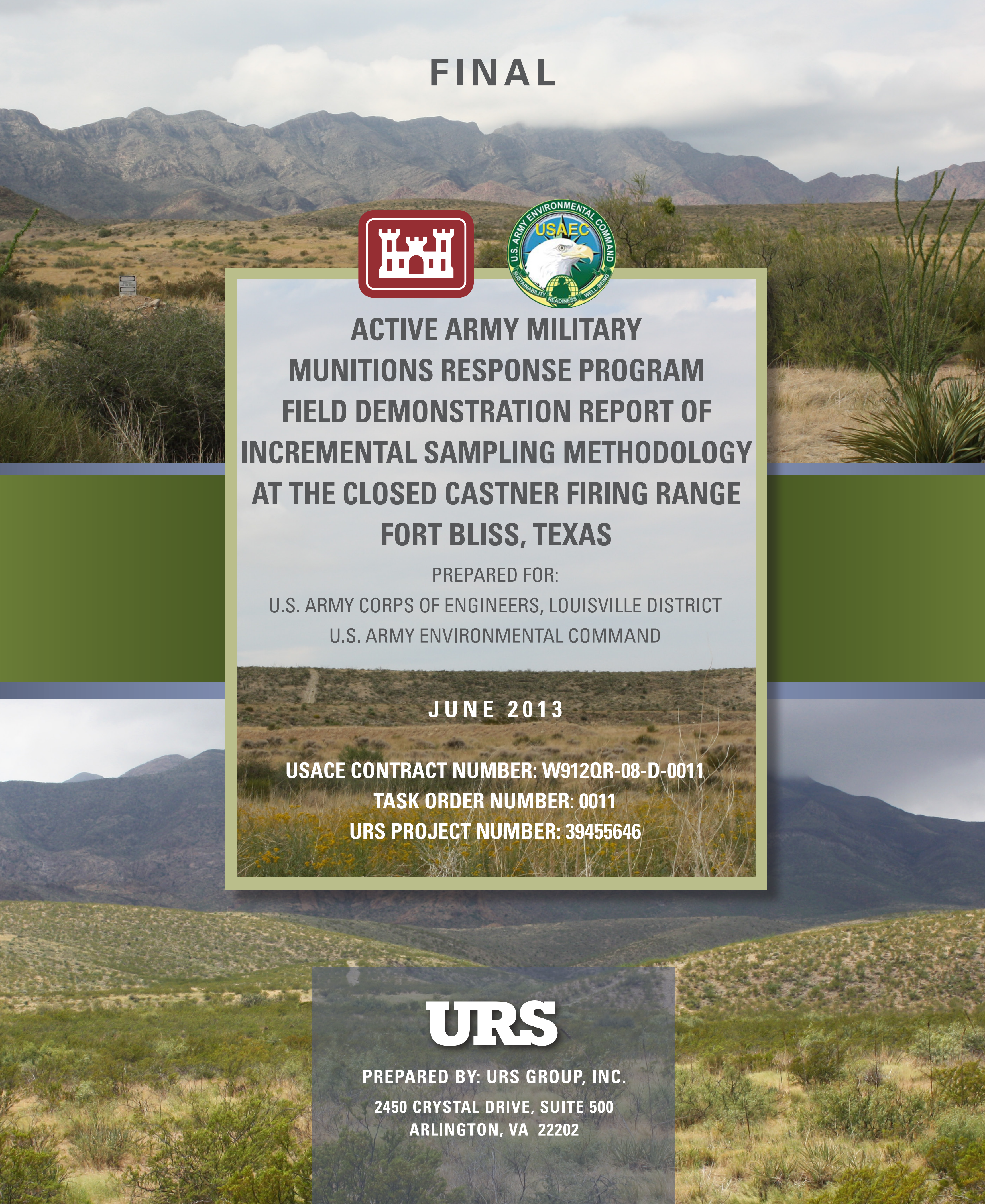

FINAL

ACTIVE ARMY MILITARY MUNITIONS RESPONSE PROGRAM FIELD DEMONSTRATION REPORT OF INCREMENTAL SAMPLING METHODOLOGY AT THE CLOSED CASTNER FIRING RANGE FORT BLISS, TEXAS

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT
U.S. ARMY ENVIRONMENTAL COMMAND

JUNE 2013

USACE CONTRACT NUMBER: W912QR-08-D-0011
TASK ORDER NUMBER: 0011
URS PROJECT NUMBER: 39455646

URS

PREPARED BY: URS GROUP, INC.

2450 CRYSTAL DRIVE, SUITE 500
ARLINGTON, VA 22202

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Prepared for

U.S. Army Corps of Engineers, Louisville District

and

U.S. Army Environmental Command

Prepared by

URS Group, Inc.
2450 Crystal Drive, Suite 500
Arlington, VA 22202-4812

June 2013

EXECUTIVE SUMMARY

Incremental sampling methodology (ISM) combines equivalent small soil increments from multiple points within an area of interest to create a soil sample of 1 to 2 kg. Large particles (i.e., greater than 2mm) are sieved out, and the soil is ground to powder and thoroughly blended so that laboratory aliquots are representative of the remaining sample mass. Soil analysis obtained on samples collected using incremental methods are designed to represent the mean concentration of the analytes in the sampled area, and have been shown to be more reproducible than either discrete or composite samples. ISM and its application to Department of Defense ranges and training areas have become increasingly common, and a draft implementation guidance document was prepared by the Army.

The purpose of this project was to demonstrate the implementation of the Army's draft *MMRP Guidance Document for Soil Sampling of Energetics and Metals* under field conditions representative of a full-scale investigation (U.S. Army Cold Regions Research and Engineering Laboratory [CRREL] 2011). The study area was approximately 4,000 acres of the Closed Castner Firing Range Munitions Response Site (MRS) (Army Environmental Database-Restoration [AEDB-R] number FTBLS-004-R-01) at Fort Bliss, Texas. The study area focused on areas that were previously characterized geophysically in the Wide Area Assessment Field Demonstration Project. Sampling and analysis data quality was controlled in accordance with remedial investigation standards so that the resulting data could be used in subsequent investigations.

The objectives of this project were as follows:

- Implement the Army's draft incremental sampling protocol and recommend modifications to improve effectiveness
- Determine the nature and extent of munitions constituents (MC)
- Gain regulatory acceptance of the sampling approach and results
- Test the effect of sampling unit size on MC concentrations
- Test the correlation between munitions and explosives of concern (MEC) density and MC concentrations

The approach selected through planning and review with regulators and stakeholders was to randomly place 60 1-acre sampling units in areas with fewer than 500 metallic anomalies per acre, and another 60 in areas with more than 500 metallic anomalies per acre. The first phase of sampling occurred in February 2011. Evidence of explosives was limited, localized, and attributed to known range activities. Metals were, of course, more widespread because they are naturally occurring in the environment. Data were evaluated for correlations of metals concentrations with soil type, target area, and MEC density. Geostatistical kriging was performed, and a data gap analysis recommended additional samples to achieve a sufficient spatial coverage of the areas of interest. Additionally, more background sampling units were evaluated, and uncertainties in the Phase 1 data were identified. A second round of sampling performed in September 2012 collected approximately 56 additional primary samples.

In summary, project objectives were addressed as follows:

- The Army's draft guidance was successfully implemented at full scale, and recommendations were developed.
- Geostatistical methods such as kriging were successfully used to delineate the nature and extent of MC at the Closed Castner Firing Range. Kriging methods are useful and appropriate tools when using a sufficient number of randomly distributed data points to delineate the extent of contamination over a large area of interest. Additional study and sampling may be required to complete the delineation in a Remedial Investigation.
- Site-specific background upper prediction limits were calculated based on 15 incremental samples collected from nearby property unaffected by military activities.
- Texas regulations do not specifically address the use of ISM but are amenable to considering investigations based on the methodology. In addition to meetings with Texas Commission on Environmental Quality, the project team met in Technical Project Planning meetings with stakeholders to discuss the planning, execution, intermediate, and final results.
- Sampling units were uniformly 1 acre, which was supported by prior research and stakeholder agreement; larger (i.e., 10-acre) sampling units were not tested.
- There is a statistically significant correlation between MEC/MD density and MC concentrations. Because of the correlation, the digital geophysical mapping results may be used to guide the number and placement of MC sampling units.

On the basis of the study results, the Army's guidance for implementing ISM at full scale on Army ranges appears suitable for use and ready for adaptation to a formal guidance document.

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ACRONYMS AND ABBREVIATIONS

AEDB-R	Army Environmental Database-Restoration
APAR	Affected Property Assessment Report
bgs	below ground surface
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMIST	CRREL Multi-Increment® Sampling Tool
COC	Constituent of Concern
COPC	Constituents of Potential Concern
CRREL	U.S. Army Cold Regions Research and Engineering Laboratory
CSM	Conceptual Site Model
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DMM	Discarded Military Munitions
DNB	Dinitrobenzene
DNT	Dinitrotoluene
DoD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objective
EMI	Electromagnetic Induction
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
FD	Field Duplicate
FS	Feasibility Study
FT	Field Triplicate
FUDS	Formerly Used Defense Sites
GIS	Geographical Information System
GPS	Global Positioning System
GW	Groundwater
HASP	Health and Safety Plan
HE	High Explosive
HMX	Cyclotetramethylenetetranitramine
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology and Regulatory Council
Lidar	Light Detection and Ranging
LOQ	Limit of Quantification
MC	Munitions Constituents
MCOC	Munitions Constituents of Concern
MD	Munitions Debris
MDL	Minimum Detection Limit
MEC	Munitions and Explosives of Concern
MIS	Multi-increment Sampling
MMRP	Military Munitions Response Program

MRS	Munitions Response Site
MYBP	Million Years Before Present
NRCS	Natural Resource Conservation Service
OB	Open Burn
OD	Open Detonation
PA	Preliminary Assessment
PCL	Protective Concentration Limit
PETN	Pentaerythritol Tetranitrate
pH	Potential of Hydrogen (acidity scale)
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
RI	Remedial Investigation
RMSE	Root Mean Square Error
RSD	Relative Standard Deviation
SI	Site Inspection
SOP	Standard Operating Procedure
SSURGO	Soil Survey Geographic
TCEQ	Texas Commission on Environmental Quality
TNT	Trinitrotoluene
TP	Target Practice
TPP	Technical Project Planning
TRRP	Texas Risk Reduction Program
UCL	Upper Confidence Limit
UPL	Upper Prediction Limit
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USDA	U.S. Department of Agriculture
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
WAA	Wide Area Assessment

1. INTRODUCTION

1.1 Authorization

The task order entitled, "Active Army Military Munitions Response Program Field Demonstration of Multi-Increment Sampling at Closed Castner Firing Range, Fort Bliss, Texas," was issued to URS Group, Inc. (URS) under contract number W912QR-08-D-0011, delivery order 0011. The start date was April 12, 2010.

Modification 01 was issued on June 24, 2010. The scope of work was revised to incorporate a commercial analytical laboratory to meet the Texas Commission on Environmental Quality (TCEQ) requirements under the Texas Risk Reduction Program (TRRP). US Army Environmental Command (USAEC) had originally anticipated using U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) sampling and analysis, but TCEQ requires that laboratories analyzing samples in support of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response be TCEQ-approved for the analytes and methods performed.

Modification 02 was issued on March 23, 2011; a no-cost, period-of-performance extension was granted through December 31, 2011.

Modification 03 was issued on March 13, 2012; a no-cost, period-of-performance extension was granted through March 31, 2013.

1.2 Purpose and Scope

The purpose of the Field Demonstration at the Closed Castner Firing Range, Fort Bliss, Texas, was to assist USAEC in demonstrating the implementation of incremental sampling methodology (ISM) to characterize munitions constituents (MC) at an Active Army Military Munitions Response Program (MMRP) site, the Closed Castner Firing Range, at Fort Bliss, Texas.

This project was to demonstrate the implementation of ISM and provide feedback to refine the Army's guidance for broad implementation across the Active Army MMRP. In particular, this project sought to field test the CRREL-developed incremental sampling guidance, (CRREL 2011) and evaluate its suitability for application in a full-scale MMRP production environment. Data were collected to meet the requirements of TRRP and in a manner to support future investigations (i.e., Remedial Investigation/Feasibility Study [RI/FS]) in the MMRP process and/or the Affected Property Assessment under TRRP at the Closed Castner Firing Range.

This project was conducted in conjunction with, and partially based on the results of, the Wide Area Assessment (WAA) Field Demonstration project (Contract Number W912QR-08-D-0011, DK01) conducted at the Closed Castner Firing Range from September 2009 through July 2012 (URS 2012). In that study, the costs and benefits of applying various wide area investigation methods were demonstrated at the Closed Castner Firing Range Munitions Response Site (MRS). WAA data were collected to define the relative densities and distribution of munitions and explosives of concern (MEC) and munitions debris (MD) at the MRS to support future investigations and land management decisions. Data in the WAA project were collected with the objectives of (1) supporting the identification of areas of concentrated munitions use, (2) confirming the identification of areas with no indication of munitions use, and (3) improving the understanding of relative densities of MEC/MD across the MRS. The WAA methods demonstrated include (1) light detection and ranging (lidar) and orthophotography, (2) helicopter-borne magnetometer survey, (3) man-portable electromagnetic induction (EMI) survey, and (4) analog range reconnaissance using handheld EMI instruments and personal digital assistants. Intrusive investigation was used to identify and classify nearly 3000 metallic anomalies identified by geophysical means.

1.3 Report Organization

Section 2 of this report describes the Closed Castner Firing Range historical use and physical, meteorological, geological, and ecological characteristics.

Section 3 reviews the previous investigations, studies, and removal actions at the site.

Section 4 summarizes the objectives of the current study and describes the methods used to design the sampling approach to meet the objectives. Stakeholders are identified, and methods used to control the quality of the data collection and management are described. Section 4 also includes a description of the data evaluation of the Phase 1 data set, and the identification of data gaps that were then filled through Phase 2 sampling.

Section 5 examines the resulting Phase 1 and Phase 2 data, and discusses them in light of the project objectives and within the context of future investigations. Section 5 also evaluates the project in terms of the CRREL guidance and offers recommendations for adjusting the guidance to a full-scale MMRP production environment.

Section 6 summarizes the conclusions and recommendations.

Section 7 lists relevant documents and reports referenced in the body of this report.

Appendices containing substantiating data and additional supporting information are attached as listed in the table of contents.

2. SITE DESCRIPTION

2.1 Site Location

Fort Bliss is located in three counties, Dona Ana and Otero counties in New Mexico and El Paso County in Texas. The cantonment area is situated adjacent to the city of El Paso, Texas, just north of the city of Juarez, Chihuahua, Mexico. The installation encompasses approximately 1.1 million acres. Figure 2-1 is a location map of Fort Bliss.

The Closed Castner Firing Range MRS (designated in the AEDB-R as FTBLS-004-R-01) on Fort Bliss is located within El Paso, Texas, between U.S. Highway 54 and the Franklin Mountains State Park, and is approximately 8 miles south of the border with New Mexico. The MRS is now 7,007 acres, after acreage east of U.S. Highway 54 was transferred to non-Department of Defense (DoD) entities. The site contains medium and large caliber projectiles (including high explosives [HE], fragmentation, and target practice [TP]), mortars, pyrotechnics, illumination flares, grenades, and small arms. Figure 2-2 is a map of the Closed Castner Firing Range MRS and its topography.

2.2 Historical Information

2.2.1 Overview of Historical Uses

During the war with Mexico in 1846, Colonel Alexander W. Doniphan and the 1st Missouri Mounted Volunteers became the first U.S. Army troops to enter the El Paso area. On November 7, 1848, the War Department directed the establishment of a post in El Paso to protect railways, stage routes, and settlers. The post was named Fort Bliss in honor of Lieutenant Colonel William Wallace Smith Bliss on March 8, 1854. El Paso established a permanent site for the post in 1890 and troops began to occupy the current location in 1893. The greatest period of growth for Fort Bliss occurred in response to a raid across the border by Pancho Villa, instigating a border control mission. World War II saw the cavalry dominance replaced by anti-aircraft artillery and the establishment of the installation as the largest overland air defense missile range and training center in the world. The U.S. Air Force closed neighboring Biggs Air Force Base in 1966 and turned it over to Fort Bliss (Fort Bliss 2001).

2.2.2 Ownership History

The acquisition of Castner Range began in 1926, initially encompassing approximately 3,500 acres. Additional land was acquired by 1939 increasing the Range to 8,328 acres. Castner Range was heavily used as an impact area for small arms training and artillery firings from 1926 to 1966. In 1971, the Department of Army reported the Closed Castner Firing Range as surplus to its needs. As a result explosives clearance actions were undertaken resulting in several portions of the Range being transferred to non-DOD entities. Because explosives clearance actions were suspended, the remainder of the Range was returned to Fort Bliss in 1983 as un-disposable due to the presence of explosives. As a result the remaining 7,007 acres that is modern day Castner Range, remains in the Army property inventory.

