (lab data <R-SRL)			Excavation sidewall samples east of PO 8	2	
	M13	3	Lab	No Exceedances					
	N10	0.5, 3, 6	XRF	No Exceedances					
	N12	0.5, 3, 6	XRF	No Exceedances					
	N14	0.5, 3, 6	XRF	Exceed TI R-SRL at 3 feet (lab data <R-SRL)					
	N14	3	Lab	No Exceedances					
	O11	0.5, 3, 6	XRF	No Exceedances					
	O13	0.5, 3, 6	XRF	No Exceedances					
O13	3	Lab	No Exceedances						
18 (0.878)	E9	0.5, 3, 6	XRF	No exceedances	URS, 2016 Soil Sampling and Risk Assessment Results Report	Three existing laboratory-analyzed samples. Collect additional soil samples for laboratory analysis to confirm soils less than R-SRLs. Sample at H12 and J14 to verify that TI does not exceed the R-SRL.	H12 at 0.5 and 3 ft	2	5 Plus 3 existing Plus DU 22, plus sidewall samples from DUs 5a and 5b See Figure 6
	E9	6	Lab	No exceedances			J14 at 0.5 feet	1	
	E11	0.5, 3, 6	XRF	No Exceedances			F13 at 0.5 feet	1	
	F10	0.5, 3, 6	XRF	No Exceedances			I13 at 0.5 feet	1	
	F10	6	Lab	No Exceedances					
	G9	0.5, 3, 6	XRF	No Exceedances					
	G11	0.5, 3, 6	XRF	See DU 22					
	H12	0.5, 3, 6	XRF	Exceed TI R-SRL at 3 feet					
	I13	0.5, 3, 6	XRF	No Exceedances					
	J14	0.5, 3, 6	XRF	Exceed TI R-SRL at 0.5 feet					
J14	3	Lab	No Exceedances						
19 (1.046)	A7	0.5, 3, 6	XRF	Exceed TI R-SRL at 3 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Three existing laboratory-analyzed samples. Collect additional soil samples for laboratory analysis to confirm soils less than R-SRLs. Sample at A7, A9, B8, and B10 to verify that TI does not exceed the R-SRL. Additional sample at C13.	A7 at 0.5 and 3 feet	2	8 Plus 3 existing Plus sidewall samples from DU 1a See Figure 6
	A9	0.5, 3, 6	XRF	Exceed TI R-SRL at 3 feet			A9 at 0.5 and 3 feet	2	
	A11	0.5, 3, 6	XRF	No Exceedances			B8 at 0.5 and 3 feet	2	
	A11	3	Lab	No Exceedances			B10 at 0.5 feet	1	
	B8	0.5, 3, 6	XRF	Exceed TI R-SRL at 3 feet			C13 at 0.5 feet	1	
	B10	0.5, 3, 6	XRF	Exceed TI R-SRL at 0.5 feet					
	C9	0.5, 3, 6	XRF	Exceed TI R-SRL at 3 feet (lab data <R-SRL)					
	C9	3	Lab	No Exceedances					
	C11	0.5, 3, 6	XRF	No Exceedances					
	D10	0.5, 3, 6	XRF	No Exceedances					
	E9	0.5, 3, 6	XRF	No Exceedances					
	E9	6	Lab	No Exceedances					
	E11	0.5, 3, 6	XRF	No Exceedances					

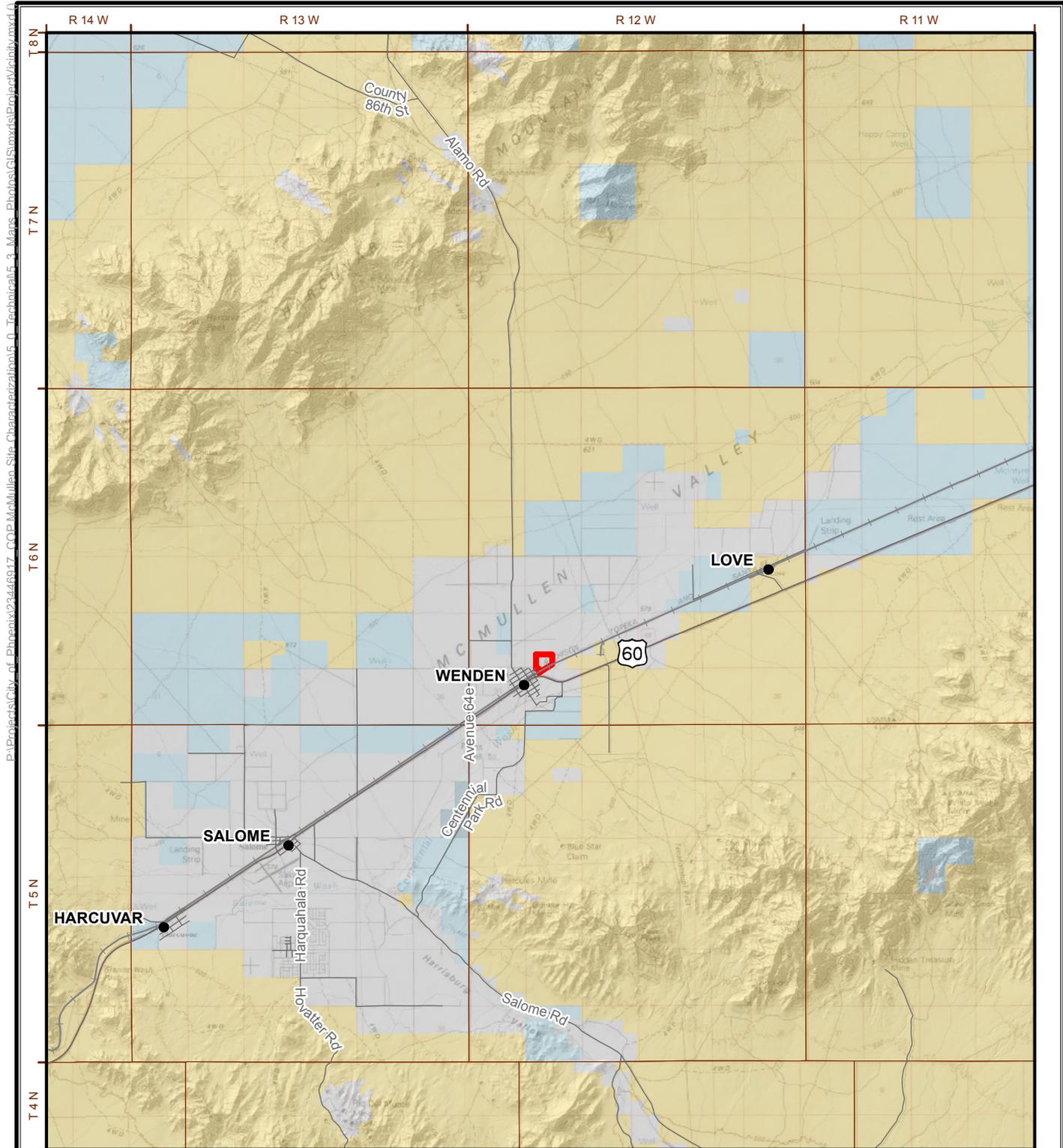
Notes:
Bold = lab sample location that will remain following planned excavation
Italic = XRF sample location that will remain following planned excavation

Table 1. Summary Description of Decision Units, Historical Sampling, Proposed Remediation Activities, and Proposed Sampling Following Remediation

Decision Unit (size in acres)	Existing Sample Points	Depth (feet) <i>see notes</i>	Analysis Type	Results <small>(As=Arsenic; Pb=Lead; Mn=Manganese; Tl=Thallium; SRL=Soil Remediation Level; NR=Non-Residential; R=Residential; RL= Reporting Limit)</small>	Reference	Actions	Proposed Confirmation Samples	Number Confirmation Samples	Total Number Confirmation Samples Per DU
20 (0.009)	P10	0.5, 3, 6	XRF	Exceed As NR-SRL at 3 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Pothole to 3 feet to collect sample to verify As less than the R-SRL. If NR-SRL is exceeded, excavate to remove an area of 20 feet by 20 feet and collect floor and sidewall samples (6 total).	P10 at 3 feet	1	1
21 (0.009)	N6	0.5, 3, 6	XRF	Exceed As NR-SRL at 3 feet Exceed TI R-SRL at 3 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Pothole to 3 feet to collect sample to verify As less than the NR-SRL and TI less than the R-SRL. If NR-SRLs are exceeded, excavate to remove an area of 20 feet by 20 feet and collect floor and sidewall samples (6 total).	N6 at 3 feet	1	1
22 (0.009)	G11	0.5, 3, 6	XRF	Exceed TI NR-SRL at 3 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Pothole to 3 feet to collect sample to verify TI less than the R-SRL. If NR-SRL is exceeded, excavate to remove an area of 20 feet by 20 feet and collect floor and sidewall samples (6 total).	G11 at 3 feet	1	1
23 (0.009)	R4	0.5, 3, 6	XRF	Exceed As NR-SRL at 0.5 feet	URS, 2016 Soil Sampling and Risk Assessment Results Report	Re-sample R4 at 0.5 feet for laboratory analysis to verify As concentration. If NR-SRL is exceeded, excavate to remove an area of 20 feet by 20 feet and collect floor and sidewall samples (6 total).	R4 at 0.5 feet	1	1
24	RS-1	0.5	Lab	No Exceedances	URS, 2013 Phase II ESA	Collect an additional 10 samples at 0.5 feet for laboratory analysis as shown in Figure 5.	See Figure 5	10	10 Plus 10 existing See Figure 5
	RS-2	0.5	Lab	No Exceedances					
	RS-3	0.5	Lab	No Exceedances					
	RS-4	0.5	Lab	No Exceedances					
	RS-5	0.5	Lab	No Exceedances					
	RS-6	0.5	Lab	No Exceedances					
	RS-7	0.5	Lab	No Exceedances					
	RS-8	0.5	Lab	No Exceedances					
	RS-9	0.5	Lab	No Exceedances					
	RS-10	0.5	Lab	No Exceedances					
25	SS-18	2	Lab	No Exceedances	URS, 2012 Manganese Ore Area Letter	Collect an additional 5 samples at 0.5 feet for laboratory analysis as shown in Figure 5.	See Figure 5	5	5 Plus 4 existing See Figure 5
	PO-9	0.5	Lab	No Exceedances	URS, 2013 Phase II ESA				
	PO-10	0.5, 3	Lab	No Exceedances					