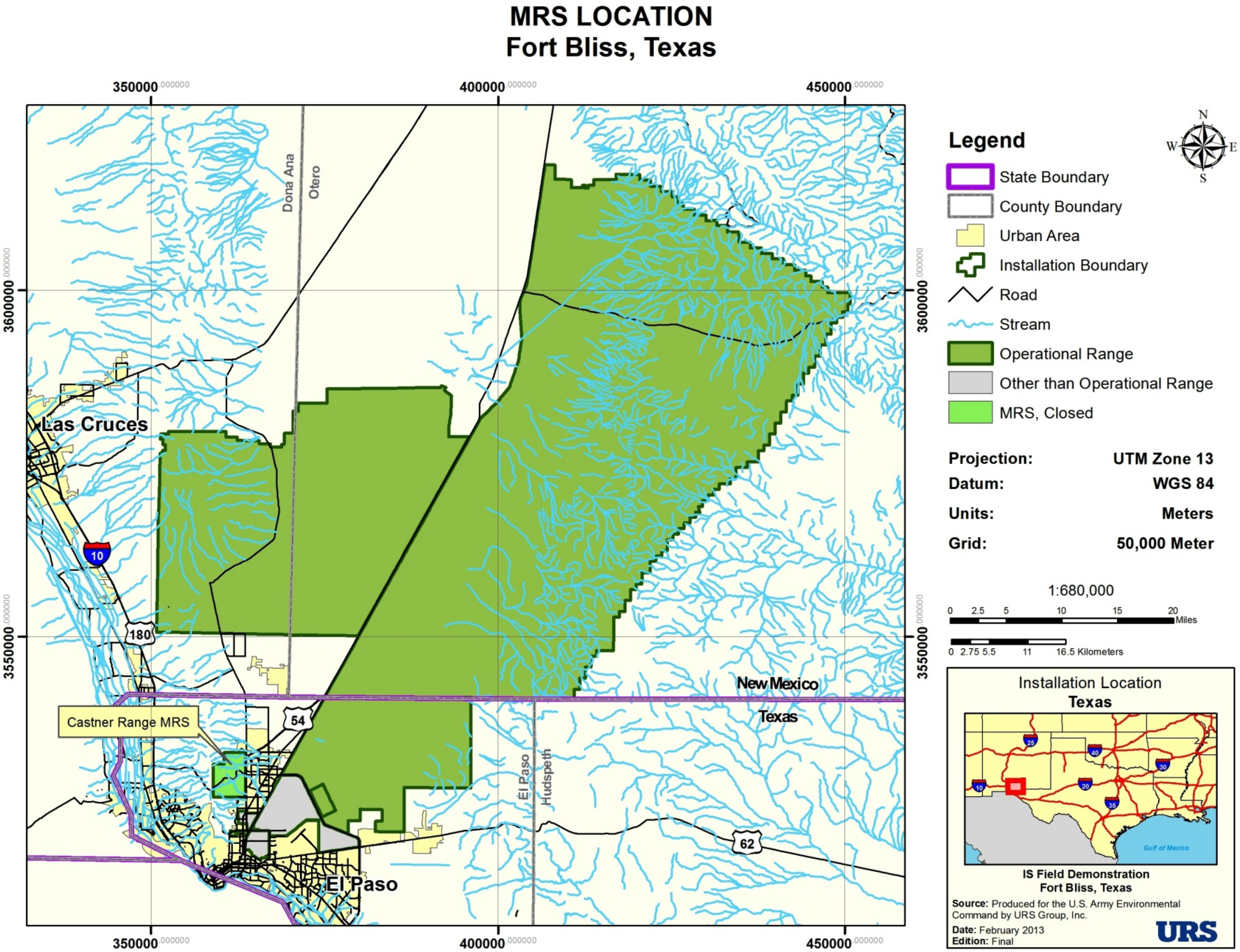

Figure 2-1. Fort Bliss Location Map

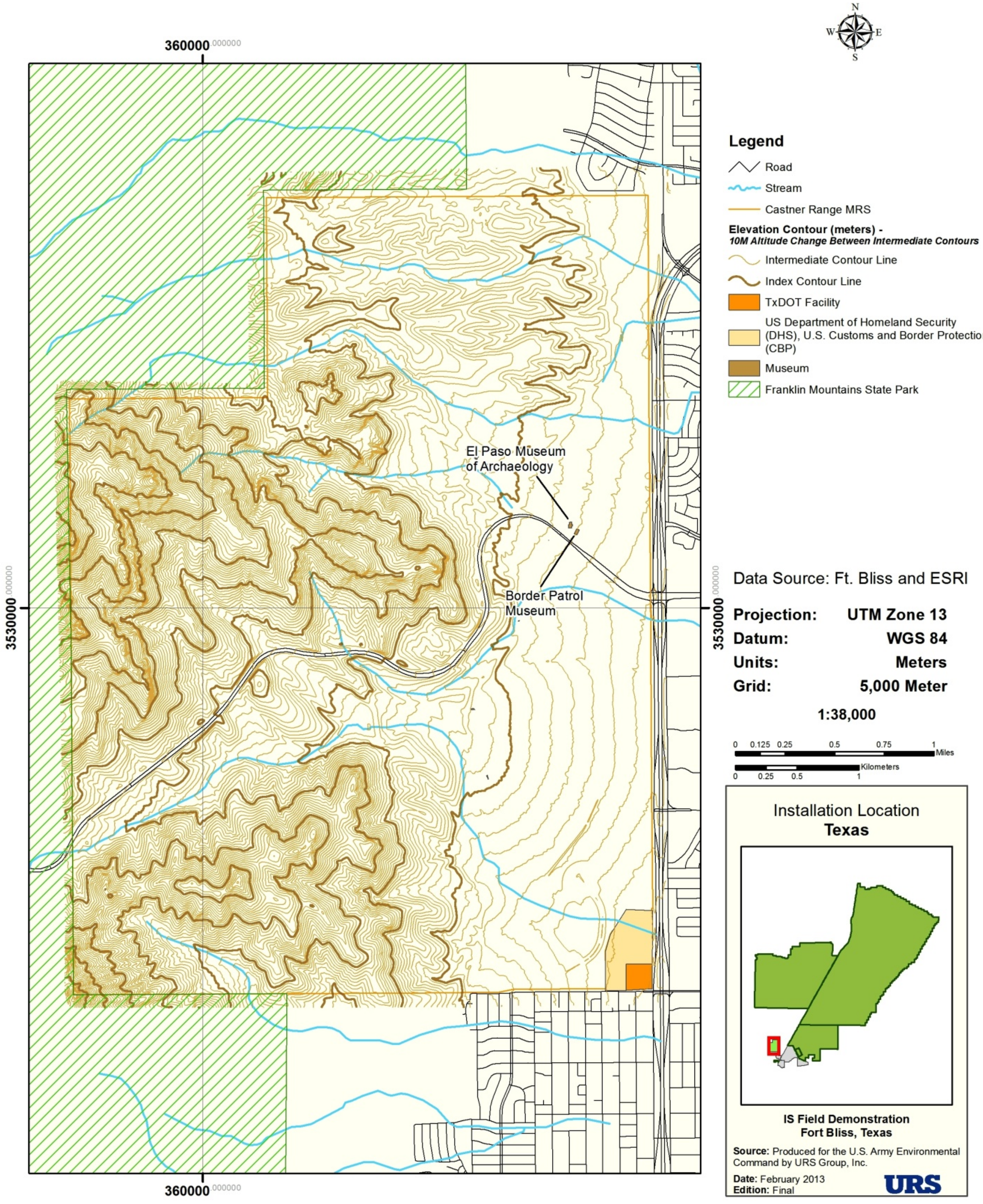

Figure 2-2. Closed Castner Firing Range MRS and Topography

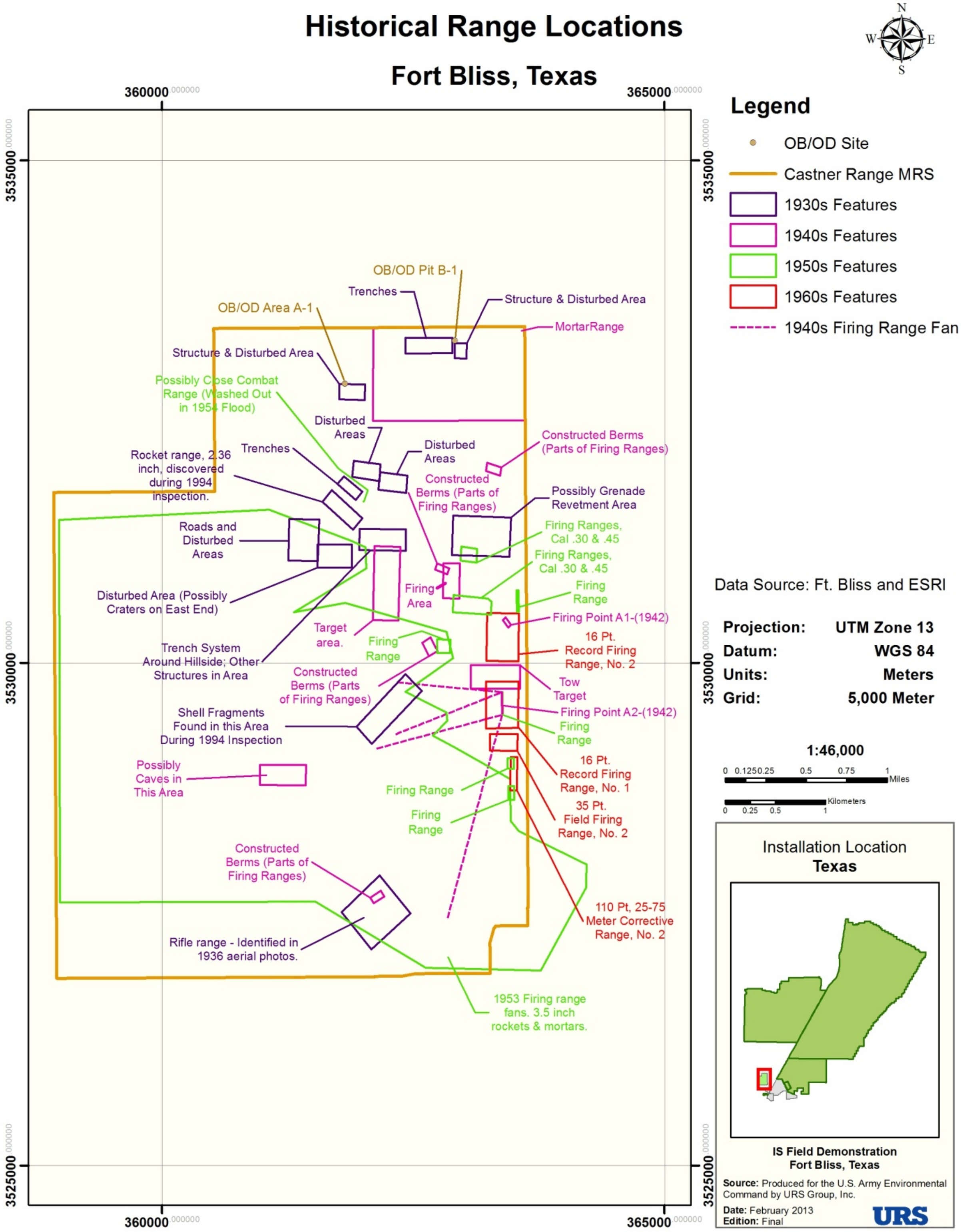

Figure 2-3. Historical Uses of the Closed Castner Firing Range MRS Study Area

2.2.3 Munitions Fired On-Site

Based on records reviewed in the Site Inspection (SI) Report (e2M 2007), the Closed Castner Firing Range MRS potentially contains munitions items related to flares; signaling items; training simulator devices; screening smoke; grenades (hand, rifle, smoke); small, medium, and large projectiles (20mm–155mm); mortars; rockets; and small arms.

Reports from investigation and clearance activities on the Closed Castner Firing Range MRS over the past 40 years have documented actual finds of munitions, including grenades (hand, rifle, and smoke); small, medium, and large projectiles (20mm–120mm); mortars (3-in. Stokes, 4.2 in., and 81mm); rockets (2.36 in. and 3.5 in.); and small arms items. The SI Report indicates that approximately 80% of the site was used for small arms training.

The Historical Records Review and SI indicate that mechanisms by which the munitions may have been released into the environment include intentional activities, such as firing into a target area, and disposal operations by open burn (OB)/open detonation (OD). The OB/OD area (FTBL-073) was found to contain cyclotetramethylenetetranitramine (HMX), cyclotrimethylenetrinitramine (RDX), and Resource Conservation and Recovery Act (RCRA) metals (e2M 2007).

2.3 Site Physical Characteristics

2.3.1 Surface Features

The Closed Castner Firing Range MRS lies in the foothills of the Franklin Mountains. The dominant terrain types are gently rolling terrain (approximately 40%, or 2,800 acres), heavily rolling terrain (approximately 20%, or 1,400 acres), and mountainous terrain (approximately 40%, or 2,800 acres). The Franklin Mountains’ northernmost reaches extend into Fort Bliss and are composed mostly of lower slopes and alluvial fans, which range in elevation from 4,265 ft to slightly over 5,000 ft above mean sea level.

Fusselman Dam and other unnamed drainage, diversion, and retention features help to manage runoff during precipitation events. The Woodrow Bean Transmountain Road (Loop 375) bisects the Closed Castner Firing Range, east-west. Topographic features of the Closed Castner Firing Range MRS are shown on Figure 2-2. The MRS is a generally open area, although the steep slopes (greater than 10% slope) of the Franklin Mountains on the western portion of the parcel presented a topographic constraint on the extent of this investigation (Figure 2-4).

2.3.2 Meteorology

The climate across Fort Bliss, including the Closed Castner Firing Range, is typified by low relative humidity, hot summer months, and moderate spring and winter months. Higher elevations on the installation receive higher levels of precipitation and can, therefore, display semi- and sub-humid climatic zones.

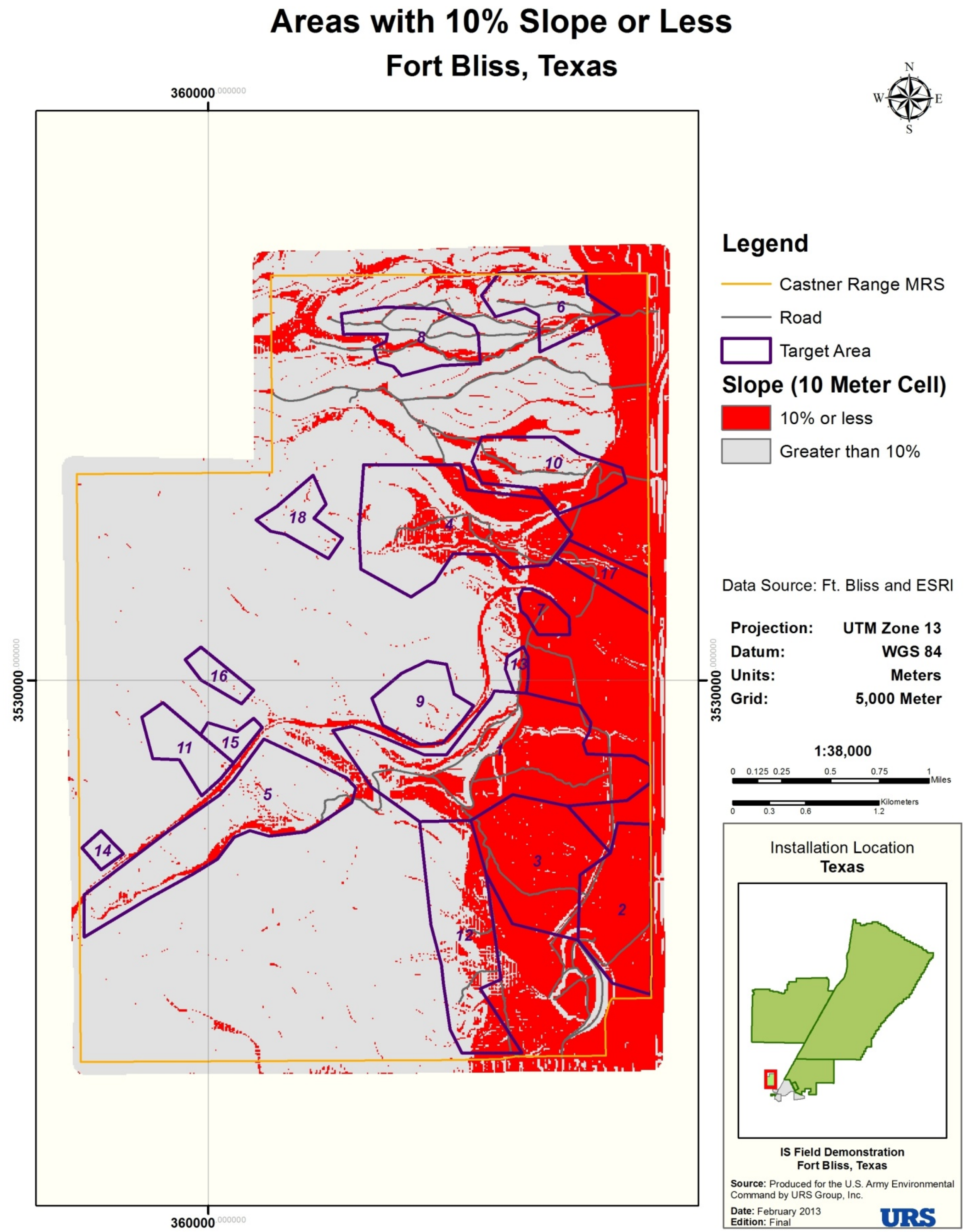

Figure 2-4. Slopes Greater Than 10% Constrained the Available Sampling Areas

The average annual precipitation at Fort Bliss ranges from 8 in. in the valley to 20 in. in the mountains. Warm, moist air from the Gulf of Mexico, and occasionally from the Pacific Ocean, precipitates thunderstorms in the region. Thunderstorm activity is prevalent between July and September, accounting for the majority of the annual rainfall. A dry season occurs from winter to early summer. Snowfalls average 4.6 in. annually, but ground snow rarely lasts for more than a day.

Fort Bliss experiences a highly variable range of temperatures throughout the year, between –8ºF and 114ºF. The daily average is 64ºF, with a daily maximum average of 76ºF and a minimum of 51ºF. Temperatures typically rise above 90°F on an average of 87 days/year, and fall below freezing on an average of 34 days/year. Evaporation rates are very high on the installation, averaging a 97 in. precipitation deficit each year (Fort Bliss 2001).

2.3.3 Surface Water Hydrology

No perennial surface water flows on the Closed Castner Firing Range. Natural drainage channels are well defined in the steeper foothill areas near the Franklin Mountains, providing channels for heavy stormwater flow. As the drainages reach the flatter eastern alluvial fans below the foothills, they become more shallow and variable in their courses. Fusselman Dam and other engineered drainage, diversion, and retention features have been constructed to help manage runoff during heavy precipitation events.

2.3.4 Geology

The study area and vicinity were part of a relatively shallow marine shelf from the late Cambrian (600–500 million years before present [MYBP] through the early Pennsylvanian [310–280 MYBP] eras). Dolomite beds are from the late Cambrian to the late Ordovician (500–425 MYBP) and are the oldest sedimentary deposits in the area. Deposition during Devonian time consisted mainly of marine shales and shaly limestones. A relatively thin sequence of upper Mississippian age limestone and shale overlies the Devonian rocks. Unconformably overlying the Mississippian deposits are approximately 3,000 ft of Pennsylvanian age sediments. These strata consist of limestone, sandstone, dolomite, and shale, which were deposited in a shallow marine environment. Tectonic disturbances in Virgilian time (late Pennsylvanian) altered the sedimentation origin from marine to terrestrial. The tectonic movement resulted in the subject area becoming a large depression with landmasses developed to the east, west, and southwest. In later Pennsylvanian and early Permian time, the Hueco Basin received a thick sequence of land-derived sediments. Most sedimentary rocks in the area consist of limestone strata of the San Andres formation. These sediments mark the return of marine shelf deposition in the area. Broad regional uplift that occurred between 80 and 40 MYBP (Cenozoic Era) and differential drift within the North American Plate, which occurred 30 MYBP (Miocene), created fault patterns in the region. The result was a physiographic province characterized by down-dropped basins (grabens) bounded by tilted fault block mountains. These grabens have been filled with heterogeneous, unconsolidated to poorly consolidated sediments, which cover underlying sediments. By middle Cenozoic time (present to 65 MYBP), the Hueco and Mesilla bolsons on the east and west of the Franklin Mountains, respectively, were the prominent basins of deposition. There is evidence that the Hueco Basin has had a history of continuous, closed basin deposition, with Kansas playa complexes possibly united with Lake Cabeza de Vaca and/or Lake Lucero to the north. Eroded petrocalcic horizons, braided stream deposits alternating with poorly sorted mudflows, relic and Paleozoic horizons, topographic expressions of old sediment surfaces and terrace strand lines, and multiple superimposed petrocalcic (caliche) horizons demonstrate several periods of alternatively wetter and drier climatic trends during and since the Pleistocene (0.01–2 MYBP).

The southern portion of the Hueco Basin contains more than 6,000 ft of valley fill, stream sand, and gravel; rock slides; alluvial fans from mountains on either side; and lake deposits rich in salt and gypsum derived from sedimentary rocks of the adjacent ranges. Any rainfall or melted snowfall that occurs in the valley either seeps into the porous valley deposits or evaporates from small pools, leaving deposits of gypsum, salt, or other minerals. Fault lines along the edge of the Hueco Basin may still be active, although no movement has been recorded in recent time. The mountain ranges adjacent to Fort Bliss developed during separate geologic periods and comprise a variety of minerals and soils. These geologically different mountain ranges generally contain site-specific substrates, creating areas of unique communities. The Fort Bliss region lies in an area considered to be of moderate seismic activity. The Franklin Mountains block has been rising and the Hueco Bolson block has been sinking for tens of millions of years. Earthquake data estimate that the strongest earthquake in the area in a 100 year period lies between a magnitude of 4.8 and 6.0 on the Richter scale (e2M 2007).

Relatively small deposits of Castner Limestone containing diabase (or dolerite) dikes and sills are located in the central portion of the site, west of the Fusselman Dam area (see Figure 2-5). This area of potentially magnetic geology is in relatively higher elevations and steeper terrain. During the WAA project, magnetometer-based geophysical mapping was not performed in that area; however, magnetometer-based geophysical mapping was conducted in the lower elevations and generally flatter eastern part of the site, which is downslope from these potentially magnetic flows. These deposits, although localized, could be a source of the magnetic interference experienced in this downslope area. It is possible that, before the installation of the dam, the potentially magnetic geology to the north of the dam eroded and was deposited in the alluvial fan on the flat eastern part of the site at the base of the Franklin Mountains. This is depicted on Figure 2-5.

2.3.5 Soil

Consociations based on the dominant soil series for each map unit found on the range were identified through the U.S. Department of Agriculture's (USDA) Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database (2009). As shown on Figure 2-6, the Missile, Crotalus, and Chaparral soils dominate the northern portion of the site, while the Missile and Chipotle series dominate the southern extent.

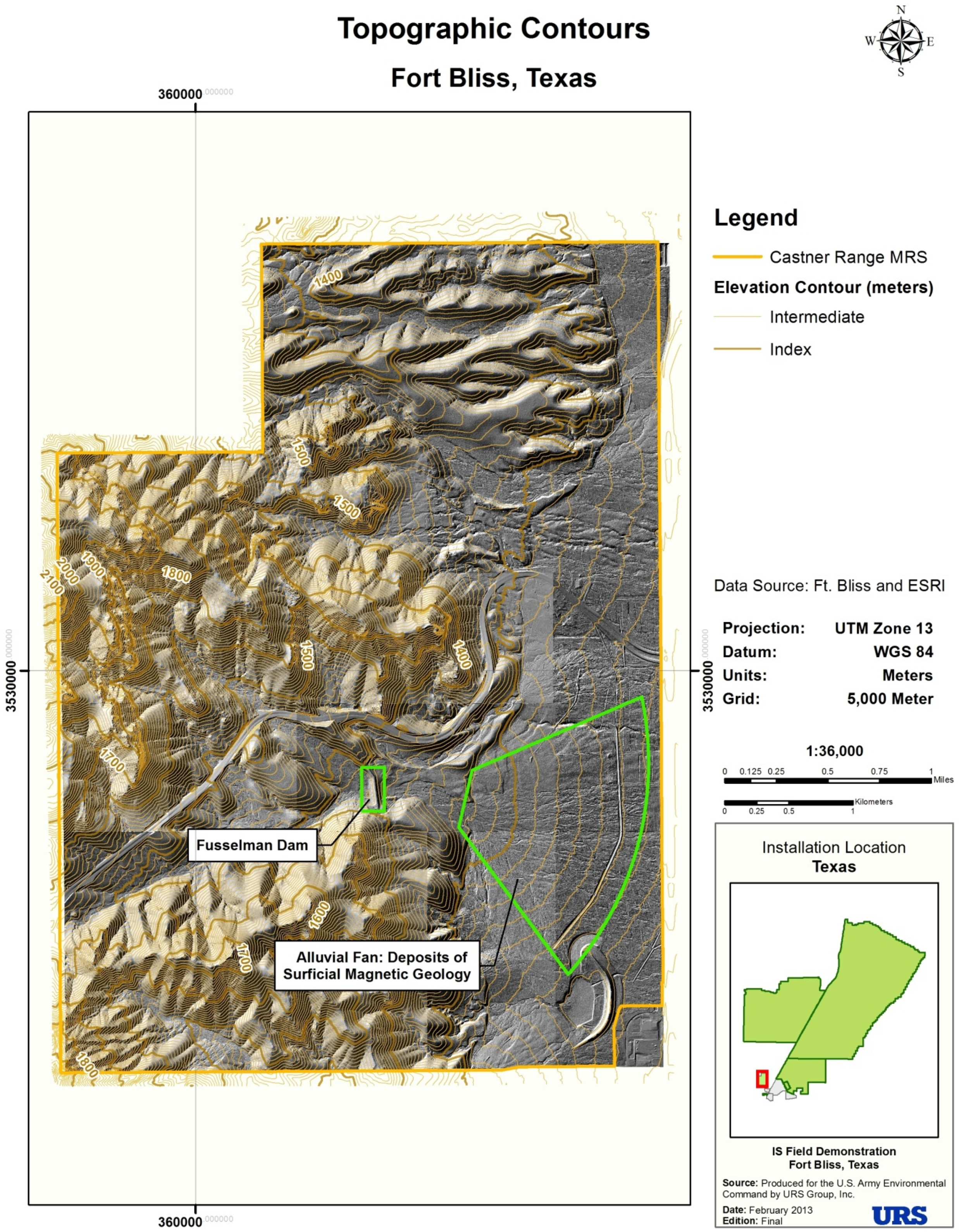

Figure 2-5. Areas Affected by Magnetic Deposits

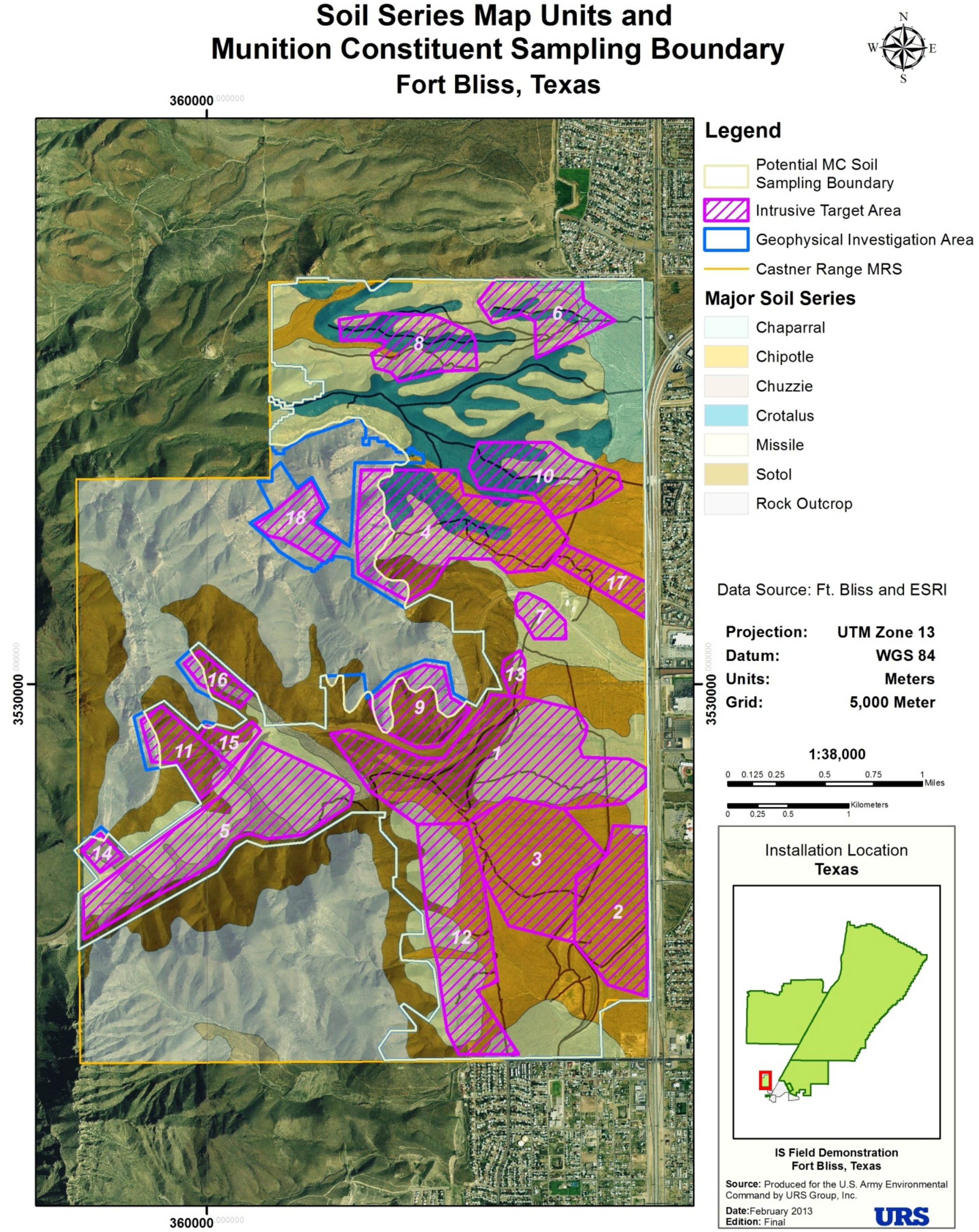

Figure 2-6. Soil Units Relative to Defined Target Areas

The Missile, Crotalus, and Chaparral soils found within the northern region of the site are all part of the Aridisol soil order. Aridisols are primarily located in arid regions, which limit percolation of water into the soils due either to sparse rainfall or another restricting factor. As such, these soils are characterized by a lack of water available to mesophytic plants for extended periods, one or more pedogenic horizons, a surface horizon or horizons not significantly darkened by humus, and an absence of deep, wide cracks or andic soil properties. Each of these series are slightly alkaline (USDA 1999).

The Chipotle soil found in the southern portion of the site is an Entisol. Entisols can be found in any climate and under any vegetation. Some unique properties of soils found in this order are the dominance of mineral soil materials and absence of distinct pedogenic horizons. This absence of features is in itself an important distinction to soils of this order and may be the due to causes such as the result of inert parent material, slowly soluble hard rock, insufficient time for horizons to form, or their occurrence on slopes where the rate of erosion exceeds the rate of formation of pedogenic horizons. The Chipotle series are moderately acidic.

As seen on Figure 2-6, a significant portion of the site is rock outcrop that has insufficient soil for sampling. Even in areas showing specific soil types, the rocky and gravelly nature of the Closed Castner Firing Range results in thin soil cover over much of the range, especially closer to the Franklin Mountains. Surface sampling is difficult; subsurface sampling is frequently impossible.

2.3.6 Hydrogeology

Groundwater is found in both fluvial and lacustrine deposits, although fluvial aquifers are the primary source for the area. Groundwater used at Fort Bliss comes from two major basins, the Hueco Bolson and the Mesilla Bolson, which are separated by the Franklin Mountains. The Hueco Bolson is located in the southern half of the Hueco Basin paralleling the eastern base of the Franklin Mountains. It contains fill material consisting primarily of fluvial and lacustrine deposits with a maximum thickness of 9,000 ft. Groundwater recharge is provided by the runoff of precipitation percolating through alluvial deposits at nearby mountain bases.

The Mesilla Bolson lies on the west side of the Franklin Mountains, extending along the Rio Grande Valley through New Mexico and Mexico. The geology in the Mesilla Bolson is similar to that of the Hueco Bolson, with basin fills that are contemporaneous formations of recent and Sante Fe geologic periods. Fort Bliss uses only limited water resources from the Mesilla Bolson (e2M 2007).

No groundwater wells exist on the Closed Castner Firing Range. Below El Paso, the depth to groundwater of the Hueco Bolson on the east side of the Franklin Mountains ranges from 250 ft to 400 ft below ground surface (bgs) (Sheng 2001), but has not been measured on the site. A public well about 1 mile east of Highway 54 reports a static depth to water of 324 ft bgs. During site investigation activities in 2004, a test boring was drilled to a depth of 48.5 ft bgs and groundwater was not encountered.

2.3.7 Demography and Land Use

Although in 1972 the Army attempted to declare the Closed Castner Firing Range surplus to its needs, the declaration was not accepted because of the presence of UXO. Several parcels have since been cleared of UXO and transferred either outright or via lease. These transfers have permitted public uses in connection with Transmountain Road and adjacent overlook picnic areas, the Border Patrol Museum, the Archaeology Museum, Operation Head Start, and the Girls Scouts of America. Governmental sites on the Closed Castner Firing Range include the Department of Homeland Security Border Patrol Station and Texas Department of Transportation (DOT) maintenance yard. Despite signs, notices, fines, and potential jail time, illegal hiking, biking, digging, and harvesting of plants continues to occur on the Closed Castner Firing Range MRS.

Future land use for the Closed Castner Firing Range MRS is undetermined at this time.

2.3.8 Ecology

2.3.8.1 Vegetation

Vegetation types found on the site include barren or low grass (approximately 35%), low grass with brush (approximately 64%), and brush with some trees (approximately 1%). The topographic relief and associated heterogeneity of climate in the southwest result in rich vegetative biodiversity on Fort Bliss. The mountains of Fort Bliss are populated with juniper savanna, conifer and mixed woodlands, and montane conifer forests. The plant communities in the lowland areas include desert grasslands, Chihuahuan Desert scrub, and plains mesa sandscrub.

The Closed Castner Firing Range MRS has three primary plant communities: agave-lechuguilla, alluvial fan-creosotebush, and draw yucca grassland. The Closed Castner Firing Range MRS's mountainous areas are characterized by the agave-lechuguilla community, which forms dense clonal clumps on colluvial slopes of hills and mountains, extending downslope onto erosional piedmont surfaces. The agave-lechuguilla community's predominant species include viscid acacia (*Acacia neovernicosa*), lechuguilla (*Agave lechuguilla*), common sotol (*Dasylirion wheeleri*), ocotillo (*Foquieria splendens*), and catclaw mimosa (*Mimosa aculeaticarpa*).

The alluvial fans of the Franklin Mountains are home to the alluvial fan-creosotebush community, characterized by creosotebush (*Larrea tridentate*), whitethorn (*Acacia constricta*), American tarbush (*Flourensia cernua*), Spanish dagger (*Yucca torreyi*), broom snakeweed (*Gutierrezia sarothrae*), and lechuguilla. Grasses are rare, and, where present, basal coverage is low at less than 0.5%. Arroyos and drainage areas are more moist than other areas and support different vegetation types, including desert willow (*Chilopsis linearis*), Apache plume (*Fallugia paradoxa*), and little leaf sumac (*Rhus microphylla*) (Fort Bliss 2001).

Although there is no documentation of any threatened or endangered plants on the Closed Castner Firing Range MRS, a high outcropping rock formation on the southwest corner of the range exemplifies preferred habitat and substrate for the Sneed Pincushion Cactus *(Coryphantha* *sneedii var. sneedii),* a federal and state endangered species. However, no specimens of the cactus have been found there (Corral 2011), and no project activities occurred in this area.

2.3.8.2 Wildlife

The borderlands region of New Mexico and Texas is a center of biodiversity in temperate North America for birds, mammals, amphibians, and reptiles, so the diversity of terrestrial vertebrates on Fort Bliss is high. However, a few warm-blooded vertebrates are centered in or limited in distribution to the Chihuahuan Desert. Many of the birds and mammals (and a good proportion of the herpetofauna) found on Fort Bliss are those generally found in the intermountain west, with a substantial great plains influence. Approximately 335 species of birds, 58 species of mammals, 39 species of reptiles, and 8 species of amphibians are known to occur on Fort Bliss lands. Although invertebrates play a crucial role in the trophic structure of desert ecosystems, no thorough inventories of invertebrates have been conducted on Fort Bliss. However, the highest known arthropod diversity in North America is found in the southwest, and several groups of arthropods have their centers of diversity for North America in the borderlands region (Fort Bliss 2001).

Several species with various levels of protective status exist on Fort Bliss. Only two threatened fauna occur or potentially occur on the Closed Castner Firing Range MRS, as shown in Table 2-1 (Locke 2011).

Table 2-1. Special Status Fauna Occurring or Potentially Occurring on the Closed Castner Firing Range MRS

Species	Federal Status	Texas Status
Texas horned lizard (*Phrynosoma cornutum*)	—	T
Texas lyre snake (*Trimorphodon biscutatus vilkinsonii*)	—	T

T = threatened species
Source: e2M 2007.

3. PREVIOUS STUDIES

3.1 Wide Area Assessment Field Demonstration

WAA is the specialized application of site characterization technologies to gather data over large areas rapidly, thereby improving the understanding of a site and supporting site management decisions. WAA is not a single technology, but rather a set of methods for applying technologies that increases their coverage and data collection rates.

The Closed Castner Firing Range MRS at Fort Bliss, Texas, was selected as the demonstration site because of its extensive prior use as a training range, large size (over 7,007 acres), and field conditions, including large areas of flat terrain and relatively sparse and low vegetation. The selected approach was to use WAA technologies—lidar, orthophotography, helicopter-borne magnetometry, man-portable EMI digital geophysical mapping (DGM), analog range reconnaissance, and intrusive investigation—in a layered approach. The objective was to demonstrate the ability to use multiple layers of data to identify areas of concentrated munitions use, confirm areas with no munitions use, and improve the understanding of the density and distribution of MEC across the MRS.

The layers of data from these assessment technologies were compiled and compared to identify 18 preliminary target areas, or areas of possible concentrated munitions use. The remaining acreage was hypothesized to be nontarget area based, in part, on the data showing a low probability of encountering MEC. UXO dig teams excavated nearly 3,000 anomalies and classified each find as to type and source. The results of this demonstration project are shown on Figure 3-1. Although this project was not part of an MMRP RI, data collection methods, stakeholder involvement, and application of quality control (QC) measures produced a data set that meets the stringent requirements of an RI (URS 2012).

3.2 Other Studies and Removal Actions

A site inspection report was completed in 2007 for six potential munitions response sites at Fort Bliss, including the Closed Castner Firing Range (e2M 2007). Through a review of historical records, sufficient evidence of MEC and MC presence at the Castner Range was collected to support a recommendation for further investigation and characterization.

Historic site investigations between 1971 and 1999 included 12 surface clearance investigations, 1 subsurface clearance, and 4 soil sample studies (e2M 2007). See Figure 3-2. These investigations discovered MEC as well as soil contamination on the Closed Castner Firing Range MRS. MEC were either removed, blown-in-place or, in some cases left on the range, and included various projectiles, complete rounds, grenades, and other UXO and discarded military munitions (DMM). Analysis of soil samples documented metals, including lead, and various explosives in concentrations above minimum protective concentration levels (PCLs). The development and use of PCLs are discussed in detail in the project-specific Quality Assurance Program Plan (QAPP, URS 2011).

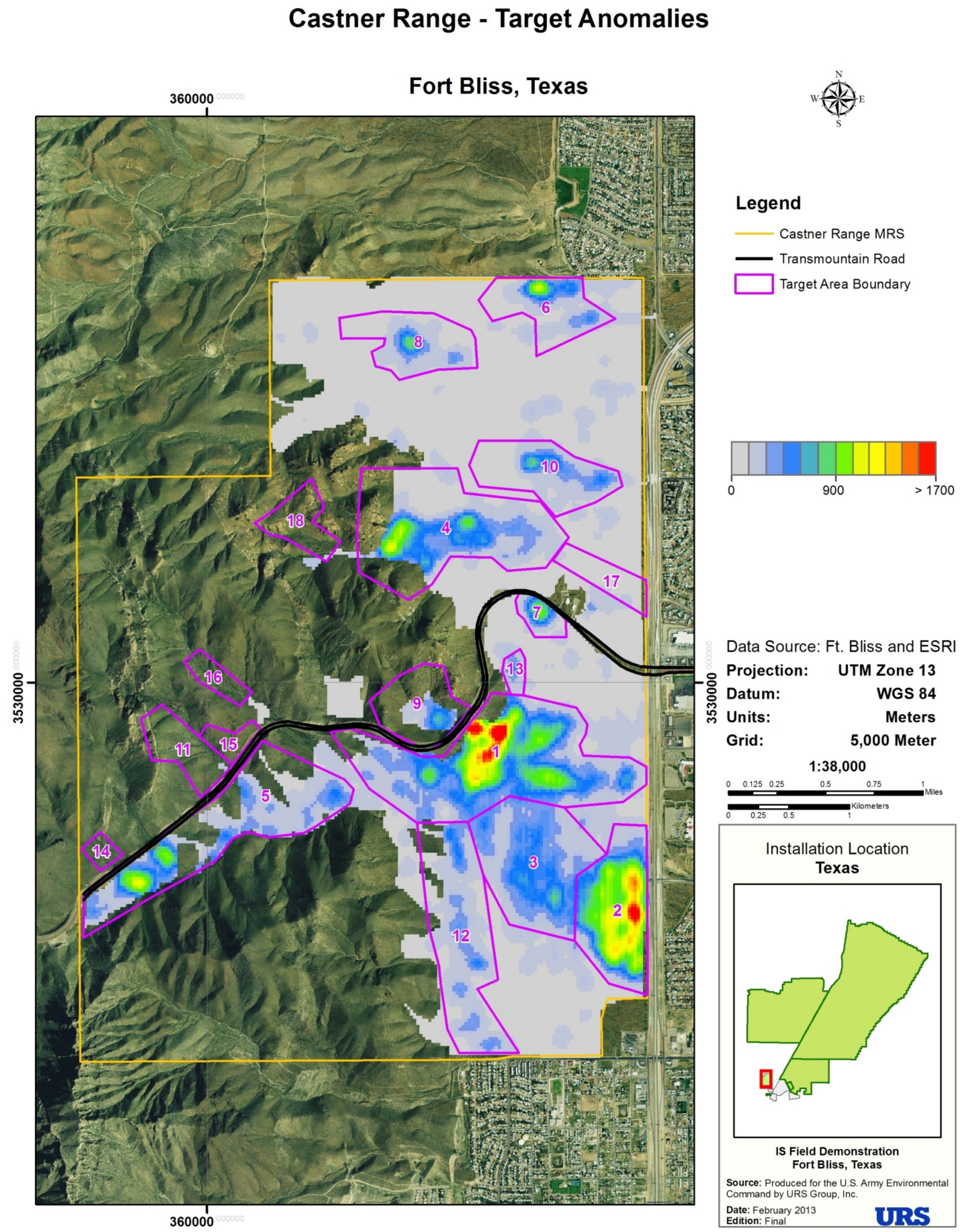

Figure 3-1. The WAA Project Mapped Metallic Anomaly Density and Identified Possible Target Areas

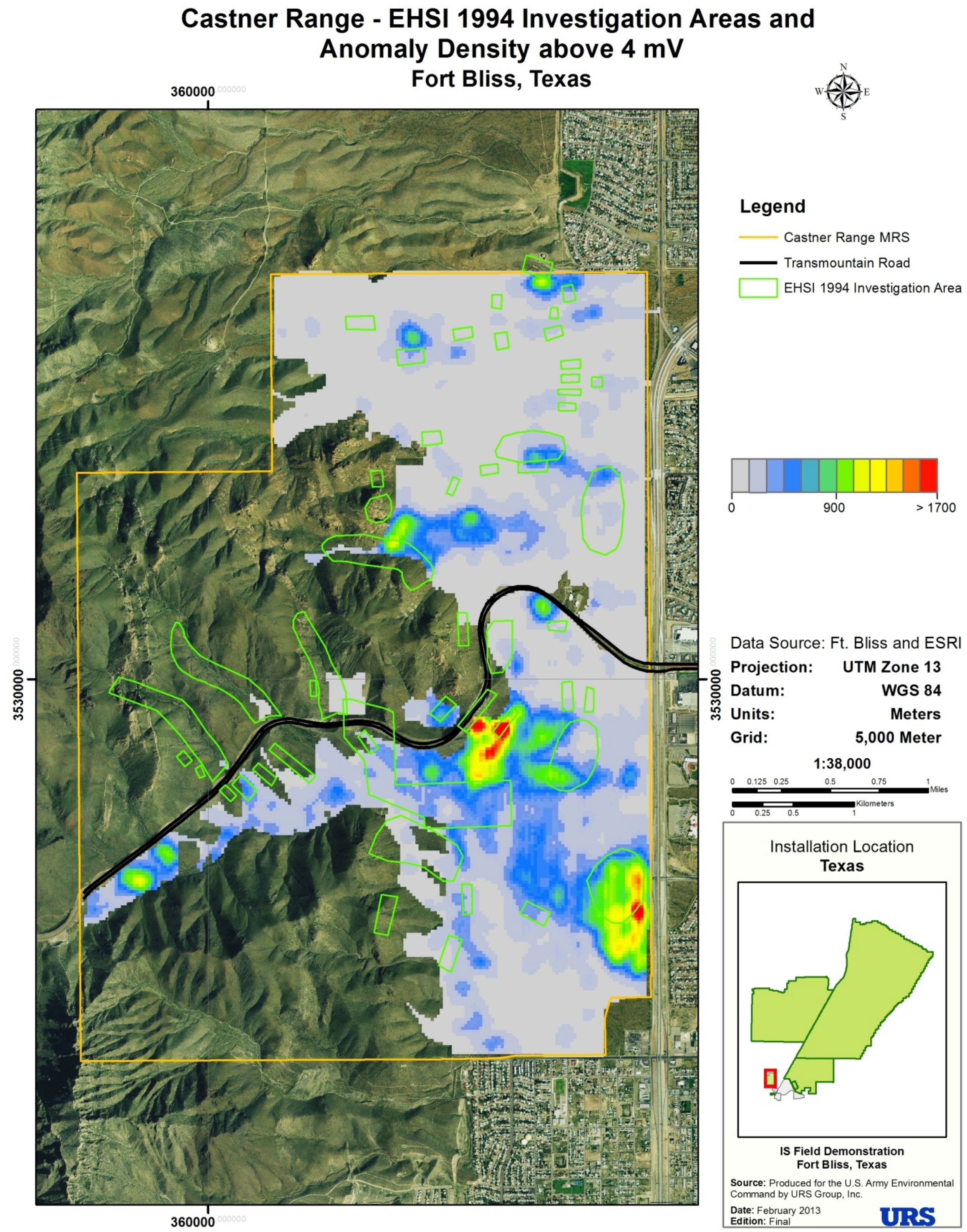

Figure 3-2. Previous Surface Investigations Were Largely Superseded by the WAA Study

In January and June–July 2001, at the Transmountain Buried Drum Site, a surface clearance resulted in the removal of one 105mm projectile and two 2.36 in. rocket motors prior to excavation of tar, asphalt, and metal debris. Analytical results from soil samples showed that this remedial action fulfilled clean closure requirements (e2m 2007).

The OB/OD pit (FTBL-072) was cleared to a depth of 1 ft in June 2001, and no ordnance was found on the site. During site investigation of the OB/OD area in 2002, soil samples were tested for suspected MC, including HMX, RDX, and RCRA metals. Results indicated that no regulated materials were released on the site above Environmental Protection Agency (EPA) Region VI screening levels (e2M 2007).

An additional MEC removal action was conducted on the Closed Castner Firing Range MRS from July 1, 2003, to March 11, 2004; a surface clearance was conducted on 975 acres, and a subsurface clearance of 167 acres (Figure 3-3) resulted in excavation of approximately 41,000 subsurface anomalies. During this action, 180 MEC and 241 assorted small arms ammunition items were located, identified, and disposed of. Surface soils sampled in the former OB/OD area (FTBL-073) in September 2003 did not show explosives or propellants. A test boring drilled on January 28, 2004, at the OB/OD site to a depth of 48.5 ft bgs did not reach groundwater (e2M 2007). During the September 2012 sampling event, two fuzed 37mm projectiles were discovered and disposed on-site by the Fort Bliss Explosives Ordnance Disposal (EOD) personnel.