Notes:
Bold = lab sample location that will remain following planned excavation
Italic = XRF sample location that will remain following planned excavation

FIGURES



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- Legend**
- Subject Property
 - City
 - Road
 - Railroad
 - Township and Range Boundary
- Surface Management**
- Bureau of Land Management
 - Local or State Parks
 - State Trust Land
 - Private

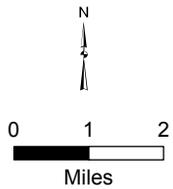
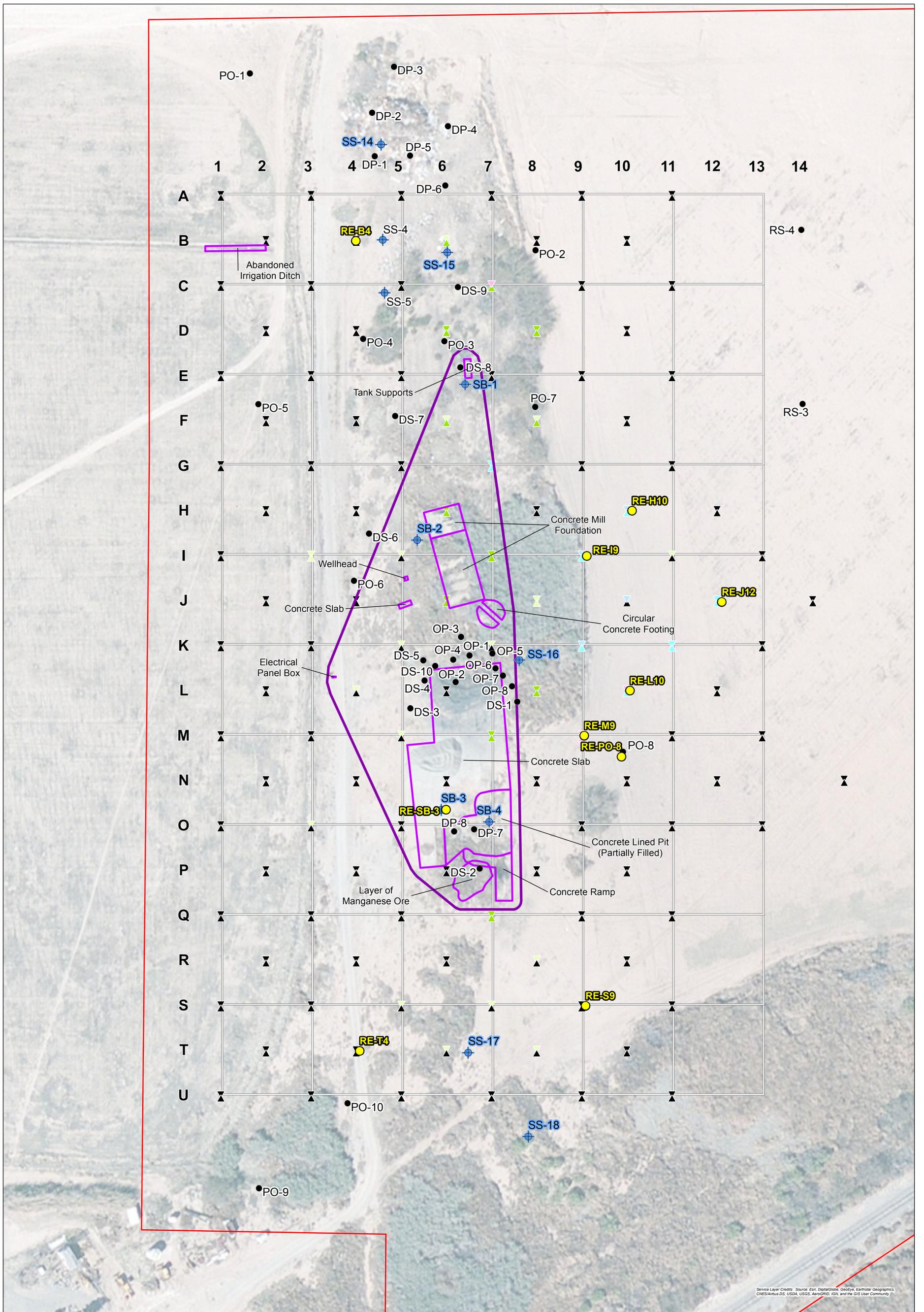