Figures 3-2 and 3-3 show that, although many investigations and clearance actions have been undertaken at the Closed Castner Firing Range, the WAA study provides the most comprehensive data set for understanding the distribution and density of MEC and MD. Previous soil sampling has been highly localized.

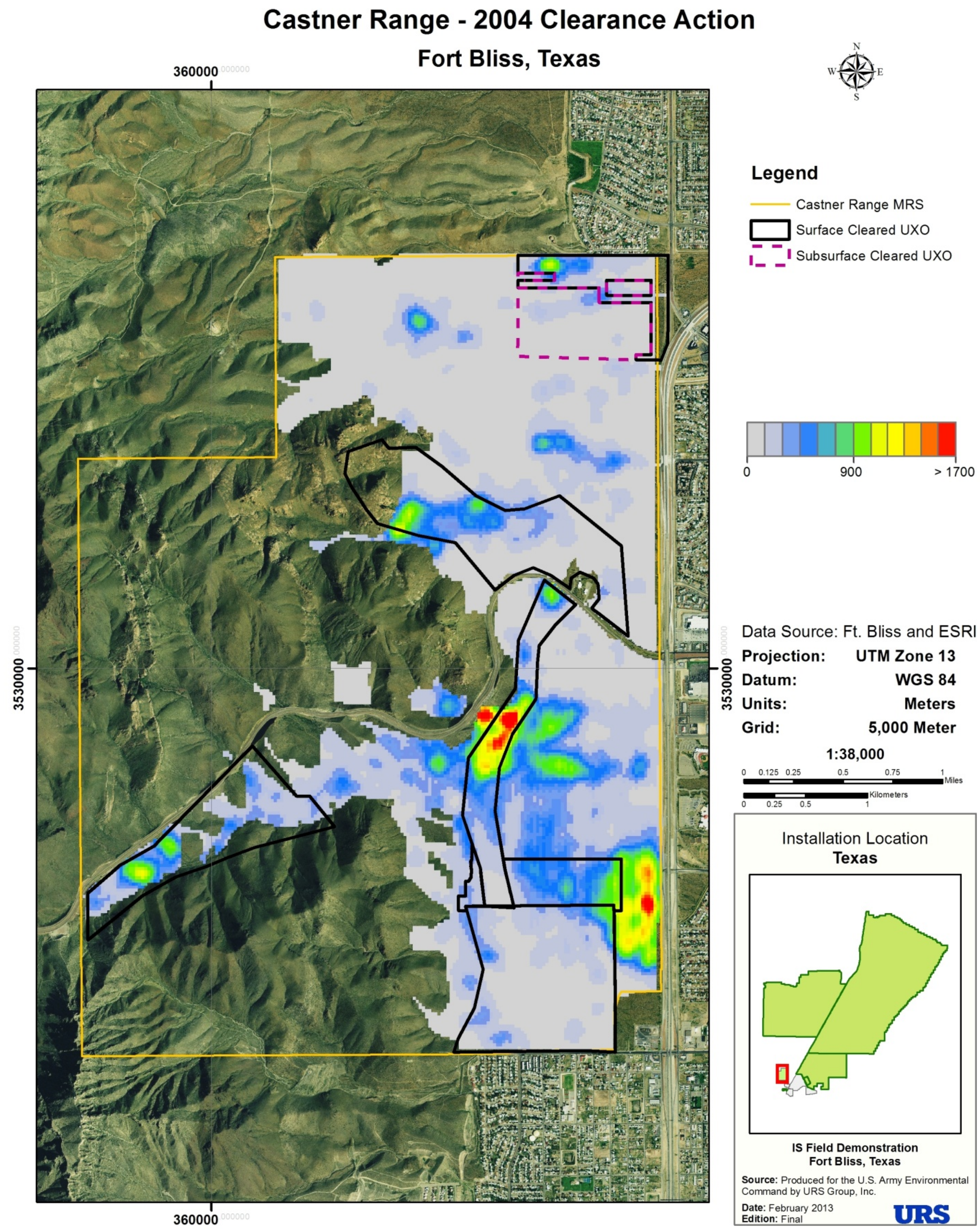

Figure 3-3. A Clearance Action in 2004 Did Not Address Key Areas of the Closed Castner Firing Range

4. PROJECT OBJECTIVES AND METHODS

4.1 Problem Statement

The Defense Environmental Restoration Program (DERP) was established to restore lands affected by military training. Under the DERP, the MMRP was created in 2001 to implement the CERCLA process on nonoperational ranges and to ensure proper management of the safety issues affiliated with MEC, MC, and DMM.

DoD inventoried nonoperational ranges and conducted Preliminary Assessments and Site Inspections (PA/SI). The outcome of an SI is a determination of whether a site should progress to the next regulatory step of an RI based on evidence of release of contamination. In an RI, the goal is to determine the nature and extent of contamination. For MMRP MRSs, contamination can consist not only of UXO and DMM, but also chemical constituents of munitions (MC), such as explosives or metals. The endpoint of an RI is the assessment, based on data, of whether MEC or MC constitutes an unacceptable risk to human health or the environment. MC risk assessments are based on the comparison of site data to guidelines and standards set forth by state or federal programs under CERCLA of 1980, amended under the Superfund Amendments and Reauthorization Act of 1986; and/or RCRA of 1976, amended by the Hazardous and Solid Waste Amendments of 1984.

For a remediation project, representative sampling should be a major project objective (EPA 2002, 2003). To obtain soil samples that are representative of the constituents in an area, the sampling strategy must address the compositional and distribution heterogeneity of the analytes. Compositional heterogeneity is due to a heterogeneous distribution of target analyte concentrations in the soil-sized particles of the sampled population. This heterogeneity is at a maximum when a portion of the target analytes is present as discrete particles, as is often the case for energetic residues and metals scattered during incomplete detonation. Error due to compositional heterogeneity is inversely related to the sample mass (Pitard 1993, Gy 1998). Distributional heterogeneity is due to scattering of contaminant particles across a site, sometimes with a systematic component as well as a short-range random component to the distribution (CRREL 2011).

Previous to the advent of incremental sampling methodology (ISM), the mean concentration of an MC contaminant was estimated by collecting and analyzing many discrete samples across the affected area. Studies to measure the sampling error of this approach show that, because of compositional and distributional heterogeneity inherent in the deposition processes, the concentrations of munitions-related target analytes may vary over several orders of magnitude. Ultimately, the use of discrete samples to estimate the mean concentration results in large uncertainty and sampling error (CRREL 2011).

ISM composites small soil increments from multiple points within an area of interest to create a soil sample of 1 to 2 kg. Large particles are sieved out, and the remaining sample is ground to a powder and thoroughly blended. Aliquots from the blended powder are representative of the entire sieved sample mass. Incremental samples represent the mean concentration of analytes in the sampled area and are more reproducible than either discrete or composite samples (CRREL 2011).

The ISM and its application to DoD ranges and training areas have been under development at CRREL, and are presented in *MMRP Guidance Document for Soil Sampling of Energetics and Metals* (CRREL 2011). Guidance documents are in development and many state and federal regulators are unfamiliar with the method (ITRC 2012). The U.S. Army Corps of Engineers (USACE) has published an interim guidance document (USACE 2009), and the Interstate Technology and Regulatory Council (ITRC) has prepared ISM training courses and guidance documents (ITRC 2012). ISM implementation by the Army is in accordance with the CRREL document, which explains how to collect and process soil samples and quantify explosives and metals in soil. The CRREL document also outlines how to estimate the average concentration of energetics and metals in soils and determine the error in the estimated concentration.

4.2 Purpose of Study

The purpose of this project is to demonstrate the implementation of the draft *MMRP Guidance Document for Soil Sampling of Energetics and Metals* (CRREL 2011) under field conditions representative of a full-scale investigation. Sampling and analysis data quality was controlled in accordance with RI standards so that the resulting data can be used in subsequent MMRP investigations at the MRS (URS 2011).

4.3 Study Objectives

The objectives of the ISM Field Demonstration on the Closed Castner Firing Range MRS were to assist USAEC and USACE to:

- Implement the Army’s draft incremental sampling protocol and recommend modifications to improve effectiveness
- Determine the nature and extent of MC
- Gain regulatory acceptance of the sampling approach and results
- Test the effect of sampling unit size on MC concentrations
- Test the correlation between MEC density and MC concentrations

4.4 Technical Project Planning

In accordance with the requirements of the scope of work and USACE guidance (USACE 1998), four Technical Project Planning (TPP) meetings were held:

- TPP 1: June 16, 2010 (held in conjunction with WAA TPP 3)
- TPP 2: October 21, 2010
- TPP 3: February 10, 2011
- TPP 4: April 3, 2013

Additionally, four technical interchange meetings were held to coordinate with team members and stakeholders.

- Kickoff Meeting: May 3, 2010
- TCEQ: July 29, 2010
- Fort Bliss Restoration Advisory Board (RAB): April 6, 2011
- Fort Bliss RAB: July 2012
- TCEQ: January 31, 2013
- Fort Bliss RAB: February 27, 2013

Presentations and meeting minutes are included in Appendix A. The following stakeholders were invited to each TPP meeting:

Stakeholder Organization	Attended TPP
City of El Paso-Mayor	N
City of El Paso-District 1, 2, and 4 Representatives	N
Chihuahuan Desert Education Coalition	Y
Customs and Border Protection – U.S. Border Patrol	Y
EPA Region 6	N
Fort Bliss Installation Restoration Program Manager	Y
Fort Bliss RAB	Y
Franklin Mountain Wilderness Coalition	Y
The Frontera Land Alliance	Y
Congressman Silvestre Reyes	N
TCEQ Region 6	Y
Texas Parks and Wildlife	Y
Texas DOT	Y
URS	Y
USACE, EMCX-MM	Y
USACE, ERDC-CRREL	Y
USACE, Louisville District	N
USACE, Omaha District	Y
USACE, Tulsa District	Y
USAEC	Y

4.5 Methods Used

4.5.1 Study Design

4.5.1.1 Conceptual Site Model

The conceptual site model (CSM) for the Closed Castner Firing Range is derived from the usage of the range as a live-fire training area, the characteristics of the range, and the proximity of potential receptors. A CSM defines the source, pathway, and receptor for a given site and group of constituents.

Source Areas: Potential sources at the Closed Castner Firing Range are defined by the historic usages of the range. The variety of potential source areas is based on the types of munitions used and the potential residue still remaining after cleanup and removal projects. The WAA Field Demonstration project (URS 2012) used historical maps, lidar/orthophotography, man-portable EMI geophysical equipment, and intrusive investigation of selected subsurface metallic objects to define potential target areas (Figure 3-1). Target areas were primarily defined as areas where a high number of anomalies were positively identified as MD. Historical range use maps were helpful in understanding potential locations, but a combination of geophysics and intrusive investigation produced the definitive data. Within target areas, munitions constituents derive from the fired munitions items. The CSM assumes that most of the munitions fully detonated as intended, but some fraction either did not function (dud/UXO), or functioned poorly, resulting in a less-than-complete detonation (low order detonation.) CRREL notes that low order detonations can deposit 10,000 to 100,000 times more contaminant mass than a properly functioning munitions item (CRREL 2011).

Deposition also occurred during the intentional destruction of UXO or low-order rounds *in situ* (blow-in-place) using donor explosives such as C4. This would have resulted in a deposition pattern similar to a normal round, but with the additional concentration of MC from the partially ignited donor explosives. Additionally, nonfunctioning, obsolete, and unusable munitions items were periodically gathered to an OB/OD range, where they were destroyed in a consolidated explosion with donor explosives. OB/OD would have occurred repeatedly in the same general area, and could concentrate the deposition of explosives and metals. Often for blow-in-place detonations and consolidated explosions, sandbags or other engineering controls are used for blast and fragment mitigation. Use of engineering controls in this manner would result in localized “hot spots” of MC at these locations. Other munitions items were scattered over the range, but are not sufficiently concentrated to be considered source areas.

Metal sources created by range use might consist of backstop berms on small arms ranges that contain bullets (lead, copper, antimony), impact and target areas on artillery or mortar ranges, or munitions disposal areas. Energetics residues are found in target/impact areas, where sufficient fired munitions were either duds or low-order detonations. Energetics residues are also frequently found at firing points and in munitions OB/OD disposal areas. As noted above, the mode of deposition results in a heterogeneous distribution of residue concentrations.

Based on the munitions use at the Closed Castner Firing Range, the MC of interest and relevant analytical methods are:

- Method SW846 6010B: aluminum, antimony, arsenic, barium, beryllium, cadmium, total chromium, cobalt, copper, inorganic lead, molybdenum, manganese, nickel, nickel compounds, selenium, silver, thallium compounds, vanadium, zinc
- Method SW846 7471A: mercury
- Method SW846 8330B: explosives and propellants

Other analytes frequently found on ranges, white phosphorus and perchlorate, were determined to be unlikely at concentrations of concern.

Potential Exposure Pathways: Human access to the Closed Castner Firing Range is prohibited (posted warning signs) due to the presence of MEC; however, trespassing human and ecological receptors may be exposed to site constituents either at the point of release or after their transport by wind or water.

Human and ecological exposure to surface soils via direct contact, including incidental ingestion of and/or dermal contact with soils, is reasonably anticipated to be a complete exposure pathway. Receptors may contact the constituents at the point of deposition, or after transport; constituents may be mobilized by infrequent but heavy rainfall, such as that accompanying a thunderstorm. Water can mobilize constituents through dissolution and percolation into the soil column, or it can scour constituents into runoff channels and arroyos. No perennial surface water flows on Closed Castner Firing Range, and no permanent water bodies exist. Natural drainage channels are well defined in the steeper foothill areas near the Franklin Mountains, providing channels for heavy storm water flow. As the drainages reach the flatter eastern alluvial fans below the foothills, their courses become more shallow and variable.

Site constituents may also be transported by wind. There is little brush or protective cover at the Closed Castner Firing Range, although the desert pavement—the surface covering of small interlocking rocks—can be an effective dust suppressant. Wind might mobilize dust that contains metals or explosives. Smaller dust particles are more easily lofted and transported a longer distance. Only materials exposed to the surface are available for transport in this manner.

No groundwater wells exist on the Closed Castner Firing Range. In El Paso, the depth to groundwater of the Hueco Bolson on the east side of the Franklin Mountains ranges from 250 ft to 400 ft bgs (Sheng 2001); groundwater depth has not been measured on the site. A public well about 1 mile east of Highway 54 reports a static depth to water of 324 ft bgs. During site investigation activities in 2004, a test boring was drilled to a depth of 48.5 ft bgs and groundwater was not encountered. Because of the depth to water, the generally arid conditions (8 to 20 in. of annual rainfall) transport to groundwater is believed to be an unlikely transport pathway or mechanism for exposure. Groundwater contact is expected to be unlikely.

The identification of potential pathways is required to determine appropriate PCLs. For the soil samples collected for this project, the sample results will be compared to the appropriate TRRP PCLs representing the site-specific exposure pathways. The surface soil data collected will be compared to the following PCLs. Section 4.5.1.2 discusses the steps used under TRRP to select the specific PCL for comparison:

- Total soil combined ($^{Tot}\text{Soil}_{Comb}$)
- Soil to groundwater used as drinking water ($^{GW}\text{Soil}_{Ing}$)
- Inhalation of volatiles emanating from the soil ($^{Air}\text{Soil}_{Inh\text{-}v}$)

Receptors: Potential receptors include human and ecological species, both flora and fauna. Typically, human receptors are evaluated for current and future land use. Current land use is restricted; a conservative assumption is that there could be residential exposure in the future; PCLs for residential use are the lowest PCLs.

Human receptors include transient users of the range, such as trespassers and recreational users like hikers, bikers, and visitors to the museums on Transmountain Road. Workers at the museums and at the Texas DOT and Border Patrol offices and construction workers anywhere on the range might also have exposure. Although less likely, nearby residents may also be potential receptors of windborne contamination. The potential uptake mechanisms for human receptors might include inhalation, ingestion, and dermal absorption. This report does not assess the likelihood of these pathways, nor the possible risks and effects of contaminant transport. Typically under CERCLA, a subsequent RI and risk assessment would complete that task within state guidelines. Because the Closed Castner Firing Range falls under the TCEQ TRRP, the site investigation will be completed under TRRP as an Affected Property Assessment where the pathways will be further evaluated.

Although a variety of diverse flora and fauna might be exposed to some contamination at the Closed Castner Firing Range, ecological receptors include species requiring special protective measures, such as designated threatened or endangered species. As noted previously, no threatened plants have been documented on the Castner Range, and only two special status animals have been identified (see Table 2-1).

The sampling program design was based the understanding of the sources, the pathways and the receptors, as follows:

- ISM was confirmed as the sampling methodology because ISM is useful in areas with composition and distribution heterogeneities, such as would be caused by target usage and low order detonations (CRREL, 2011).
- Absence of perennial surface waters indicates that water or sediment sampling is not necessary.
- Aridity and depth to groundwater indicate groundwater sampling is not necessary.
- Expected transport phenomena indicate sampling of surface and near-surface soils.
- Distribution of expected sources indicates biased sampling in defined target areas.
- Potential runoff MC transport indicates sampling in drainages and arroyos.

4.5.1.2 Project Data Quality Objectives

In accordance with the Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA 2006), the data quality objective (DQO) process was followed for the ISM Field Demonstration to identify data needs and to collect the type, quantity, and quality of data necessary to evaluate the Closed Castner Firing Range MRS. The following paragraphs describe the DQO decision elements.

Problem Statement: In summary, for a remedial project at an MMRP MRS, incremental sampling is needed to address the compositional and distribution heterogeneity of MC so that an accurate estimate of mean concentration can be measured for comparison to PCLs.

Decision Identification: The ISM Field Demonstration collected data to answer the following study questions:

- How is the presence or absence of MC determined using a representative concentration approach?

- Is MC present on the Closed Castner Firing Range at levels above regulatory concentrations? What is the nature and extent of contamination?
- What is the effect of sampling unit size on incremental sampling results?
- What is the correlation between MEC/MD density and MC concentrations?
- What modifications to the Army MIS Guidance would make the implementation more effective and efficient in the context of an MMRP RI?

The CRREL guidance uses the term “decision unit” to define the sampled area of interest. Because the future land use is undetermined at the Closed Castner Firing Range, and because the emphasis of this study is on data gathering, the term “sampling unit” is used in this report to define the boundaries of the area covered by each incremental sample. This was discussed and resolved in TPP 2 in October 2010 (Appendix A).

Inputs to the Decision: The following information and data are needed to make the decisions specified above:

- Historical information on the munitions that may have been used at the MRS
- Site-specific environmental characteristics
- State and national soil screening levels
- Geophysical data collected through the WAA used to characterize the study area according to anomaly density
- Intrusive investigation results identifying MEC and MD
- ISM results from the study area
- ISM results from sampling unit size variation

Regulatory Framework: One of the objectives of the field demonstration was to gain regulatory feedback of the sampling approach and results. Under CERCLA, sites are assessed in order to understand site characteristics, determine the contaminants of concern, and develop a path forward, which typically involves the completion of an RI and a human health risk assessment (and ecological risk assessment, as necessary).

To achieve the goal of regulatory feedback, URS, USAEC, and USACE initiated meetings with the TCEQ to open discussions regarding the incremental sampling approach and how the approach and resulting analytical data could be used under TRRP. The team agreed that an incremental sample result is considered a representative concentration of the sampling unit.

Study Boundaries: The study area was defined during the SI (e2M 2007) and characterized during the WAA demonstration (Figure 3-1). The MRS is a generally open area, although the steep slopes (greater than 10% slope) of the Franklin Mountains on the western portion of the parcel presented a topographic constraint on the extent of the investigation. [This constraint may also apply to potential exposure; steep slopes are less likely to be encountered by potential human receptors.] The study area was limited to those areas having soils, based on the NRCS SSURGO database (2009). This revised study area is primarily the eastern portion of the MRS as shown on Figure 2-6 and is approximately 4,000 acres.

The Closed Castner Firing Range was selected for the ISM field demonstration because of the detailed and relevant usage areas that were established using RI-level studies in the previous WAA project (URS 2012).

Anthropogenic constraints on the extent of the investigation included the presence of the Transmountain Road, Highway 54, the National Border Patrol Museum, the El Paso Museum of Archaeology, an Immigration and Naturalization Service Border Patrol Office, and a Texas DOT Regional Office within or bounding the MRS.

Decision Rules: The primary objective of the Army's draft *MMRP Guidance Document for Soil Sampling of Energetics and Metals* (CRREL 2011) is the determination of the nature and extent of MC; therefore, decision rules focus on achievement of this objective.

Geophysical data collected through the WAA project were used to characterize the study area according to anomaly density (Figure 3-1). These anomaly data were used to stratify the site into higher and lower anomaly densities; the threshold selected was an anomaly density of 500 anomalies per acre (Figure 4-1). It was hypothesized that the higher anomaly density within the target areas was attributable to MEC and MD. The site stratification then was adopted as the basis for the selection and location of individual sampling units.

The strategy of establishing sampling units based on anomaly density had multiple purposes:

- Increase the probability of finding MC
- Enable correlation of MC to MEC/MD density
- Increase the homogeneity between individual increments within a sampling unit and reduce the possibility of having outliers in the data set
- Increase the power of random samples collected within each of these defined strata, increasing the accuracy of the estimates
- Enable characterization of each stratum as well as the site as a whole

By taking 59 or more samples from each anomaly density stratum, statistical inferences can be made about unsampled areas, as discussed in section 4.5.1.3, below. For example, if no analyte exceeds the selected TCEQ PCLs established under TRRP (Table 4-1), then it can be inferred with 95% confidence that the mean concentration of 95% of the unsampled area is also below the specified PCL.

Following the first round of sampling, sufficient additional data were collected in Phase 2 sampling to support calculation of a site-specific background value for metals comparison.

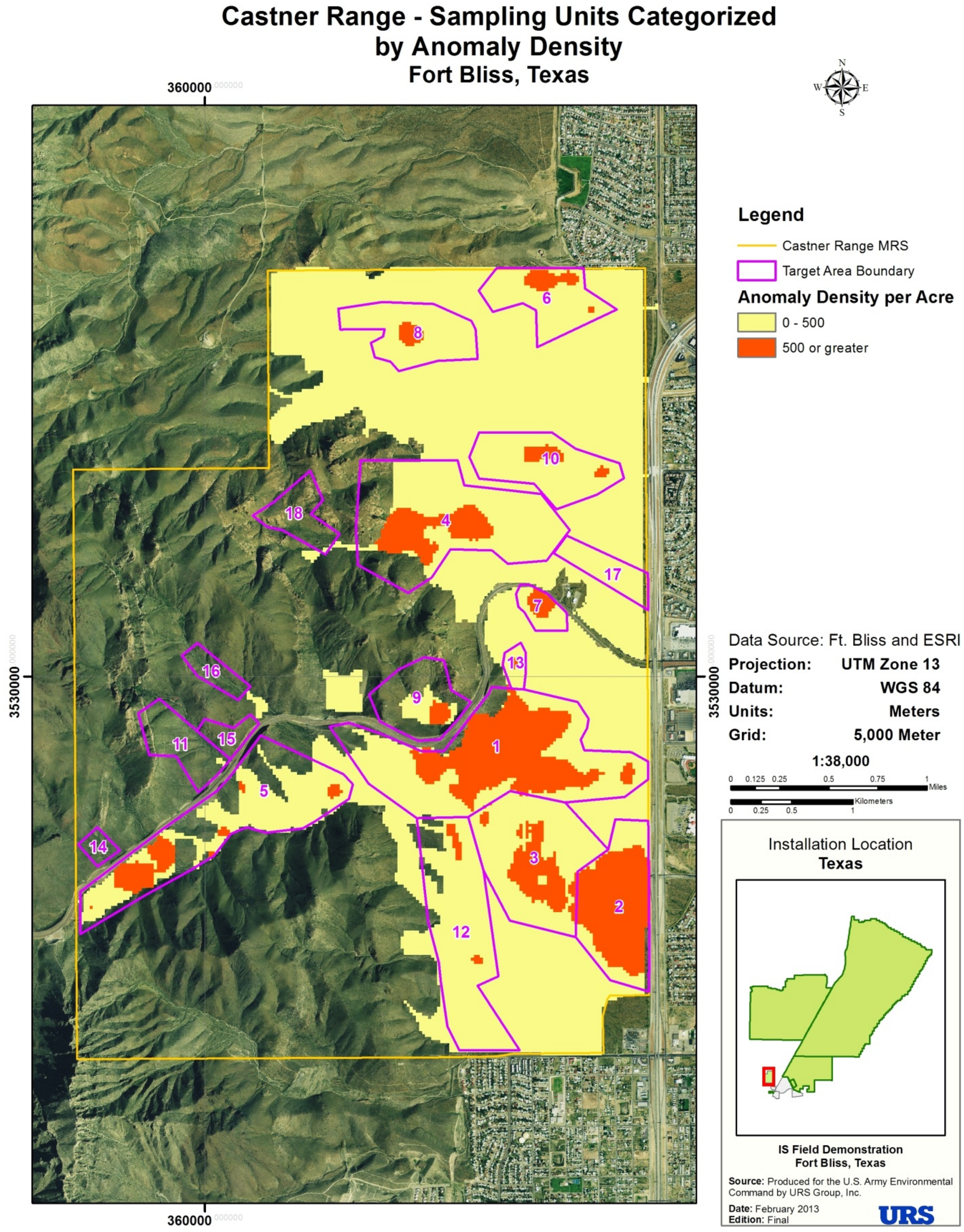

Figure 4-1. Sampling Units Were Categorized by Anomaly Density Based on the WAA Geophysical Results

Triplicate incremental samples were collected at 10% of the primary sampling units, with the intent of calculating percent relative standard deviation (RSD). The concentrations of replicate incremental samples from a sampling unit tend to have low variance and normal distributions, a property not true of data sets collected using discrete samples. As a guideline, if the RSD determined from three incremental sample replicates from the same sampling unit is less than 30%, the sampling design and execution are likely adequate. Hewitt and others (CRREL 2009) suggest that if the RSD is less than 30%, a normal distribution can be assumed and a meaningful upper confidence limit (UCL) calculated. Although an RSD of less than 30% cannot conclusively demonstrate that a distribution is normal, a larger RSD would suggest deviations from normality and indicate that the field sampling design or laboratory processing were inadequate to control for distributional or compositional heterogeneity.

Tolerance Limits on Decision Errors: The ISM data could lead to two types of errors:

- An incorrect determination that one or more of the sampling units exceeds the PCL when no exceedences exists (false positive)
- An incorrect determination that one of more of the sampling units with analyte concentration above the PCLs is not identified as having an exceedences (false negative)

While false positives may result in areas being included in additional investigations when they do not warrant investigation, which misallocates resources, this decision error would likely be corrected during the additional investigation. A false negative may result in areas being excluded from additional investigation when it is actually warranted, representing an error type of higher concern and consequence.

Data Quality Requirements: Complete and detailed requirements for planning, collection, documentation, transport, sample preparation, laboratory analysis, validation, and reporting were defined in the QAPP (URS 2011).

Table 4-1. TRRP Tier 1 Residential Soil PCLs[a]

Chemical of Concern	CAS	30-acre Source Area			Texas-Specific Background (mg/kg)
		${}^{Tot}\text{Soil}_{Comb}$[b] (mg/kg)	${}^{GW}\text{Soil}_{Ing}$[c] (mg/kg)	${}^{Air}\text{Soil}_{Inh\text{-}V}$[d] (mg/kg)	
EXPLOSIVES					
Amino-2,6-dinitrotoluene, 4-	19406-51-0	8.9E+00	3.3E-02	4.5E+01	–
Amino-4,6-dinitrotoluene, 2-	35572-78-2	9.3E+00	5.0E-02	5.6E+01	–
Cyclotetramethylenetetranitramine (HMX)	2691-41-0	2.0E+02	1.2E+00	2.3E+02	–
Cyclotrimethylenetrinitramine (RDX)	121-82-4	2.5E+01	1.8E-02	2.9E+01	–
Dinitrobenzene, 1,3- (dinitrobenzene, 2,4-)	99-65-0	6.3E+00	3.8E-03	1.2E+02	–
Dinitrotoluene, 2,4-	121-14-2	6.9E+00	2.7E-03	1.5E+01	–
Dinitrotoluene, 2,6-	606-20-2	6.9E+00	2.4E-03	2.2E+01	–
Trinitrobenzene, 1,3,5-	99-35-4	2.0E+03	9.1E-01	–	–
Trinitrophenylmethylnitramine (tetryl; nitramine)	479-45-8	3.4E+01	5.5E-01	3.9E+01	–
Trinitrotoluene, 2,4,6-	118-96-7	1.7E+01	8.6E-02	3.7E+01	–
METALS					
Aluminum	7429-90-5	6.4E+04	8.6E+04	–	30,000
Antimony	7440-36-0	1.5E+01	2.7E+00	–	1
Arsenic	7440-38-2	2.4E+01	2.5E+00	–	5.9
Barium	7440-39-3	7.8E+03	2.2E+02	–	300
Beryllium	7440-41-7	3.8E+01	9.2E-01	–	1.5
Cadmium	7440-43-9	5.2E+01	7.5E-01	–	–
Chromium (total)	7440-47-3	2.7E+04	1.2E+03	–	30
Cobalt	7440-48-4	2.1E+01	3.3E+00	–	7
Copper	7440-50-8	5.5E+02	5.2E+02	–	15
Lead (inorganic)	7439-92-1	5.0E+02	1.5E+00	–	15
Manganese	7439-96-5	3.4E+03	5.8E+02	–	300
Mercury (pH = 4.9, EPA Method 7471A)	7439-97-6	2.1E+00	3.9E-03	2.4E+00	0.04
Molybdenum[e]	7439-98-7	1.6E+02	2.5E+00	–	–
Nickel and compounds	7440-02-0	8.3E+02	7.9E+01	–	10
Selenium	7782-49-2	3.1E+02	1.1E+00	–	0.3
Silver	7440-22-4	9.5E+01	2.4E-01	–	–
Thallium and compounds (as thallium chloride)	7791-12-0	6.3E+00	8.7E-01	–	–
Vanadium	7440-62-2	2.9E+00	1.7E+01	–	50
Zinc	7440-66-6	9.9E+03	1.2E+03	–	30

Notes: Values in yellow denote the selected comparison levels.

[a] The Phase 1 evaluation used the TCEQ TRRP PCLs dated March 2010.

[b] Exposure media are combined soil and air; the source medium is soil; the exposure pathways are combined ingestion, dermal contact, inhalation of volatiles and particulates, and ingestion of aboveground and belowground vegetables.

[c] Exposure medium is groundwater; the source medium is soil; the exposure pathway is groundwater ingestion.

[d] Exposure medium is air; the source medium is soil; the exposure pathway is inhalation.

[e] Molybdenum was added to the analyte list contained in the QAPP; tin was removed.

4.5.1.3 Number of Sampling Units

The sampling unit is the specific volume of soil represented by a single incremental sample, and includes a specified depth as well as size (CRREL 2011). Because of the large area covered by the range investigation, a probabilistic approach was used to establish the number of sampling units. As noted previously, geophysical data were used to divide the site into areas with greater than 500 anomalies per acre and areas with fewer than 500 anomalies per acre. Within each of these two strata, it was desired to use the results of the sampling to make statistical inferences about the unsampled acreage. In this case, to achieve 95% confidence that 95% of the unsampled units had the same characteristics as the sampled units, 59 sampling units were required (Table 4-2) (CRREL 2011). For Phase 1, 60 sampling units were selected per stratum; one additional sampling unit was added for a grenade range, and two were planned for background data, for a total of 123 primary samples. Ten percent of the MRS sampling units and both background units were planned for duplicate and triplicate samples (another 28 samples).

Table 4-2. Number of Sampling Units Required to Achieve a Specified Confidence Level (Binomial Distribution)

p=0.05	**Confidence Level**		
Number of Failures	**90%**	**95%**	**99%**
0	45	**59**	90
1	77	93	130
2	105	124	165
3	133	154	198
4	158	181	229
5	184	208	259

This approach allowed the assessment of results obtained from individual sampling units, each stratum, and the entire study boundary as a whole.

4.5.1.4 Sampling Unit Size and Shape

A sampling unit is dictated by project objectives and can be any size and shape (CRREL 2011). Although sampling units up to 10 acres were initially considered, a 1-acre sampling unit size was selected. The 1-acre sampling unit was selected for the following reasons:

- Conservative approach for potential future land use
- Within limits of previously studied sampling unit sizes (up to 100 m by 100 m, or about 2.5 acres)
- Acceptable to stakeholders
- Smaller sampling units increase probability of homogeneity of key characteristics (e.g., soil type, munitions density, historical use) within the sampling unit.

While sampling units can be of any shape, CRREL guidance recommends rectangular-shaped units for ease of planning and execution; square units were selected, with the exception of 1-acre arroyo sampling units in Phase 2 sampling, which were shaped to the drainage channel, but still encompassed approximately 1 acre (see Section 4.7).

One of the original study objectives was to evaluate the effect of sampling unit size on analytical results, and early planning included 10-acre sampling units. The thought to use larger sampling units was to screen a greater fraction of the large range. Following planning discussions with CRREL and TCEQ stakeholders, it was determined that all sampling units would be limited to 1 acre. Much of CRREL’s prior research had involved areas much smaller than 10 acres, and in many cases smaller than 1 acre. Stakeholders were concerned that there was insufficient scientific support for a 10-acre sampling unit, and little experience at assessing the accuracy and interpreting the results at that scale. Because the future land use of the Closed Castner Firing Range is unknown, and because the final number of sampled acres was 163, or about 2.3%, it was concluded that 1-acre sampling units provided the best balance between established experience and aerial coverage. The stakeholders concurred with this decision.

4.5.1.5 Number and Distribution of Increments

To reduce the influence of distributional heterogeneity in the estimate of the mean concentration for a sampling unit, the Army’s draft guidance recommends that 50 to 100 evenly spaced increments be collected for an incremental sample that weighs between 1 and 2 kg (CRREL 2011).

The objective of collecting incremental samples using a systematic random design is to obtain MCOC residue particles of every composition and shape proportional to and representative of what exists within the selected sampling unit, and not to over- or under-sample any portion of the sampling unit. The systematic random sampling design is best suited for ISM, and was implemented here. Using this technique, uncertainty in the data was quantified by collecting triplicate samples, in this case at a rate of 10% of the sampling units.

The CRREL guidance document also describes field studies of heterogeneously distributed contaminants showing that 50 to 100 increments are required to achieve good reproducibility among replicates. Just as increasing the number of discrete samples analyzed from a given area reduces the uncertainty of the estimated mean concentrations of the area, increasing the number of increments for an incremental sample reduces the uncertainty of the estimated mean concentrations among replicate incremental samples. However, studies have also shown that increasing the number of increments above 100 provides only marginal improvement in precision in most cases (CRREL 2011). To account for unknown past site use and the potential heterogeneity created through this variable, 100 increments were collected from each of the sampling units.

4.5.1.6 Depth of Increments

Increments were collected with a 2 cm coring bit, to a depth of 5 cm. Each increment was estimated to weigh about 20 grams, for a total target sample weight of 2 kg. Actual increments and total weight varied in size depending on field conditions. A sample depth of 5 cm (approximately 2 in.) was selected based on a review of the following considerations:

- Range characterization studies show that most of the energetic residues remain within the first 2 cm of the surface (CRREL 2011).

- Sampling depth should be shallow enough to reflect the surficial deposition of most MC.
- The number of increments must be balanced with the mass of each individual increment to yield a total sample mass that is sufficient to overcome the compositional heterogeneity of the soil.

4.5.1.7 Sampling Unit Locations

Primary sampling units were randomly distributed among the 1-acre parcels of each stratum, using Hawths Analysis Tools in the ArcGIS® application (Figure 4-2). Sampling units selected for triplicate sampling are shown on Figure 4-3.

4.5.1.8 Discrete Samples versus Incremental Samples

The TRRP rule and guidance typically recommends discrete sampling, which is similar to other states. In the original planning, a statistically valid number of discrete samples was conceptually included as a means to assess data variability. The rationale for this sampling was that the first round of 121 primary incremental samples would indicate “hot spots” of contamination, but not fully delineate them. Discrete samples were considered to help characterize and map localized areas of elevated contamination.

The first round of sample results did not show elevated explosives and showed metals concentrations were below screening values, except for lead. Lead above the PCL was ubiquitous and relatively uniform across the range. Guidance discourages mixing both incremental sampling and discrete sampling at a site, since direct comparison of sample results collected using such different methods is not meaningful (ITRC 2012). An analysis of data gaps from the first round of sampling (see Section 4.6) resulted in the conclusion that additional incremental samples were of more benefit than discrete sampling, and the planned discrete sampling was eliminated.

4.5.1.9 Background Samples

All samples were analyzed for metals, because metals are naturally occurring, and state and regional default background (Texas-specific) values might not accurately represent local conditions. Background samples were collected to determine site-specific mean background concentrations. The results of these samples serve as a baseline to which other site data may be compared when screening data or evaluating risks.

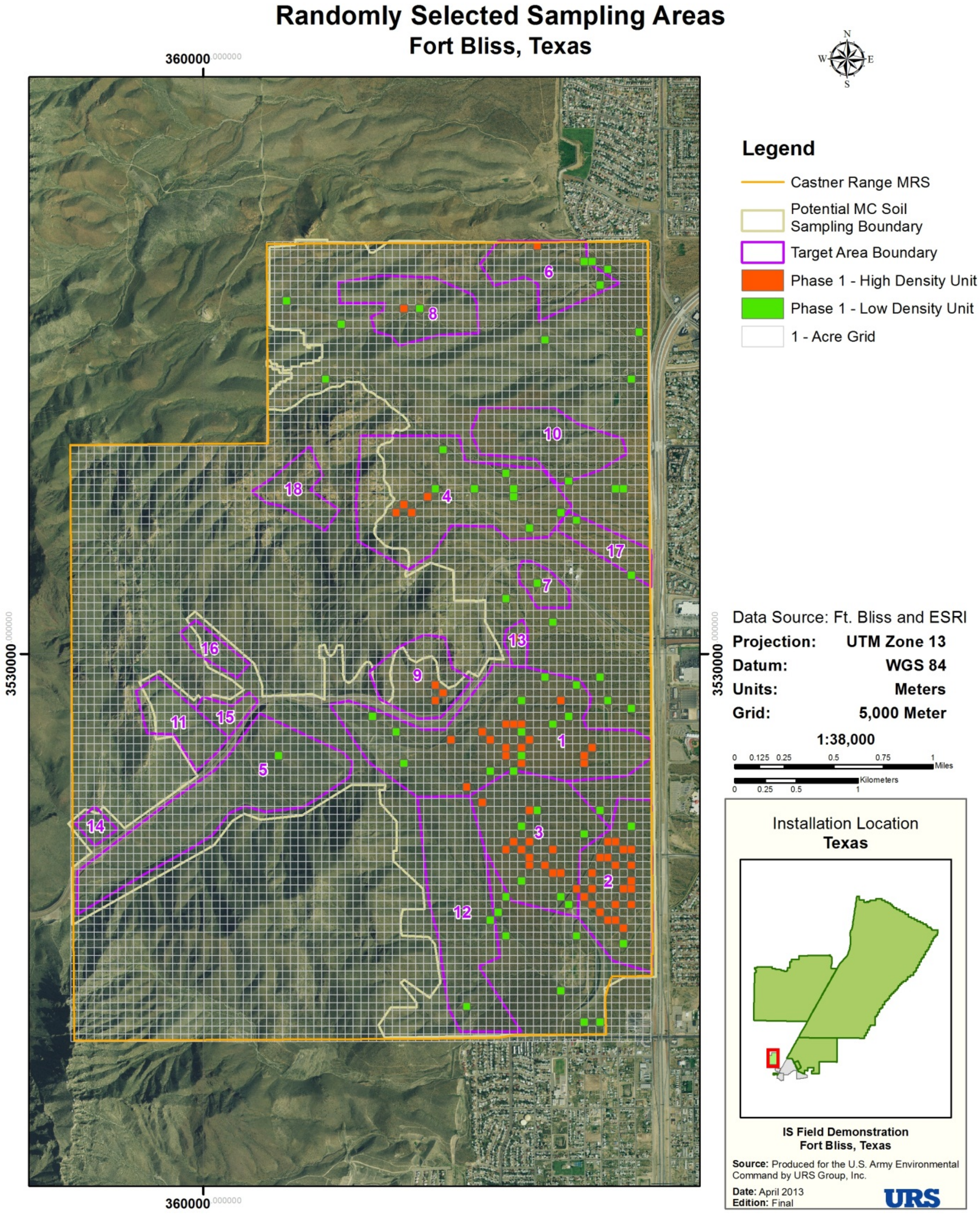

Figure 4-2. Sampling Units Were Randomly Distributed in Each of the Strata

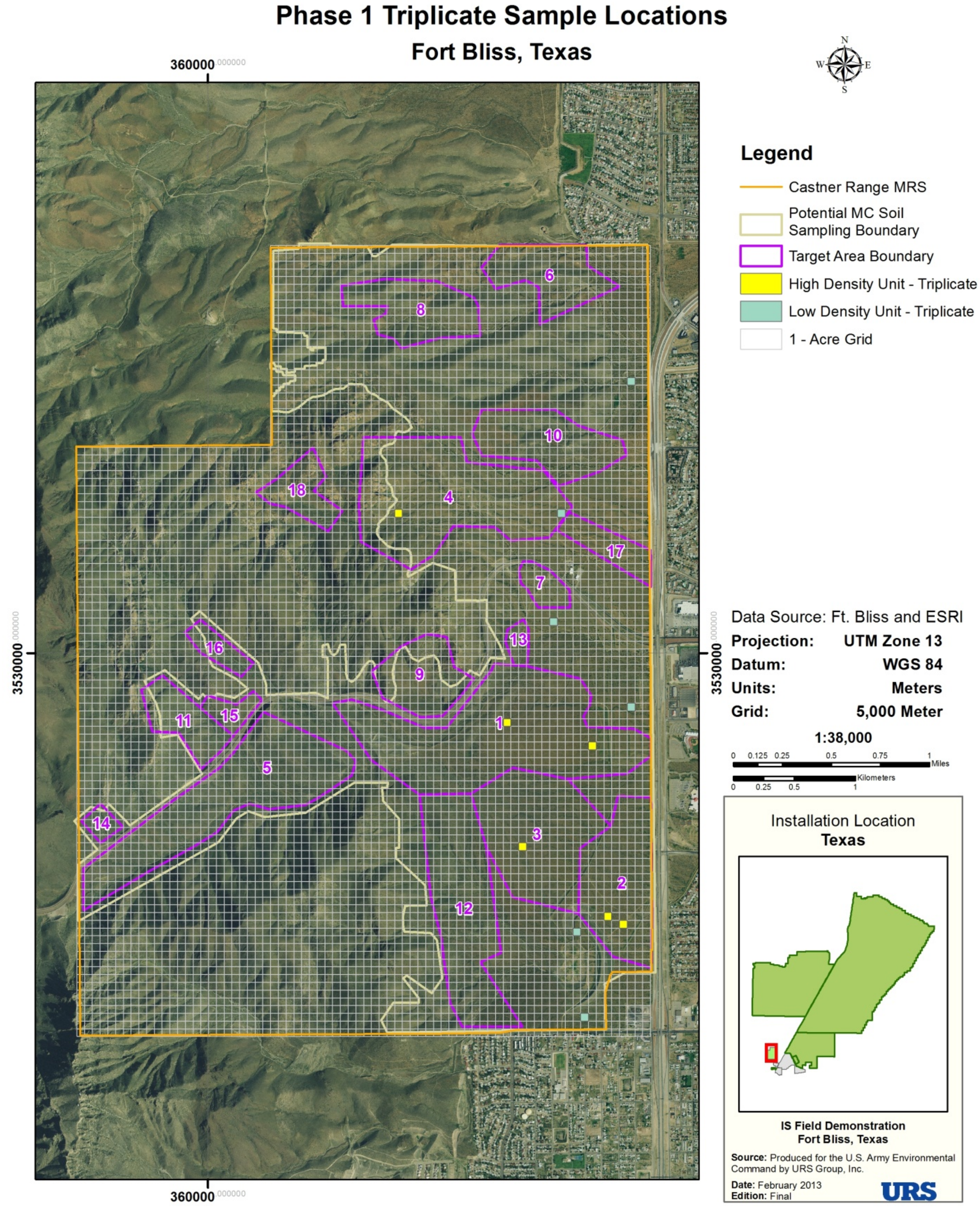

Figure 4-3. Triplicate Sample Locations

4.5.2 Sampling Methods

The first round of sampling, or Phase 1 sampling, was conducted from February 1 through 17, 2011. Following analyses of these data, additional sampling was proposed to fill data gaps identified from the initial sample results. The second round, or Phase 2, of sampling was conducted from September 10 through 14, 2012, and is described in more detail below.