FIGURE 1
SITE VICINITY MAP
 MCMULLEN VALLEY
 FORMER MANGANESE ORE SITE
 LA PAZ COUNTY, ARIZONA

Source:
 ALRIS 2014, ADOT 2014
 Copyright: © 2013 National
 Geographic Society, i-cubed



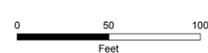
Service Layer Credits: Source: Esri, DataGeo, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

- Legend**
- Subject Property
 - ▲ XRF Sample Location_Pb Result
 - ▼ XRF Sample Location_Mn Result
 - 100-Foot Sample Grid
 - Additional XRF Sample Locations
 - ⊕ Historical Soil Boring Location (2012)
 - Historical Soil Boring Location (2013)
 - Cultural Survey Boundary
 - Cultural Survey Features

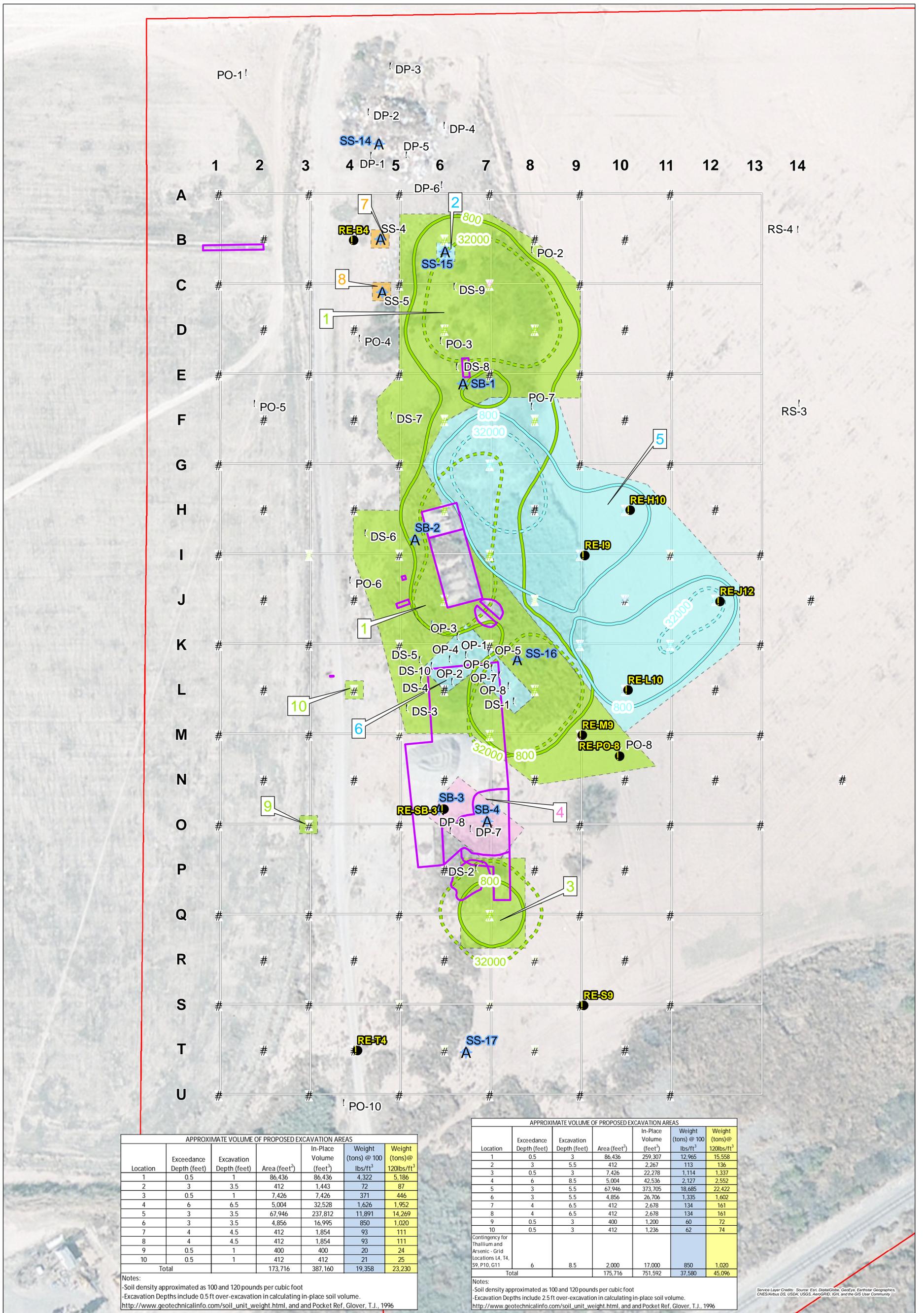
Definitions:
XRF - X-Ray Fluorescence

FIGURE 2
SITE MAP WITH SAMPLING LOCATIONS,
SITE FEATURES AND CULTURAL SITE BOUNDARY

MCMULLEN VALLEY FORMER MANGANESE ORE SITE
LA PAZ COUNTY, ARIZONA



May 2017 **AECOM**



APPROXIMATE VOLUME OF PROPOSED EXCAVATION AREAS

Location	Exceedance Depth (feet)	Excavation Depth (feet)	Area (feet ²)	In-Place Volume (feet ³)	Weight (tons) @ 100 lbs/ft ³	Weight (tons) @ 120 lbs/ft ³
1	0.5	1	86,436	86,436	4,322	5,186
2	3	3.5	412	1,443	72	87
3	0.5	1	7,426	7,426	371	446
4	6	6.5	5,004	32,528	1,626	1,952
5	3	3.5	67,946	237,812	11,891	14,269
6	3	3.5	4,856	16,995	850	1,020
7	4	4.5	412	1,854	93	111
8	4	4.5	412	1,854	93	111
9	0.5	1	400	400	20	24
10	0.5	1	412	412	21	25
Total			173,716	387,160	19,358	23,230

Notes:
 - Soil density approximated as 100 and 120 pounds per cubic foot