4.5.2.1 Health and Safety/MEC Avoidance

A site-specific Health and Safety Plan (HASP) was prepared as the basis of safe work practices in the field. Because any given sampling unit may contain UXO, DMM, or materials potentially presenting an explosive hazard, field activities within the range boundaries were supervised by UXO technicians qualified in accordance with the Department of Defense Explosive Safety Board (DDESB) Technical Paper 18 (DDESB 2004). In accordance with the HASP, MEC avoidance protocols were implemented. Each team sampling within the range boundaries included a UXO technician equipped with a Schonstedt handheld magnetometer. The UXO technician ensured no metallic debris existed at each increment location before allowing the coring tool to be used. During the sampling in February 2011, one MEC item, an unfuzed 20mm HE projectile was found. Fort Bliss Range Control was contacted for disposal of this MEC item. During the September 2012 sampling event, two fuzed 37mm projectiles were discovered and disposed on-site by the Fort Bliss Explosives Ordnance Disposal (EOD) personnel.

4.5.2.2 Preliminary Sampling Demonstration

On January 5, 2011, about 1 month before full-scale mobilization, URS and CRREL personnel mobilized to prove-out the sampling methodology in the field. Figures 4-6 through 4-8 are photographs depicting preliminary sampling activities.

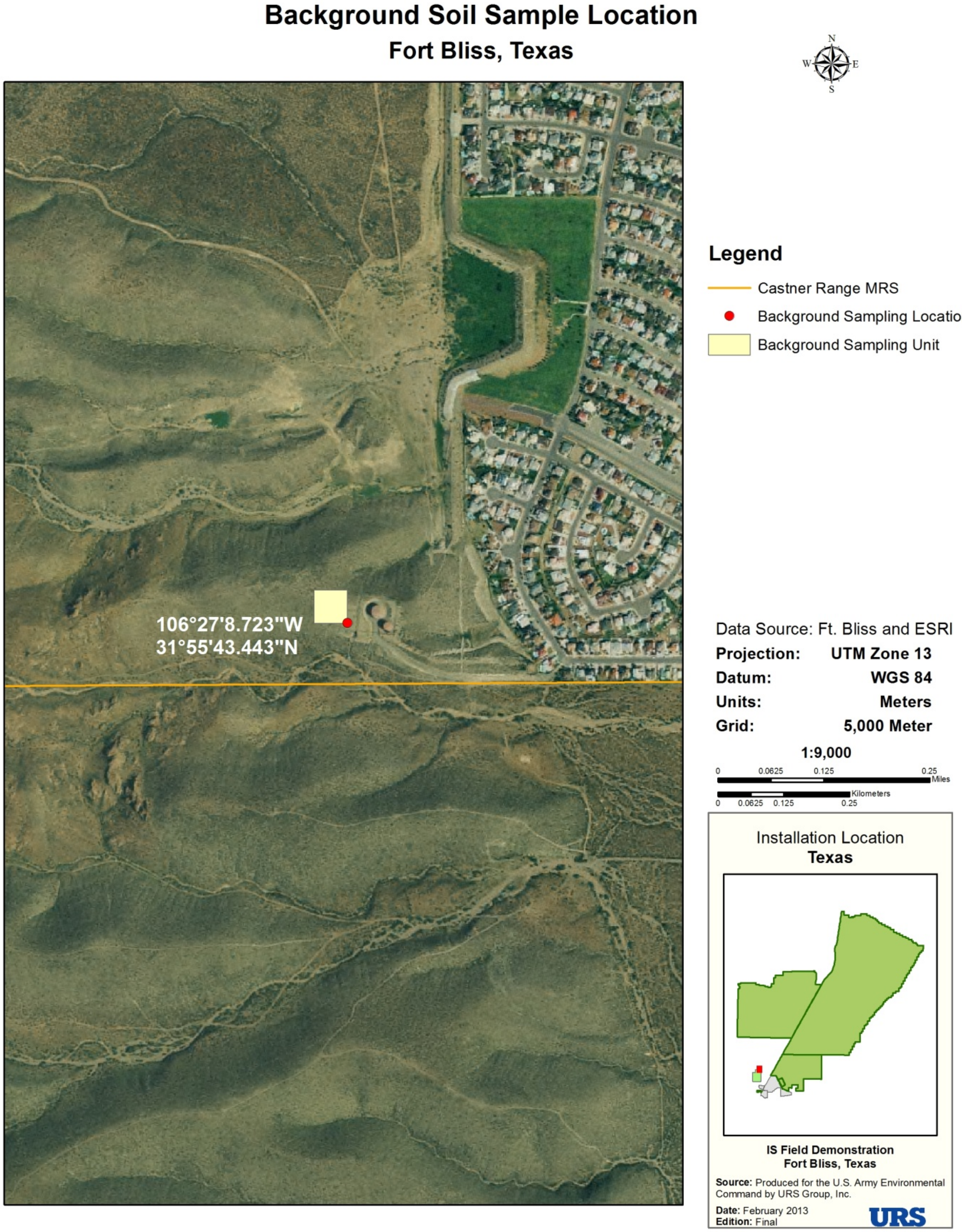

Figure 4-4. Background Soil Sample Location to Represent Northern Closed Castner Firing Range Soils

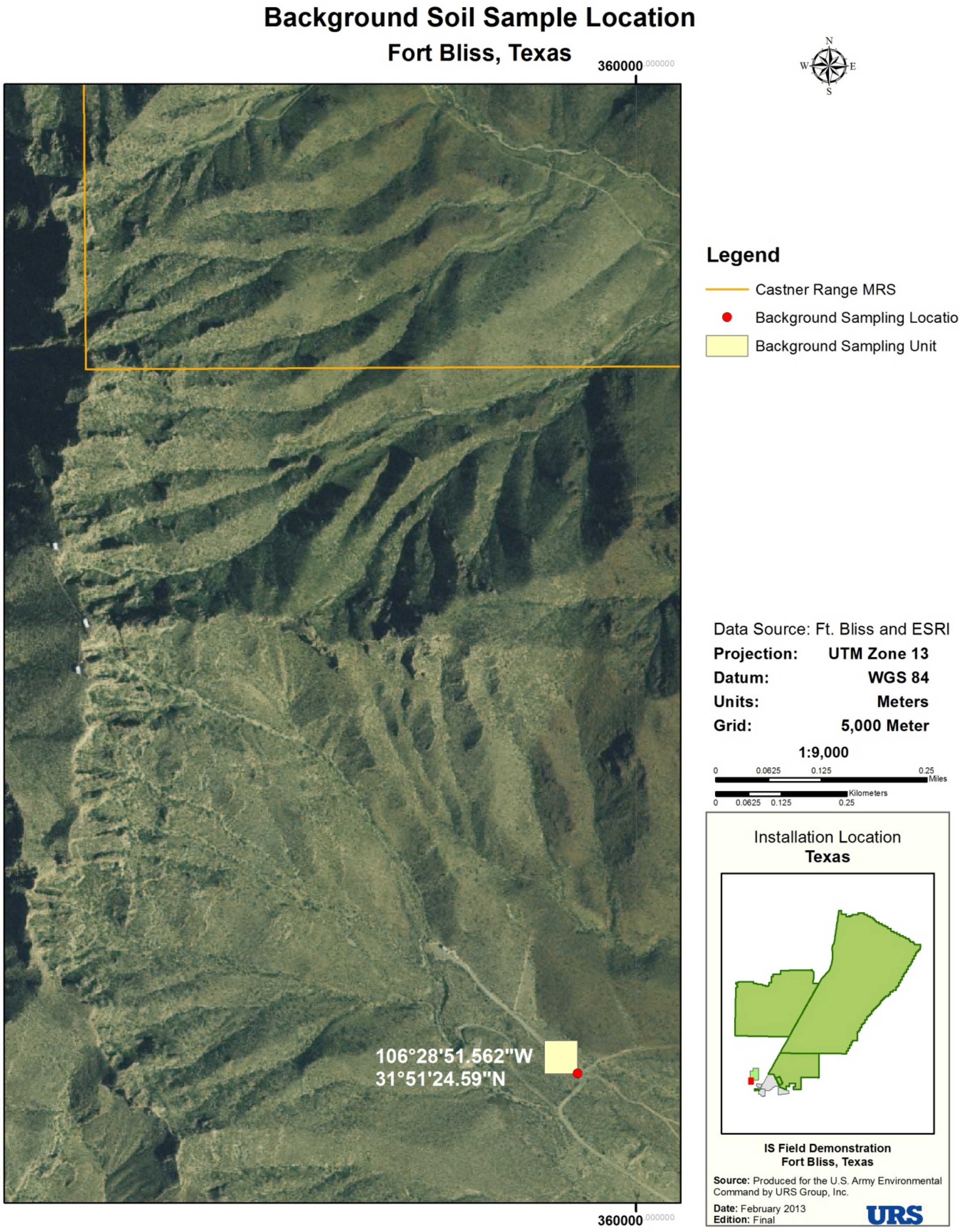

Figure 4-5. Background Soil Sample Location to Represent Southern Closed Castner Firing Range Soils

Figure 4-6. Teams Navigated to Sample Points by GPS; UXO Technician Used Magnetometer to Check Increment Location for Metallic Debris

Figure 4-7. A Coring Tool was Used to Collect Uniform Increments

Figure 4-8. 100 Increments per Sampling Unit Were Collected in Sample Bags for Shipment to the Laboratory

The following issues were raised and resolved in conjunction with the Army in preparation for full-scale sampling.

- **Issue**: The distance between the sampling unit corner point and the first sampling increment, and between each subsequent increment, is not the same. A handheld global positioning system (GPS) was selected as the tool to identify the physical location of each sampling unit and each increment (primary, duplicate, and triplicate). Each increment location was generated based on the primary increment within the sampling unit. However, the distance between the sampling unit corner point and the first increment was not the same as the distance between each increment. Since CRREL had not previously conducted ISM using GPS, increment locations had never been established in this manner. CRREL was concerned about accurate representation of the sampling unit if the first increment location was not established within an evenly distributed sampling unit sub-grid.

  Resolution: The ArcGIS Hawths Analysis Tools were used to ensure the first randomly generated sampling increment within the sampling unit was within an equally distributed sub-grid within the unit.

- **Issue**: The first increment location was not different for each new sampling unit. Although the first increment location of the first sampling unit was randomly selected with the Hawths Analysis Tools, CRREL was concerned about compromising the principle of randomness by having each subsequent sampling unit use the same relative location.

Resolution: It was agreed that the Hawths Analysis Tools within ArcGIS would be used to generate a random point for the first increment within a sampling unit, and that each subsequent increment would be spaced equidistantly throughout the 1-acre sampling unit. It was concluded that sufficient randomness was preserved if all subsequent sampling units used the same increment locations and spacing. In a production environment with many sampling units, it could be too time-consuming to run the random point generator for each sampling unit. See Figure 4-9.

Figure 4-9. Primary (o), Duplicate (x), and Triplicate (✓) Increment Locations

- **Issue**: The method of generating the first randomly selected increment location was originally described in the guidance as a manual process.

  Resolution: It was concluded that using the random number generator of the ArcGIS software, and pre-loading all the sampling points into the field GPS units would be sufficiently random and more efficient in a production environment than a manual process.

- **Issue**: CRREL was concerned about the randomness of using the same duplicate and triplicate sampling locations for every sampling unit. As initially planned, the duplicate and triplicate sampling locations within each sampling unit for the preliminary sampling event were established as offsets from the primary increment sampling locations. CRREL discussed the possible benefit of generating a new random starting location for each duplicate and triplicate sample versus using the same offset pattern for each QC sampling unit. The extra cost, in terms of preparation effort and complexity of the preloaded GPS files, was discussed in light of the effectiveness and efficiency of a production program.

Resolution: It was concluded that sufficient randomness would be preserved by using the Hawths Analysis Tools within ArcGIS to generate a random point for the primary increment, and that duplicate and triplicate increment locations would be fixed offsets from the primary, with the same pattern applied to all QC (triplicate) sampling units.

- **Issue**: Sampling on steep slopes is very difficult. One of the sampling units (AT032) selected for the preliminary sampling event was located on a steep location (slope greater than 10%) in the northern portion of the Closed Castner Firing Range. This sampling unit was intended to assess a sampling team's ability to sample on similar terrain across the range.

  Resolution: The sampling team determined that this was an example of the steepest slope that would be safe for sample collection. Slopes greater than 10% (see Figure 2-4) were eliminated from consideration. Because steeper sampling units require more caution and time, an additional person was added to each sample collection team. Because terrain was mixed for each team, the additional field team member assisted in all sampling units.

- **Issue**: The inaccessibility or inability to sample some individual increments due to rockiness or plant cover was discussed.

  Resolution: The QAPP clarified the steps required if unable to collect one or more increments within a sampling unit. If the designated increment location was inaccessible, the nearest viable location was to be selected. Ninety percent of the designated increments were required to make a viable sample (i.e., a minimum of 90 increments collected per sampling unit).

4.5.2.3 Sampling Procedures

Once the grids were randomly selected, the starting point and the increment locations within the grid were generated and loaded into the handheld GPS units. The sampling procedure followed by each team is detailed in Standard Operating Procedure (SOP)-001, "Incremental Soil Sampling" (URS 2011). In general, the sampling proceeded as follows:

1. The GPS operator navigated the team to the corner of the sampling grid using the shape files loaded in the handheld GPS unit (Figure 4-10). The GPS position was recorded and a photograph was taken looking across the sampling unit.
2. Because the locations of all of the sampling grids and increments were preselected and preloaded into the handheld GPS units, for increased efficiency, field navigation by the GPS was used to identify the sampling points, instead of physically marking each grid with surveyor's tape.

3. A polyethylene sampling bag was labeled and fitted inside a 5 gallon bucket, and the sampling tool was prepared and decontaminated in accordance with SOP-006, "Equipment Decontamination Procedures" (URS 2011) (Figure 4-11).
4. The UXO technician conducted a visual sweep of the increment location, followed by an instrument-aided sweep with a Schonstedt magnetometer (Figure 4-12). Large rocks were gently removed from the surface of the increment location.
5. A coring tool with a 2 cm diameter coring bit set to a 5 cm depth was used to collect increments of a uniform size at a uniform depth (Figure 4-13). Where soils were coarse or shallow, a hand trowel was used to collect the increment, taking care to match the size of the increment collected with the coring tool. Increments were placed in the sampling bag in the bucket (Figure 4-14).
6. Whenever an increment location was obstructed by brush or a large rock, the increment was collected from the closest viable point.
7. The team followed the GPS navigation locations moving first up one column and then down the next until 100 soil sample increments were collected. In some cases, increments were skipped if the location was inaccessible (i.e., vegetation), unsampleable (i.e., rocky), or not representative (roadway, graveled pathway). If more than 10 increments were skipped, the sampling unit was abandoned and replaced with another unit.
8. If the sampling unit was selected for replicate samples, the process-including decontamination-was repeated for each additional set of increments.
9. Once all 100 increments were collected and placed into the labeled, clean, polyethylene sampling bag, the bag was sealed and placed into a second marked, clean, polyethylene sampling bag (Figure 4-15).
10. Samples were labeled in accordance with SOP-002 (URS 2011). The numbering system consisted of the site designation ("CR" Castner Range), the sample type ("IS" or "MIS" for incremental samples), the grid designation (an alphanumeric name of the form "AA000"), and the sample number (01 for primary samples, 02 for duplicate, and 03 for triplicate). A typical sample name might be CR-IS-CL055-01.
11. The samples were prepared for shipment in accordance with the directions in SOP-004, "Packing and Shipping Environmental Samples" (URS 2011) (Figure 4-16).
12. The chain-of-custody was prepared in accordance with SOP-003, "Chain-of-Custody" (URS 2011).
13. Field observations were documented in the field logbook following the directions in SOP-005, "Field Activity Records" (URS 2011).

Figure 4-10. Handheld GPS Used to Navigate to Sampling Points

Figure 4-11. Decontamination Included an Acetone Rinse Followed by a Water Rinse

Figure 4-12. All Sampling Locations Were Checked by Magnetometer Prior to Intrusive Sampling by Coring Tool or Trowel

Figure 4-13. The Sampling Tool Collected Uniform Cores to a Uniform Depth

Figure 4-14. All Increments From a Given Sampling Unit Were Collected into a Single Sample Bag for Shipping

Figure 4-15. Samples Were Double-bagged for Shipment

Figure 4-16. Samples Were Iced for Shipment

4.5.2.4 Sampling Tools

A sampling methodology is considered unbiased if all the particles in the sampling unit have the same probability of being included in the sample. To obtain a sample that is representative of the population in terms of particle type, size, and proportion, the volume of soil in each increment must be constant. Coring devices ensure a uniform diameter core through the entire sampled interval and a consistent depth interval for each increment. In the Phase 1 sampling in February 2011, the CRREL MULTI-INCREMENT® Sampling Tool (CMIST) was used by all teams; and in the Phase 2 sampling in 2012, the Enterprise Ventures Corporation Soil Stick™ tool was used by all teams for increment collection. Both of these coring tools included a 2-cm diameter coring bit set to a 5-cm depth.

4.5.2.5 Investigative-Derived Waste Plan

Because sampling activities used reusable stainless steel coring devices as described previously, and surface samples were collected, no soil waste was generated. Decontamination fluids were collected and allowed to evaporate. Disposable personal protective equipment (PPE) (i.e., rubber gloves) were collected and disposed of.

4.5.3 Data Evaluation and Data Gap Analysis

The Phase 1 samples were analyzed and the data were validated in accordance with TRRP Guidance (TCEQ 2010) and determined to be useable for the intended purpose (Appendix B).

The data, as flagged from the validation process, are shown in Table 4-3. The data were compared to PCLs to identify any exceedences. The results are presented on Figures 4-17 and 4-18. Appendix C contains a map showing all the sampling unit locations.

4.5.3.1 Explosives and Metals Exceedences

An initial examination of the Phase 1 (February 2011) data showed that results for explosives and metals were significantly different. Figure 4-17 shows the locations of the sampling units that had exceedences of explosives and nonlead metals. Figure 4-18 shows the locations of sampling units that had exceedences of lead.

Explosives and energetics compounds were detected sporadically and typically in association with known range activities. Sample preparation methods were controlled as specified in the QAPP (URS2 2011) and grinding times were limited to minimize effect on explosives concentrations. It appeared that contamination from explosives was not widely spread and was typically correlated with expected explosives-heavy locations, such as the OB/OD ranges.

Sample ID	Detection	Note
CR-MIS-AD044-01	RDX above PCL	Near OB/OD B-1 range
CR-MIS-AA035-01	2,4- and 2,6-dinitrotoluene above PCL	Near OB/OD B-1 range
CR-MIS-AI018-01	2,4- and 2,6-dinitrotoluene above PCL	Near OB/OD A-1 range
CR-MIS-DI054-01	PETN (no PCL)	Isolated detection

For six of the explosives, the MDL was above the PCL, as shown in Table 4-4 from Worksheet 15 of the QAPP (URS 2011).

Metals were detected in most samples. Table 4-5 presents the PCL exceedences in the Phase 1 data set.

With the exception of lead, the presence of metals at concentrations greater than the PCL was sporadic. In some cases, it was possible to correlate exceedences with known range activities. Lead exceedences were common throughout the range. Based on the extent of lead in soil, the pH values for the soil types found on the Closed Castner Firing Range were examined. Typically, metals bind more readily to alkaline soil, and are more mobile in acidic soil. Only one soil series, the Chuzzie series, had pH values noted as acidic; however, upon examination of the sampling unit placement, it was confirmed that none of the results occurred in areas where the Chuzzie series is mapped on the Closed Castner Firing Range. It is anticipated with the predominance of alkaline soils at the site that metals would tend to bind to soil particles and remain at or near the point of deposition.

Table 4-3. Phase 1 Sampling Analytical Data Summary

			BACKGROUND NORTH 01 N	BACKGROUND NORTH 02 FD	BACKGROUND NORTH 03 FT	BACKGROUND SOUTH 01 N	BACKGROUND SOUTH 02 FD	BACKGROUND SOUTH 03 FT	CR-MIS-AA035-01 N	CR-MIS-AC041-01 N	CR-MIS-AC042-01 N	CR-MIS-AD044-01 N	CR-MIS-AF043-01 N	CR-MIS-AH003-01 N	CR-MIS-AI018-01 N
			2/9/2011	2/9/2011	2/9/2011	2/8/2011	2/8/2011	2/8/2011	2/7/2011	2/7/2011	2/7/2011	2/4/2011	2/4/2011	2/7/2011	2/7/2011
Analyte	**PCL Value**	**PCL Source**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**High Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**High Stratum**
Aluminum	64000	TotSoilComb2	**5180 X8**	**5700 X8**	**6020 X8**	**4760 X8**	**4860 X8**	**3790 X8**	**5890 X8J**	**4640 X8J**	**4630 X8J**	**3780 X8J**	**5640 X8J**	**6510 X8J**	**6650 X8J**
Antimony	2.7	GWSoilIng	<0.0950 R	<0.0950 R	<0.0950 R	**0.220 U**	<0.0950 R	<0.0950 R	<0.0950 R	**2.10 JL**	**0.0970 JL**	<0.0950 R	<0.0950 R	**0.140 JL**	**0.850 JL**
Arsenic	5.9	TX-SP Bkgd	**2.50 JL**	**2.60 JL**	**3.00 JL**	**2.70 JL**	**2.90 JL**	**3.00 JL**	**4.00 JL**	**4.50 JL**	**3.70 JL**	**3.30 JL**	**3.20 JL**	**4.90 JL**	**4.90 JL**
Barium	300	TX-SP Bkgd	**55.6**	**55.3**	**64.3**	**40.1**	**45.4**	**34.8**	**67.0 J**	**50.9 J**	**48.2 J**	**37.1 J**	**52.9 J**	**71.2 J**	**68.6 J**
Beryllium	1.5	TX-SP Bkgd	**0.650 JL**	**0.710 JL**	**0.820 JL**	**0.370 JL**	**0.390 JL**	**0.320 JL**	**1.20 JL**	**0.940 JL**	**0.990 JL**	**1.00 JL**	**1.00 JL**	**1.20 JL**	**1.10 JL**
Cadmium	0.75	GWSoilIng	**0.120 JL**	**0.130 JL**	**0.140 JL**	**0.380 JL**	**0.310 JL**	**0.320 JL**	**1.40 JL**	**0.260 JL**	**0.270 JL**	**0.170 JL**	**0.150 JL**	**0.350 JL**	**0.350 JL**
Calcium	--		**35500 X8JL**	**39200 X8JL**	**44700 X8JL**	**65100 X8JL**	**73700 X8JL**	**55800 X8JL**	**11500 X8J**	**3330 X8J**	**4730 X8J**	**3760 X8J**	**8490 X8J**	**3470 X8J**	**15700 X8J**
Chromium (total)	1200	GWSoilIng	**4.2**	**4.5**	**4.8**	**5.3**	**4.6**	**4.3**	**7.60 JL**	**7.50 JL**	**7.50 JL**	**5.00 JL**	**10.5 JL**	**8.70 JL**	**9.50 JL**
Cobalt	7	TX-SP Bkgd	**2.30 JL**	**2.40 JL**	**2.60 JL**	**2.30 JL**	**2.30 JL**	**2.10 JL**	**3.20 JL**	**4.00 JL**	**3.30 JL**	**2.70 JL**	**3.80 JL**	**5.70 JL**	**4.50 JL**
Copper	520	GWSoilIng	**8**	**8.6**	**9.3**	**15.2**	**13.2**	**11.8**	**296 JL**	**13.3 JL**	**12.4 JL**	**9.30 JL**	**9.60 JL**	**14.0 JL**	**32.1 JL**
Iron	--		**6670 X8**	**7060 X8**	**7810 X8**	**5350 X8**	**5550 X8**	**5090 X8**	**13300 X8**	**12500 X8**	**12000 X8**	**11400 X8**	**13900 X8**	**20900 X8**	**15500 X8**
Lead	15	TX-SP Bkgd	**8.50 JL**	**9.00 JL**	**9.60 JL**	**25.6 JL**	**17.6 JL**	**19.3 JL**	**40.1 JL**	**54.5 JL**	**22.8 JL**	**13.4 JL**	**18.3 JL**	**20.0 JL**	**35.2 JL**
Magnesium	--		**4440 X8JL**	**4880 X8JL**	**4990 X8JL**	**16100 X8JL**	**15600 X8JL**	**13500 X8JL**	**3010 X8JL**	**1870 X8JL**	**2370 X8JL**	**2040 X8JL**	**3650 X8JL**	**3060 X8JL**	**4810 X8JL**
Manganese	580	GWSoilIng	**108 X8**	**113 X8**	**126 X8**	**179 X8**	**183 X8**	**151 X8**	**155 X8J**	**155 X8J**	**165 X8J**	**137 X8J**	**171 X8J**	**287 X8J**	**198 X8J**
Molybdenum	2.5	GWSoilIng	**0.190 JL**	**0.220 JL**	**0.220 JL**	**0.120 JL**	**0.120 JL**	**0.960 JL**	**0.800 JL**	**0.700 JL**	**0.880 JL**	**0.880 JL**	**0.720 JL**	**1.10 JL**	**0.890 JL**
Nickel	79	GWSoilIng	**4.20 JL**	**4.40 JL**	**5.00 JL**	**4.10 JL**	**4.10 JL**	**3.70 JL**	**7.70 JL**	**6.60 JL**	**6.80 JL**	**5.60 JL**	**9.30 JL**	**9.40 JL**	**8.90 JL**
Potassium	--		**1290 X8**	**1380 X8**	**1520 X8**	**1170 X8**	**1170 X8**	**928 X8**	**1420 X8J**	**1410 X8J**	**1320 X8J**	**1110 X8J**	**1450 X8J**	**1800 X8J**	**1880 X8J**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	**0.310 JL**	**0.360 JL**	**0.270 JL**	**6.80 JL**	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**134 X8JL**	**160 X8JL**	**173 X8JL**	**180 X8JL**	**170 X8JL**	**141 X8JL**	**220 X8JL**	**261 X8JL**	**264 X8JL**	**196 X8JL**	**187 X8JL**	**226 X8JL**	**200 X8JL**
Thallium	0.87	GWSoilIng	**0.280 JL**	**0.210 JL**	**0.210 JL**	**0.430 JL**	**0.370 JL**	**0.280 JL**	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	**10.6**	**11.5**	**12.5**	**9.5**	**9.8**	**9.2**	**13.5 JL**	**17.3 JL**	**15.6 JL**	**13.8 JL**	**16.2 JL**	**23.9 JL**	**20.3 JL**
Zinc	1200	GWSoilIng	**27**	**26.9**	**29.1**	**38.2**	**31**	**35**	**80.3 JL**	**38.1 JL**	**48.8 JL**	**43.8 JL**	**45.1 JL**	**63.7 JL**	**56.2 JL**
Mercury	0.04	TX-SP Bkgd	**0.0180 J**	**0.0180 J**	**0.0240 J**	**0.0260 J**	**0.0240 J**	**0.0250 J**	**0.13**	**0.0190 J**	**0.0150 J**	**0.0130 J**	**0.0110 J**	**0.0190 J**	**0.0180 J**
1,2-Dinitrobenzene	--		**1.8**	**1.75**	**1.78**	**1.77**	**1.78**	**1.78**	**1.8**	**1.81**	**1.78**	**1.75**	**1.74**	**1.81**	**1.76**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	**4.7**	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	**1.9**
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	**0.300 J**	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	**0.100 J**
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	**1.00 X7**
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	**0.6**	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-AI020-01 N	CR-MIS-AK010-01 N	CR-MIS-AL048-01 N	CR-MIS-AM036-01 N	CR-MIS-AR008-01 N	CR-MIS-AR047-01 N	CR-MIS-AR047-02 FD	CR-MIS-AR047-03 FT	CR-MIS-BA048-01 N	CR-MIS-BD056-01 N	CR-MIS-BE064-01 N	CR-MIS-BF047-01 N	CR-MIS-BF052-01 N
			2/7/2011	2/7/2011	2/4/2011	2/7/2011	2/7/2011	2/7/2011	2/7/2011	2/7/2011	2/7/2011	2/4/2011	2/4/2011	2/3/2011	2/3/2011
			Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum
Aluminum	64000	TotSoilComb2	**5060 X8J**	**7170 X8J**	**5220 X8**	**5350 X8J**	**5910 X8J**	**4640 X8J**	**5240 X8J**	**4810 X8J**	**5520 X8J**	**4680 X8**	**5080 X8J**	**4110 X8**	**6420 X8**
Antimony	2.7	GWSoilIng	<0.0950 R	**0.100 JL**	<0.0950 R	**0.190 JL**	**0.360 JL**	**0.190 JL**	**0.120 JL**	**0.200 JL**	**0.250 JL**	<0.0950 R	<0.0950 R	<0.0950 R	**2.10 JL**
Arsenic	5.9	TX-SP Bkgd	**5.00 JL**	**5.80 JL**	**3.10 JL**	**4.00 JL**	**7.20 JL**	**3.30 JL**	**3.60 JL**	**3.70 JL**	**6.00 JL**	**4.00 JL**	**3.80 JL**	**4.30 JL**	**4.70 JL**
Barium	300	TX-SP Bkgd	**49.5 J**	**81.6 J**	**46.5**	**68.3 J**	**61.7 J**	**51.7 J**	**57.5 J**	**55.9 J**	**60.6 J**	**38.5 JL**	**51.0 JH**	**46.6**	**51.7**
Beryllium	1.5	TX-SP Bkgd	**0.900 JL**	**1.30 JL**	**0.920 JL**	**1.10 JL**	**7.20 JL**	**0.810 JL**	**0.960 JL**	**0.890 JL**	**1.80 JL**	**1.2**	**0.900 JL**	**1.40 JL**	**1.90 JL**
Cadmium	0.75	GWSoilIng	**0.300 JL**	**0.230 JL**	**0.210 JL**	**0.230 JL**	**0.420 JL**	**0.330 JL**	**0.350 JL**	**0.350 JL**	**0.320 JL**	**0.180 J**	**0.230 JL**	**0.260 JL**	**0.250 JL**
Calcium	--		**5020 X8J**	**24100 X8J**	**5770 X8J**	**38400 X8J**	**4420 X8J**	**22600 X8J**	**22400 X8J**	**20900 X8J**	**3750 X8J**	**2300 X8JL**	**6630 X8J**	**1560 X8J**	**6850 X8J**
Chromium (total)	1200	GWSoilIng	**7.20 JL**	**9.10 JL**	**10.7 JL**	**5.80 JL**	**16.5 JL**	**5.50 JL**	**6.30 JL**	**6.10 JL**	**17.1 JL**	**5.00 JL**	**6.20 JL**	**4.60 JL**	**8.10 JL**
Cobalt	7	TX-SP Bkgd	**3.10 JL**	**5.80 JL**	**3.30 JL**	**3.40 JL**	**4.20 JL**	**3.20 JL**	**3.20 JL**	**3.10 JL**	**3.60 JL**	**2.60 JL**	**2.80 JL**	**2.10 JL**	**2.30 JL**
Copper	520	GWSoilIng	**13.2 JL**	**14.9 JL**	**8.50 JL**	**12.8 JL**	**15.7 JL**	**13.4 JL**	**14.4 JL**	**15.0 JL**	**13.7 JL**	**10.1 JL**	**10.8 JL**	**8.90 JL**	**11.9 JL**
Iron	--		**13300 X8**	**18500 X8**	**12600 X8J**	**11200 X8**	**20000 X8**	**11000 X8**	**12400 X8**	**12000 X8**	**15600 X8**	**16500 X8**	**7640 X8**	**9900 X8J**	**11200 X8J**
Lead	15	TX-SP Bkgd	**22.6 JL**	**16.4 JL**	**11.7 JL**	**14.4 JL**	**22.2 JL**	**21.5 JL**	**29.9 JL**	**23.5 JL**	**20.1 JL**	**13.5 J**	**16.6 J**	**15.7 JL**	**1580 JL**
Magnesium	--		**2030 X8JL**	**4330 X8JL**	**2890 X8JL**	**6400 X8JL**	**2150 X8JL**	**5180 X8JL**	**5750 X8JL**	**5120 X8JL**	**1770 X8JL**	**1340 X8JL**	**1740 X8JL**	**955 X8JL**	**1840 X8JL**
Manganese	580	GWSoilIng	**164 X8J**	**223 X8J**	**173 X8**	**167 X8J**	**228 X8J**	**152 X8J**	**175 X8J**	**168 X8J**	**212 X8J**	**131 X8J**	**129 X8J**	**154 X8**	**151 X8**
Molybdenum	2.5	GWSoilIng	**2.90 JL**	**0.970 JL**	**0.560 JL**	**0.390 JL**	**1.30 JL**	**0.420 JL**	**0.490 JL**	**0.540 JL**	**1.40 JL**	**0.550 JL**	**0.290 JL**	**0.570 JL**	**0.720 JL**
Nickel	79	GWSoilIng	**6.10 JL**	**9.00 JL**	**9.00 JL**	**6.30 JL**	**11.0 JL**	**5.50 JL**	**6.30 JL**	**6.10 JL**	**10.6 JL**	**4.40 JL**	**5.60 JL**	**4.20 JL**	**6.20 JL**
Potassium	--		**1280 X8J**	**1850 X8J**	**1250 X8J**	**1450 X8J**	**1820 X8J**	**1420 X8J**	**1520 X8J**	**1440 X8J**	**1670 X8J**	**1350 X8**	**1520 X8J**	**1380 X8J**	**1530 X8J**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	**0.420 JL**	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**195 X8JL**	**227 X8JL**	**134 X8JL**	**199 X8JL**	**206 X8JL**	**195 X8JL**	**196 X8JL**	**207 X8JL**	**179 X8JL**	**158 X8**	**126 X8JL**	**111 X8JL**	**87.9 X8JL**
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	**0.250 JL**	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	**16.2 JL**	**31.0 JL**	**12.6 JL**	**16.8 JL**	**18.2 JL**	**15.3 JL**	**17.5 JL**	**16.4 JL**	**18.0 JL**	**11.5 JL**	**10.6 JL**	**8.20 JL**	**10.0 JL**
Zinc	1200	GWSoilIng	**44.9 JL**	**41.7 JL**	**36.6 JL**	**33.4 JL**	**51.8 JL**	**37.3 JL**	**44.0 JL**	**40.4 JL**	**49.8 JL**	**35.2 JL**	**29.9 JL**	**40.5 JL**	**42.4 JL**
Mercury	0.04	TX-SP Bkgd	**0.0150 J**	**0.0190 J**	**0.0110 J**	**0.0230 J**	**0.0270 J**	**0.0160 J**	**0.0180 J**	**0.0180 J**	**0.0160 J**	**0.0140 J**	**0.0170 J**	**0.0170 J**	**0.0180 J**
1,2-Dinitrobenzene	--		**1.71**	**1.7**	**1.94**	**1.78**	**2.39**	**1.72**	**1.7**	**1.7**	**2.02**	**1.7**	**1.78**	**1.97**	**1.99**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	**0.100 X7J**	<0.0850 X7U	**0.100 X7J**	**0.200 X7J**
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	**CR-MIS-BF057-01 N**	**CR-MIS-BF070-01 N**	**CR-MIS-BF071-01 N**	**CR-MIS-BG046-01 N**	**CR-MIS-BG057-01 N**	**CR-MIS-BH043-01 N**	**CR-MIS-BI042-01 N**	**CR-MIS-BI042-02 FD**	**CR-MIS-BI042-03 FT**	**CR-MIS-BI044-01 N**	**CR-MIS-BI063-01 N**	**CR-MIS-BI063-02 FD**	**CR-MIS-BI063-03 FT**
			2/4/2011	**2/4/2011**	**2/4/2011**	**2/4/2011**	**2/7/2011**	**2/4/2011**	**2/4/2011**	**2/4/2011**	**2/4/2011**	**2/4/2011**	**2/3/2011**	**2/3/2011**	**2/3/2011**
			Low Stratum	**Low Stratum**	**Low Stratum**	**High Stratum**	**Low Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**
Aluminum	64000	TotSoilComb2	**5220 X8**	**3950 X8**	**4450 X8**	**4310 X8**	**5480 X8J**	**4230 X8**	**4420 X8**	**3670 X8**	**3480 X8**	**4330 X8**	**4140 X8**	**4320 X8**	**3530 X8**
Antimony	2.7	GWSoilIng	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R
Arsenic	5.9	TX-SP Bkgd	**4.70 JL**	**3.20 JL**	**4.10 JL**	**3.50 JL**	**4.00 JL**	**4.80 JL**	**3.80 JL**	**4.00 JL**	**3.50 JL**	**4.00 JL**	**4.90 JL**	**4.10 JL**	**3.90 JL**
Barium	300	TX-SP Bkgd	**45.8 JL**	**38**	**42.9 JL**	**44.3**	**65.2 J**	**49.9**	**47.5**	**43.1**	**40**	**38.6**	**39.1**	**44.5**	**37.4**
Beryllium	1.5	TX-SP Bkgd	**1.5**	**1.20 JL**	**1.5**	**1.20 JL**	**2.20 JL**	**1.40 JL**	**1.30 JL**	**1.20 JL**	**1.10 JL**	**1.10 JL**	**1.30 JL**	**1.50 JL**	**1.30 JL**
Cadmium	0.75	GWSoilIng	**0.200 J**	**0.200 JL**	**0.110 J**	**0.230 JL**	**0.200 JL**	**0.270 JL**	**0.300 JL**	**0.280 JL**	**0.260 JL**	**0.260 JL**	**0.350 JL**	**0.480 JL**	**0.420 JL**
Calcium	--		**2280 X8JL**	**1530 X8J**	**1220 X8JL**	**1210 X8J**	**30500 X8J**	**1240 X8J**	**1580 X8J**	**1300 X8J**	**1310 X8J**	**1230 X8J**	**1160 X8J**	**1220 X8J**	**1110 X8J**
Chromium (total)	1200	GWSoilIng	**5.30 JL**	**8.20 JL**	**6.40 JL**	**6.40 JL**	**4.80 JL**	**5.40 JL**	**4.40 JL**	**3.80 JL**	**3.50 JL**	**5.10 JL**	**4.10 JL**	**6.50 JL**	**6.60 JL**
Cobalt	7	TX-SP Bkgd	**2.80 JL**	**2.10 JL**	**2.30 JL**	**2.10 JL**	**2.50 JL**	**2.00 JL**	**2.10 JL**	**2.10 JL**	**1.80 JL**	**2.40 JL**	**1.90 JL**	**2.10 JL**	**1.80 JL**
Copper	520	GWSoilIng	**9.50 JL**	**7.80 JL**	**7.50 JL**	**8.60 JL**	**10.1 JL**	**9.80 JL**	**12.8 JL**	**11.6 JL**	**11.3 JL**	**11.7 JL**	**6.60 JL**	**9.00 JL**	**7.70 JL**
Iron	--		**17100 X8**	**9510 X8J**	**14400 X8**	**9560 X8J**	**11000 X8**	**10100 X8J**	**9670 X8J**	**7640 X8J**	**6940 X8J**	**9140 X8J**	**7540 X8J**	**9690 X8J**	**6930 X8J**
Lead	15	TX-SP Bkgd	**13.4 J**	**12.8 JL**	**15.3 J**	**14.2 JL**	**13.7 JL**	**27.1 JL**	**38.4 JL**	**57.5 JL**	**37.0 JL**	**21.9 JL**	**11.5 JL**	**22.0 JL**	**12.7 JL**
Magnesium	--		**1350 X8JL**	**1030 X8JL**	**1010 X8JL**	**895 X8JL**	**4040 X8JL**	**898 X8JL**	**943 X8JL**	**785 X8JL**	**761 X8JL**	**911 X8JL**	**831 X8JL**	**923 X8JL**	**761 X8JL**
Manganese	580	GWSoilIng	**157 X8J**	**127 X8**	**144 X8J**	**145 X8**	**163 X8J**	**160 X8**	**163 X8**	**165 X8**	**142 X8**	**129 X8**	**126 X8**	**133 X8**	**118 X8**
Molybdenum	2.5	GWSoilIng	**0.650 JL**	**0.610 JL**	**0.690 JL**	**0.540 JL**	**0.560 JL**	**0.670 JL**	**0.550 JL**	**0.550 JL**	**0.520 JL**	**0.400 JL**	**0.480 JL**	**0.570 JL**	**0.540 JL**
Nickel	79	GWSoilIng	**4.90 JL**	**5.90 JL**	**5.10 JL**	**4.70 JL**	**4.30 JL**	**4.00 JL**	**3.70 JL**	**3.20 JL**	**3.00 JL**	**4.30 JL**	**4.10 JL**	**5.50 JL**	**5.20 JL**
Potassium	--		**1450 X8**	**1190 X8J**	**1210 X8**	**1270 X8J**	**1600 X8J**	**1270 X8J**	**1250 X8J**	**1120 X8J**	**1050 X8J**	**1220 X8J**	**1050 X8J**	**1170 X8J**	**1010 X8J**
Selenium	1.1	GWSoilIng	<0.244 UJL	**0.290 JL**	<0.244 UJL	**0.330 JL**	<0.244 UJL	<0.244 UJL	**0.300 JL**	<0.244 UJL	**0.300 JL**	<0.244 UJL	<0.244 UJL	**0.330 JL**	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 U	<0.0360 UJL	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**156 X8**	**100 X8JL**	**130 X8**	**107 X8JL**	**185 X8JL**	**90.0 X8JL**	**123 X8JL**	**116 X8JL**	**102 X8JL**	**83.9 X8JL**	**120 X8JL**	**89.6 X8JL**	**73.1 X8JL**
Thallium	0.87	GWSoilIng	**0.240 JL**	<0.206 UJL	**0.340 JL**	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	**12.0 JL**	**8.70 JL**	**10.3 JL**	**8.90 JL**	**13.9 JL**	**7.90 JL**	**8.00 JL**	**7.20 JL**	**6.50 JL**	**9.70 JL**	**7.60 JL**	**8.50 JL**	**6.90 JL**
Zinc	1200	GWSoilIng	**40.9 JL**	**33.8 JL**	**31.9 JL**	**39.6 JL**	**41.6 JL**	**42.9 JL**	**48.3 JL**	**46.4 JL**	**42.8 JL**	**36.5 JL**	**42.2 JL**	**51.1 JL**	**62.0 JL**
Mercury	0.04	TX-SP Bkgd	**0.0150 J**	**0.0110 J**	**0.0110 J**	**0.0140 J**	**0.0170 J**	**0.0230 J**	**0.0210 J**	**0.0260 J**	**0.0270 J**	**0.0230 J**	**0.0120 J**	**0.0110 J**	**0.0130 J**
1,2-Dinitrobenzene	--		**1.73**	**1.97**	**1.73**	**2.06**	**1.73**	**2.24**	**1.93**	**1.65**	**1.55**	**2**	**1.74**	**1.92**	**1.9**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	**0.300 X7J**	**0.500 X7**	**0.200 X7J**	**0.100 X7J**	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-BJ065-01 N	CR-MIS-BK059-01 N	CR-MIS-BQ072-01 N	CR-MIS-BR060-01 N	CR-MIS-BT056-01 N	CR-MIS-BW062-01 N	CR-MIS-BW062-02 FD	CR-MIS-BW062-03 FT	CR-MIS-BY057-01 N	CR-MIS-CD061-01 N	CR-MIS-CD068-01 N	CR-MIS-CE047-01 N	CR-MIS-CE065-01 N
			2/17/2011	2/15/2011	2/15/2011	2/4/2011	2/4/2011	2/3/2011	2/3/2011	2/4/2011	2/8/2011	2/9/2011	2/7/2011	2/9/2011	2/7/2011
			Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	High Stratum	Low Stratum
Aluminum	64000	TotSoilComb2	3490 X8J	3910 X8J	5040 X8J	4010 X8	4300 X8	4040 X8	4030 X8	3540 X8J	7250 X8J	7510 X8	4950 X8J	7140 X8	5120 X8J
Antimony	2.7	GWSoilIng	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	0.130 JL	<0.0950 R	1.40 JL	<0.0950 R	0.340 JL
Arsenic	5.9	TX-SP Bkgd	0.710 JL	1.00 JL	<0.0880 UJL	3.90 JL	4.00 JL	3.00 JL	3.00 JL	2.80 JL	5.10 JL	5.80 JL	6.20 JL	4.60 JL	5.40 JL
Barium	300	TX-SP Bkgd	39.9 J	42.0 J	63.2 J	947	53.3	46.5	44.9	44.5 JH	74.2 JH	59.8	71.0 J	94	68.2 J
Beryllium	1.5	TX-SP Bkgd	1.20 JL	1.20 JL	1.50 JL	1.30 JL	1.50 JL	1.30 JL	1.30 JL	1.20 JL	2.30 JL	0.800 JL	1.20 JL	1.40 JL	1.00 JL
Cadmium	0.75	GWSoilIng	0.170 JL	0.120 JL	0.230 JL	0.240 JL	0.250 JL	0.250 JL	0.250 JL	0.170 JL	0.300 JL	0.320 JL	0.530 JL	0.310 JL	0.410 JL
Calcium	--		1190 X8J	1380 X8J	1950 X8J	2020 X8J	2200 X8J	1550 X8J	1650 X8J	1410 X8J	6220 X8J	2100 X8JL	10600 X8J	44900 X8JL	3900 X8J
Chromium (total)	1200	GWSoilIng	4.20 JL	6.20 JL	4.80 JL	5.30 JL	7.80 JL	4.50 JL	7.30 JL	3.50 JL	7.40 JL	9.1	8.30 JL	7.4	9.00 JL
Cobalt	7	TX-SP Bkgd	2.10 JL	2.00 JL	2.60 JL	2.20 JL	2.00 JL	1.80 JL	1.90 JL	1.80 JL	3.80 JL	4.30 JL	4.90 JL	4.10 JL	4.40 JL
Copper	520	GWSoilIng	7.20 J	8.10 J	10.0 J	9.40 JL	8.70 JL	7.90 JL	7.60 JL	7.40 JL	17.0 JH	16.8	18.7 JL	17.5	17.9 JL
Iron	--		7290 X8J	9640 X8J	12600 X8J	9920 X8J	10100 X8J	9980 X8J	9720 X8J	10100 X8	18300 X8	14000 X8	15900 X8	11400 X8	14900 X8
Lead	15	TX-SP Bkgd	11.1 JL	11.8 JL	17.8 JL	19.0 JL	18.2 JL	27.3 JL	21.8 JL	22.0 J	129 JL	21.8 JL	66.2 JL	17.3 JL	27.2 JL
Magnesium	--		925 X8JL	876 X8JL	1160 X8JL	960 X8JL	947 X8JL	909 X8JL	915 X8JL	832 X8JL	2310 X8	1820 X8JL	3760 X8JL	11400 X8JL	2240 X8JL
Manganese	580	GWSoilIng	133 X8J	135 X8J	253 X8J	155 X8	188 X8	168 X8	161 X8	161 X8J	242 X8	202 X8	318 X8J	433 X8	261 X8J
Molybdenum	2.5	GWSoilIng	0.480 JL	0.600 JL	0.760 JL	0.680 JL	0.650 JL	0.670 JL	0.600 JL	0.490 JL	0.510 JL	0.350 JL	0.990 JL	0.0860 JL	0.740 JL
Nickel	79	GWSoilIng	4.60 JL	4.60 JL	4.50 JL	4.50 JL	5.50 JL	3.60 JL	5.10 JL	3.20 JL	6.70 JL	7.50 JL	7.90 JL	6.30 JL	7.70 JL
Potassium	--		1050 X8J	1110 X8J	1580 X8J	1240 X8J	1260 X8J	1300 X8J	1330 X8J	1250 X8J	2090 X8	2390 X8	2010 X8J	2660 X8	1960 X8J
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	0.320 JL	0.290 JL	0.270 JL	0.370 JL	0.330 JL	<0.244 UJL	<0.244 UJL	<0.244 UJL	0.320 JL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		112 X8JL	107 X8JL	155 X8JL	100 X8JL	97.5 X8JL	99.0 X8JL	91.6 X8JL	110 X8JL	167 X8JL	199 X8JL	194 X8JL	166 X8JL	185 X8JL
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	0.460 JL	<0.206 UJL	<0.206 UJL	0.960 JL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	7.30 JL	8.40 JL	10.4 JL	7.80 JL	7.20 JL	6.90 JL	6.90 JL	6.30 JL	14.9 JL	16.1	17.4 JL	12.9	19.3 JL
Zinc	1200	GWSoilIng	29.8 JL	31.8 JL	50.1 JL	51.1 JL	45.4 JL	59.0 JL	60.1 JL	53.8 JL	68.7 JL	37.9	110 JL	49.9	74.3 JL
Mercury	0.04	TX-SP Bkgd	0.0160 J	0.0140 J	0.0160 J	0.0120 J	0.0150 J	0.0110 J	0.0110 J	0.0120 J	0.0280 J	0.0270 J	0.0170 J	0.0350 J	0.0220 J
1,2-Dinitrobenzene	--		0.877	0.865	0.888	1.93	2.02	2	1.95	1.76	1.75	1.81	1.74	1.77	1.74
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	0.200 X7J	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