 - Excavation Depths include 0.5 ft over-excavation in calculating in-place soil volume.
http://www.geotechnicalinfo.com/soil_unit_weight.html, and Pocket Ref. Glover, T.J., 1996

APPROXIMATE VOLUME OF PROPOSED EXCAVATION AREAS

Location	Exceedance Depth (feet)	Excavation Depth (feet)	Area (feet ²)	In-Place Volume (feet ³)	Weight (tons) @ 100 lbs/ft ³	Weight (tons) @ 120 lbs/ft ³
1	0.5	3	86,436	259,307	12,965	15,558
2	3	5.5	412	2,267	113	136
3	0.5	3	7,426	22,278	1,114	1,337
4	6	8.5	5,004	42,536	2,127	2,552
5	3	5.5	67,946	373,705	18,685	22,422
6	3	5.5	4,856	26,706	1,335	1,602
7	4	6.5	412	2,678	134	161
8	4	6.5	412	2,678	134	161
9	0.5	3	400	1,200	60	72
10	0.5	3	412	1,236	62	74
Contingency for Thallium and Arsenic - Grid Locations L4, T4, S9, P10, G11						
Total	6	8.5	2,000	17,000	850	1,020
Total			175,716	751,592	37,580	45,096

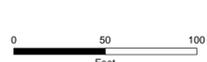
Notes:
 - Soil density approximated as 100 and 120 pounds per cubic foot
 - Excavation Depths include 2.5 ft over-excavation in calculating in-place soil volume.
http://www.geotechnicalinfo.com/soil_unit_weight.html, and Pocket Ref. Glover, T.J., 1996

- Legend**
- Subject Property
 - XRF Sample Location_Pb Result
 - XRF Sample Location_Mn Result
 - 100-Foot Sample Grid
 - Additional XRF Sample Locations
 - Historical Soil Boring Location (2012)
 - Pb XRF Concentration Contour [ppm]
 - Mn XRF Concentration Contour [ppm]
 - Pb/Mn NR-SRL [mg/kg]

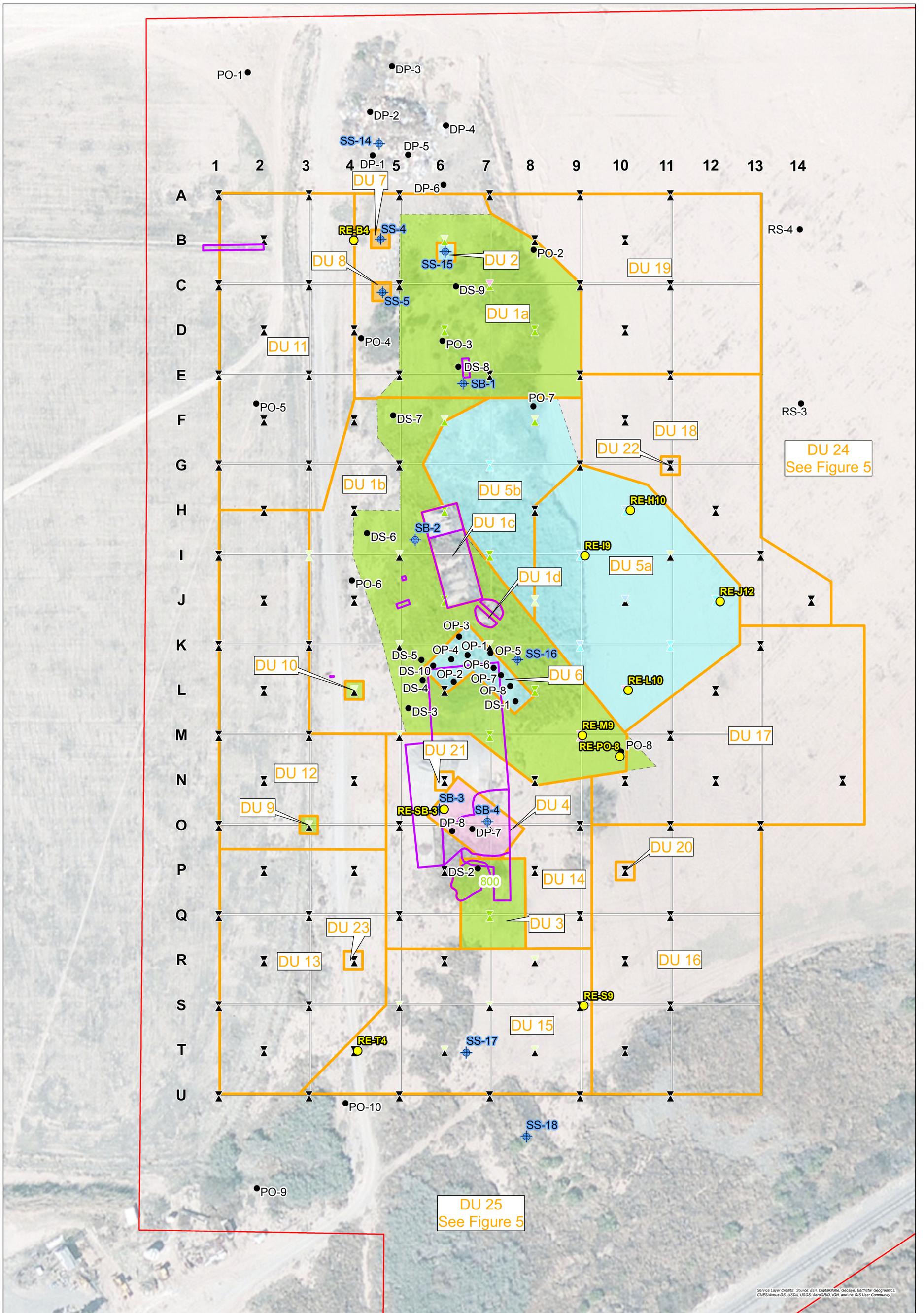
- Historical Soil Boring Location (2013)
- Concrete Structures
- Sample Depth: 0.5 feet
- Sample Depth: 3 feet
- Sample Depth: 6 feet
- Removal of 1.0 Feet of Soil BGS
- Removal of 3.5 Feet of Soil BGS
- Removal of 4.5 Feet of Soil BGS
- Removal of 6.5 Feet of Soil BGS

- Definitions:**
 XRF - X-Ray Fluorescence
 ppm - parts per million
 mg/kg - milligrams per kilogram
 BGS - below ground surface
 NR-SRL - non-residential soil remediation level
 NOTE: ppm is equivalent to mg/kg
- NR-SRL [mg/kg]
 As = 10
 Mn = 32000
 Pb = 800

FIGURE 3
 XRF AND LABORATORY NR-SRL EXCEEDANCE BOUNDARY MAP FOR As, Pb, AND Mn WITH PROPOSED DEPTH SPECIFIC SOIL REMOVAL/REMEDIATION AREAS
 MCMULLEN VALLEY FORMER MANGANESE ORE SITE
 LA PAZ COUNTY, ARIZONA



3



Service Layer Credits: Source: Esri, DataStadia, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

- Legend**
- Subject Property
 - ▲ XRF Sample Location_Pb Result
 - ▼ XRF Sample Location_Mn Result
 - 100-Foot Sample Grid
 - Additional XRF Sample Locations
 - ⊕ Historical Soil Boring Location (2012)
 - Historical Soil Boring Location (2013)
 - Concrete Structures

- Removal of 1.0 Feet of Soil BGS
- Removal of 3.5 Feet of Soil BGS
- Removal of 4.5 Feet of Soil BGS
- Removal of 6.5 Feet of Soil BGS

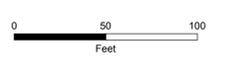
Definitions:
 XRF - X-Ray Fluorescence
 mg/kg - milligrams per kilogram
 BGS - below ground surface
 NR-SRL - non-residential soil remediation level

NR-SRL [mg/kg]
 As = 10
 Mn = 32000
 Pb = 800

As - Arsenic
 Mn - Manganese
 Pb - Lead

**FIGURE 4
 PROPOSED DECISION UNITS**

MCMULLEN VALLEY FORMER MANGANESE ORE SITE
 LA PAZ COUNTY, ARIZONA

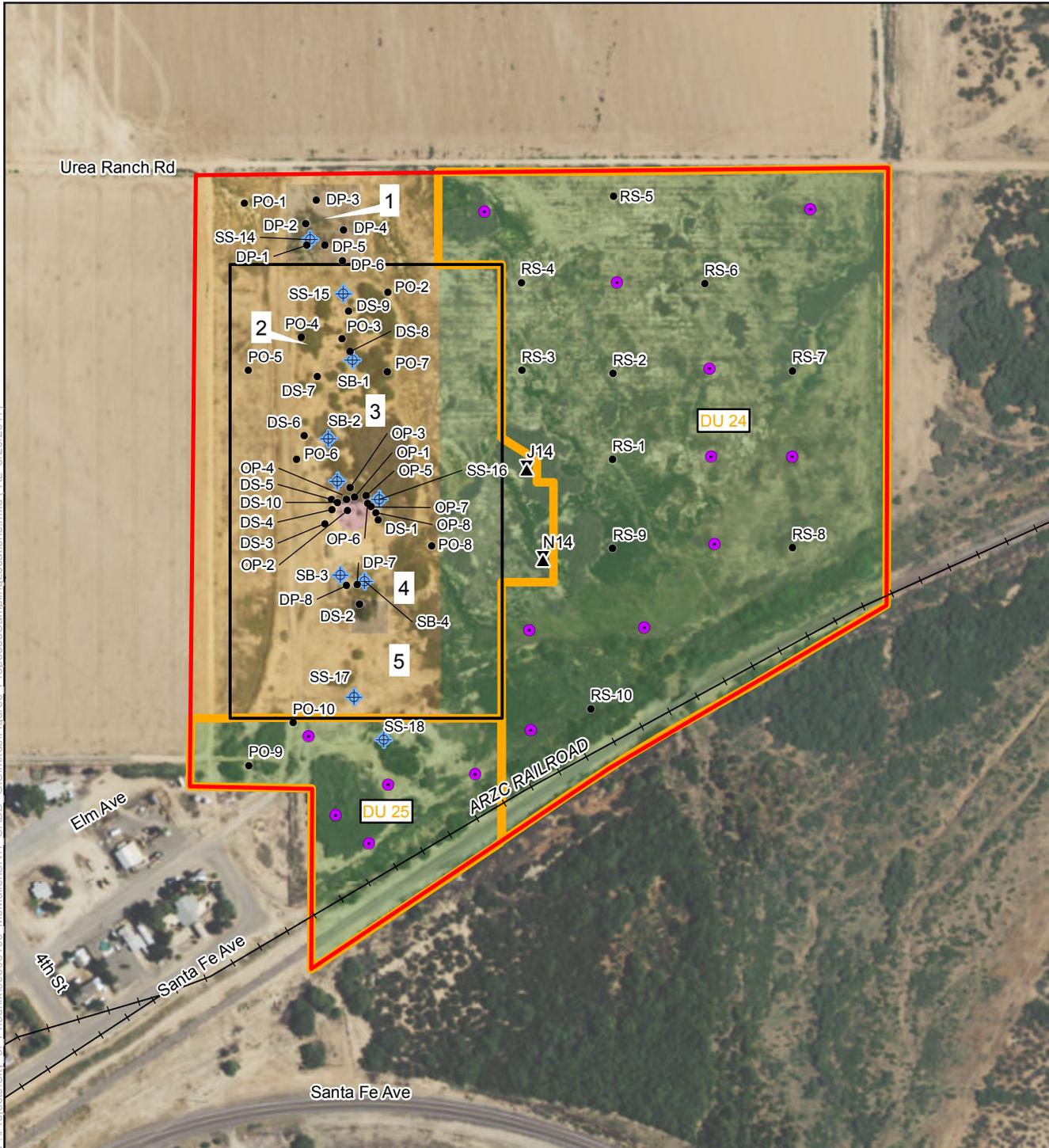


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FIGURE 5
PROPOSED SAMPLING LOCATIONS
MCMULLEN VALLEY FORMER MANGANESE
ORE PROCESSING FACILITY
LA PAZ COUNTY, ARIZONA

City of Phoenix

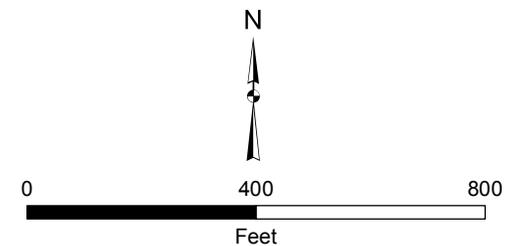


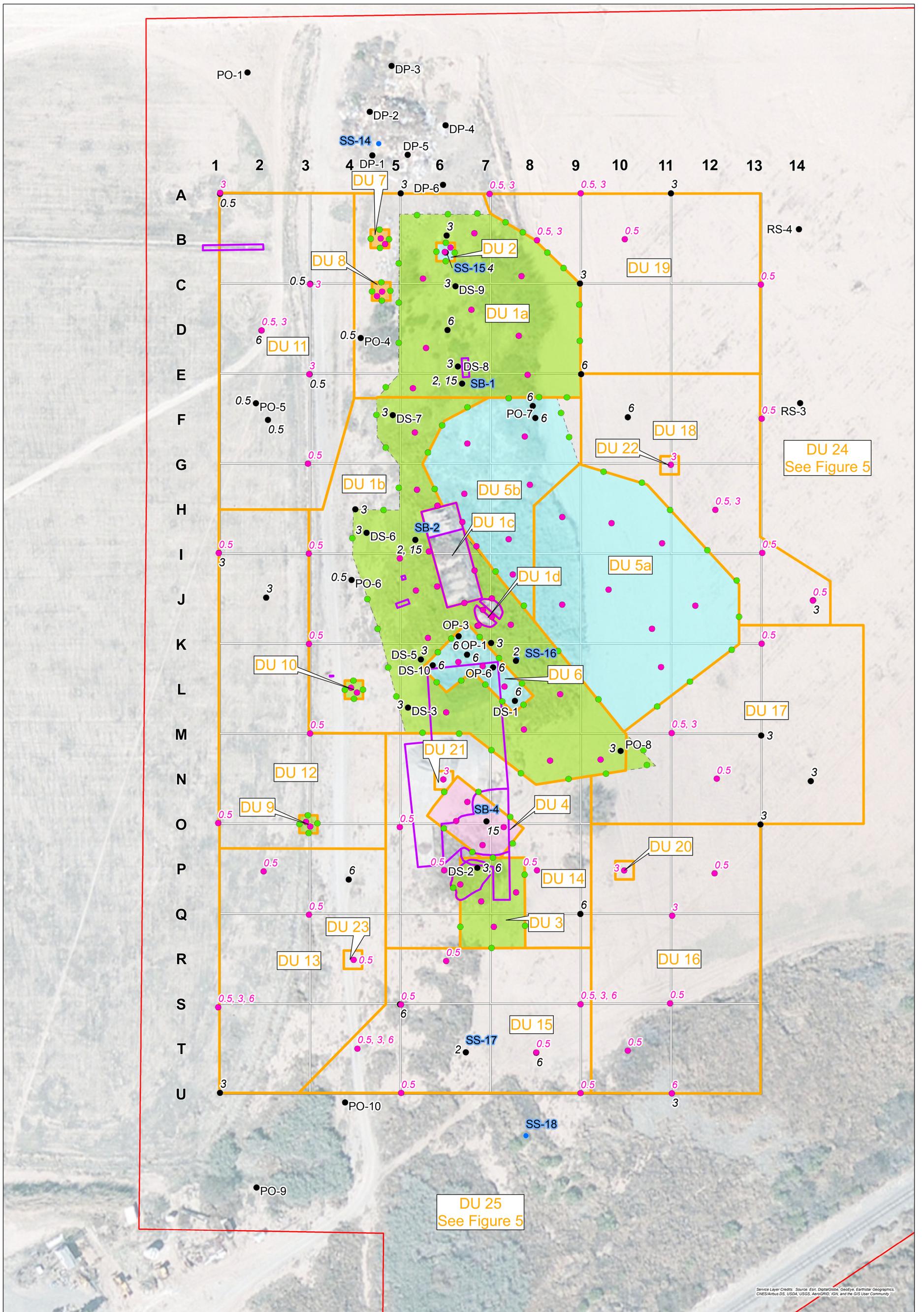
Legend

- Previous Operations Area
- Remaining Site Area
- Debris Pile
- Ore Pile
- Subject Property
- Boundary of XRF Study
- Decision Unit
- Proposed Soil Boring
- Soil Boring, 2013
- Soil Boring, 2012
- XRF Sample Location Pb Result
- XRF Sample Location Mn Result

- 1 - Trash Debris Pile
- 2 - Approximate Location of the Former AST Foundation
- 3 - Approximate Location of the Raised Foundation
- 4 - Approximate Location of the Concrete Slab
- 5 - Approximate Location of the Former Wash Pad

Source:
 Soil Boring: URS 2012, 2013
 Base map: National Agriculture Imagery Program, 2010
 Imagery: Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





Service Layer Credits: Source: Esri, DataCity, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

- Legend**
- Subject Property
 - Decision Unit
 - 0.5 Proposed Floor/Surface/Boring Laboratory Sample Boring Depth in Feet
*Depth of floor sample equals depth of excavation plus 3 inches.
 - Proposed Wall Laboratory Sample (see Table 1 for Depth)
 - 100-Foot Sample Grid
 - Historical Laboratory Soil Sample Depth in Feet
 - Concrete Structures

- Removal of 1 Foot of Soil BGS
- Removal of 3.5 Feet of Soil BGS
- Removal of 4.5 Feet of Soil BGS
- Removal of 6.5 Feet of Soil BGS

Definitions:
 BGS - below ground surface
 NR-SRL - non-residential soil remediation level

FIGURE 6
 PROPOSED LABORATORY CONFIRMATION SAMPLING LOCATIONS
 AND EXISTING LABORATORY SAMPLES REMAINING
 FOLLOWING EXCAVATION
 MCMULLEN VALLEY FORMER MANGANESE ORE SITE
 LA PAZ COUNTY, ARIZONA