			CR-MIS-CF048-01 N	CR-MIS-CG047-01 N	CR-MIS-CG058-01 N	CR-MIS-CG063-01 N	CR-MIS-CG069-01 N	CR-MIS-CH072-01 N	CR-MIS-CH072-02 FD	CR-MIS-CH072-03 FT	CR-MIS-CI039-01 N	CR-MIS-CI064-01 N	CR-MIS-CJ056-01 N	CR-MIS-CJ056-02 FD	CR-MIS-CJ056-03 FT
	PCL		2/9/2011	2/9/2011	2/9/2011	2/9/2011	2/8/2011	2/8/2011	2/8/2011	2/8/2011	2/8/2011	2/14/2011	2/8/2011	2/8/2011	2/8/2011
Analyte	**Value**	**PCL Source**	**High Stratum**	**High Stratum**	**Low Stratum**	**High Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**High Stratum**	**High Stratum**	**High Stratum**
Aluminum	64000	TotSoilComb2	7110 X8	8750 X8	7520 X8	6820 X8	6100 X8	3350 X8	4990 X8	5800 X8	5610 X8J	6890 X8	7380 X8	6740 X8J	5900 X8J
Antimony	2.7	GWSoilIng	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	3.00 JL	0.890 JL	0.520 JL	0.690 JL	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R
Arsenic	5.9	TX-SP Bkgd	2.20 JL	6.00 JL	5.90 JL	5.80 JL	6.30 JL	3.40 JL	4.70 JL	4.30 JL	7.60 JL	2.60 JL	4.90 JL	5.10 JL	4.90 JL
Barium	300	TX-SP Bkgd	64.8	91	63.8	66.2	67.4 JL	34.7 JL	48.5 JL	50.9 JL	77.6 JH	59.3 JL	58.6	56.7 JH	57.5 JH
Beryllium	1.5	TX-SP Bkgd	0.660 JL	2.40 JL	1.00 JL	1.10 JL	1.1	0.56	0.75	0.76	1.70 JL	0.790 JL	0.760 JL	0.770 JL	0.770 JL
Cadmium	0.75	GWSoilIng	0.270 JL	0.540 JL	0.300 JL	0.310 JL	0.330 J	0.210 J	0.270 J	0.250 J	0.530 JL	0.440 JL	0.290 JL	0.260 JL	0.300 JL
Calcium	--		52700 X8JL	38700 X8JL	2260 X8JL	2560 X8JL	2510 X8JL	1120 X8JL	1720 X8JL	1650 X8JL	11700 X8J	1910 X8JL	2570 X8JL	2060 X8J	2360 X8J
Chromium (total)	1200	GWSoilIng	6	8.3	9.1	11.3	8.90 JL	5.30 JL	7.30 JL	7.60 JL	6.10 JL	8.50 JL	9.1	8.30 JL	8.00 JL
Cobalt	7	TX-SP Bkgd	3.10 JL	4.80 JL	4.40 JL	4.40 JL	4.30 JL	2.40 JL	3.40 JL	3.50 JL	3.40 JL	4.00 JL	4.10 JL	3.80 JL	4.20 JL
Copper	520	GWSoilIng	14.7	20.6	17.2	18.2	19.9 JL	14.3 JL	20.0 JL	20.0 JL	17.9 JH	18.5 JH	15.2	14.8 JH	15.7 JH
Iron	--		6750 X8	19900 X8	15300 X8	16000 X8	17300 X8	7210 X8J	15100 X8J	15400 X8J	20600 X8	10600 X8	13500 X8	16500 X8	18500 X8
Lead	15	TX-SP Bkgd	15.2 JL	21.4 JL	23.1 JL	26.7 JL	113 J	134 J	114 J	101 J	34.9 JL	21.6 J	20.0 JL	29.1 JL	24.1 JL
Magnesium	--		18900 X8JL	10600 X8JL	2150 X8JL	2290 X8JL	1890 X8JL	973 X8JL	1410 X8JL	1520 X8JL	2450 X8	1660 X8J	1910 X8JL	1750 X8	1700 X8
Manganese	580	GWSoilIng	255 X8	402 X8	233 X8	256 X8	243 X8J	131 X8J	178 X8J	189 X8J	331 X8	208 X8J	191 X8	180 X8	187 X8
Molybdenum	2.5	GWSoilIng	<0.0740 UJL	0.560 JL	0.540 JL	0.670 JL	0.410 JL	0.320 JL	0.480 JL	0.420 JL	1.80 JL	0.270 JL	0.350 JL	0.340 JL	1.50 JL
Nickel	79	GWSoilIng	4.50 JL	6.80 JL	7.90 JL	9.20 JL	7.90 JL	4.60 JL	6.10 JL	6.40 JL	5.60 JL	7.20 JL	7.70 JL	7.30 JL	7.70 JL
Potassium	--		2450 X8	3320 X8	2220 X8	2030 X8	1850 X8	1080 X8	1500 X8	1600 X8	1710 X8	2190 X8	2180 X8	1930 X8	1860 X8
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	0.0990 JL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 U	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		154 X8JL	203 X8JL	187 X8JL	215 X8JL	164 X8	116 X8	136 X8	144 X8	209 X8JL	141 X8JL	165 X8JL	148 X8JL	157 X8JL
Thallium	0.87	GWSoilIng	0.560 JL	0.710 JL	<0.206 UJL	0.270 JL	0.370 JL	0.210 JL	0.290 JL	0.360 JL	0.650 JL	0.380 JL	<0.206 UJL	0.280 JL	0.340 JL
Vanadium	50	TX-SP Bkgd	11.3	18.9	17.1	16.6	16.9 JL	10.0 JL	13.6 JL	14.4 JL	12.6 JL	14.4 JL	16.5 JL	15.0 JL	14.2 JL
Zinc	1200	GWSoilIng	34	65	54.6	64.1	57.2 JL	33.5 JL	45.1 JL	46.1 JL	85.1 JL	39.4 JL	39.7 JL	39.3 JL	38.2 JL
Mercury	0.04	TX-SP Bkgd	0.0320 J	0.0350 J	0.0260 J	0.0310 J	0.0260 J	0.0200 J	0.0190 J	0.0190 J	0.0290 J	0.0230 J	0.0290 J	0.0280 J	0.0300 J
1,2-Dinitrobenzene	--		1.76	1.78	1.78	1.8	1.79	1.8	1.78	1.71	1.68	0.867	1.75	1.73	1.69
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-CJ057-01 N	CR-MIS-CJ058-01 N	CR-MIS-CJ062-01 N	CR-MIS-CK042-01 N	CR-MIS-CK053-01 N	CR-MIS-CK058-01 N	CR-MIS-CL049-01 N	CR-MIS-CL054-01 N	CR-MIS-CL059-01 N	CR-MIS-CM056-01 N	CR-MIS-CM058-01 N	CR-MIS-CM067-01 N	CR-MIS-CM067-02 FD
			2/8/2011	**2/8/2011**	**2/9/2011**	**2/8/2011**	**2/9/2011**	**2/9/2011**	**2/9/2011**	**2/9/2011**	**2/8/2011**	**2/10/2011**	**2/10/2011**	**2/15/2011**	**2/15/2011**
			High Stratum	**High Stratum**	**Low Stratum**	**Low Stratum**	**High Stratum**	**Low Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**High Stratum**
Aluminum	64000	TotSoilComb2	**4840 X8**	**6140 X8**	**7240 X8JH**	**6120 X8J**	**7130 X8JH**	**7510 X8**	**8380 X8**	**7990 X8JH**	**6700 X8**	**5510 X8J**	**6010 X8JH**	**5640 X8J**	**5020 X8J**
Antimony	2.7	GWSoilIng	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	**0.180 U**	<0.0950 R	**0.390 JL**	**0.370 JL**
Arsenic	5.9	TX-SP Bkgd	**3.80 JL**	**4.70 JL**	**5.80 JL**	**6.10 JL**	**5.40 JL**	**5.30 JL**	**5.60 JL**	**6.60 JL**	**4.70 JL**	**1.30 JL**	**5.10 JL**	**1.20 JL**	**1.40 JL**
Barium	300	TX-SP Bkgd	**36.1**	**47.2**	**61.0 J**	**73.1 JH**	**67.4 J**	**56.7**	**77**	**68.3 J**	**49**	**42.9 J**	**53.8 J**	**41.0 J**	**42.0 J**
Beryllium	1.5	TX-SP Bkgd	**0.530 JL**	**0.670 JL**	**0.850 JL**	**0.970 JL**	**0.920 JL**	**0.830 JL**	**0.930 JL**	**0.960 JL**	**0.700 JL**	**0.650 JL**	**0.740 JL**	**0.570 JL**	**0.560 JL**
Cadmium	0.75	GWSoilIng	**0.200 JL**	**0.270 JL**	**0.390 JL**	**0.330 JL**	**0.380 JL**	**0.290 JL**	**0.340 JL**	**0.430 JL**	**0.230 JL**	**0.300 JL**	**0.350 JL**	**0.290 JL**	**0.320 JL**
Calcium	--		**1130 X8JL**	**1490 X8JL**	**1860 X8JH**	**5610 X8J**	**9390 X8JH**	**1830 X8JL**	**16300 X8JL**	**2290 X8JH**	**2270 X8JL**	**1430 X8J**	**1700 X8JH**	**1260 X8J**	**1620 X8J**
Chromium (total)	1200	GWSoilIng	**5.7**	**7.6**	**9.30 JL**	**7.90 JL**	**9.30 JL**	**8.7**	**8.5**	**10.9 JL**	**9.1**	**6.20 JL**	**8.00 JL**	**6.70 JL**	**6.00 JL**
Cobalt	7	TX-SP Bkgd	**2.70 JL**	**3.60 JL**	**4.40 JL**	**4.20 JL**	**4.60 JL**	**4.00 JL**	**4.30 JL**	**4.90 JL**	**3.80 JL**	**3.00 JL**	**3.90 JL**	**3.10 JL**	**3.00 JL**
Copper	520	GWSoilIng	**10.1**	**14.7**	**18.0 JL**	**14.9 JH**	**21.2 JL**	**16**	**18.6**	**20.7 JL**	**12.6**	**12.4 J**	**17.6 JL**	**19.1 J**	**18.2 J**
Iron	--		**7450 X8**	**11800 X8**	**14600 X8JL**	**16400 X8**	**15200 X8JL**	**13400 X8**	**15400 X8**	**16200 X8JL**	**12600 X8**	**9330 X8J**	**12000 X8JL**	**9860 X8J**	**9610 X8J**
Lead	15	TX-SP Bkgd	**14.2 JL**	**19.9 JL**	**22.9 JL**	**21.8 JL**	**25.0 JL**	**20.0 JL**	**20.9 JL**	**31.6 JL**	**20.2 JL**	**19.6 JH**	**24.3 JL**	**60.3 JL**	**73.6 JL**
Magnesium	--		**1120 X8JL**	**1440 X8JL**	**1770 X8J**	**2330 X8**	**3010 X8J**	**1710 X8JL**	**3280 X8JL**	**2000 X8J**	**1550 X8JL**	**1290 X8J**	**1540 X8J**	**1240 X8JL**	**1230 X8JL**
Manganese	580	GWSoilIng	**125 X8**	**155 X8**	**201 X8JH**	**257 X8**	**214 X8JH**	**186 X8**	**215 X8**	**233 X8JH**	**169 X8**	**133 X8J**	**182 X8JH**	**137 X8J**	**142 X8J**
Molybdenum	2.5	GWSoilIng	**0.270 JL**	**0.310 JL**	**0.340 JL**	**0.670 JL**	**0.420 JL**	**0.340 JL**	**0.610 JL**	**0.400 JL**	**0.340 JL**	**0.230 JL**	**0.350 JL**	**0.270 JL**	**0.290 JL**
Nickel	79	GWSoilIng	**5.00 JL**	**6.10 JL**	**7.80 JL**	**8.10 JL**	**9.30 JL**	**7.30 JL**	**8.10 JL**	**9.10 JL**	**7.60 JL**	**5.40 JL**	**7.00 JL**	**5.30 JL**	**5.00 JL**
Potassium	--		**1430 X8**	**1760 X8**	**2230 X8JH**	**1840 X8**	**2400 X8JH**	**2090 X8**	**2100 X8**	**2310 X8JH**	**1930 X8**	**1510 X8JH**	**1960 X8JH**	**1610 X8J**	**1580 X8J**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	**0.410 JL**	**0.400 JL**
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**116 X8JL**	**142 X8JL**	**182 X8JL**	**174 X8JL**	**230 X8JL**	**172 X8JL**	**203 X8JL**	**192 X8JL**	**145 X8JL**	**69.7 X8JL**	**158 X8JL**	**124 X8JL**	**108 X8JL**
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 UJL	**0.210 JL**	**0.470 JL**	**0.260 JL**	**0.220 JL**	**0.250 JL**	**0.230 JL**	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	**10.7**	**14.2**	**16.8 JL**	**15.9 JL**	**16.3 JL**	**15.9**	**17.7**	**18.2 JL**	**14.2**	**11.0 JL**	**14.0 JL**	**11.9 JL**	**10.6 JL**
Zinc	1200	GWSoilIng	**27.1**	**32.6**	**39.3 JL**	**66.7 JL**	**49.3 JL**	**37.3**	**49.3**	**43.5 JL**	**33.2**	**34.7 JL**	**36.2 JL**	**35.4 JL**	**33.4 JL**
Mercury	0.04	TX-SP Bkgd	**0.0280 J**	**0.0520 J**	**0.0310 J**	**0.0260 J**	**0.0230 J**	**0.0320 J**	**0.0310 J**	**0.0350 J**	**0.0260 J**	**0.0240 J**	**0.0450 J**	**0.0330 J**	**0.0290 J**
1,2-Dinitrobenzene	--		**1.79**	**1.79**	**1.87**	**1.7**	**1.85**	**1.9**	**1.78**	**1.87**	**1.79**	**0.827**	**1.88**	**0.825**	**0.851**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 UJL	<0.0800 U	<0.0800 UJL	<0.0800 UJL
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-CM067-03 FT	CR-MIS-CN027-01 N	CR-MIS-CN056-01 N	CR-MIS-CN058-01 N	CR-MIS-CN066-01 N	CR-MIS-CO043-01 N	CR-MIS-CO058-01 N	CR-MIS-CO066-01 N	CR-MIS-CP054-01 N	CR-MIS-CP057-01 N	CR-MIS-CR051-01 N	CR-MIS-CT053-01 N	CR-MIS-CU059-01 N
			2/15/2011	2/8/2011	2/10/2011	2/9/2011	2/9/2011	2/8/2011	2/8/2011	2/9/2011	2/8/2011	2/8/2011	2/9/2011	2/10/2011	2/10/2011
			High Stratum	Low Stratum	High Stratum	Low Stratum	High Stratum	Low Stratum	High Stratum	High Stratum	Low Stratum	Low Stratum	High Stratum	High Stratum	High Stratum
Aluminum	64000	TotSoilComb2	**6120 X8J**	**6430 X8J**	**5610 X8J**	**6930 X8JH**	**6570 X8JH**	**5620 X8J**	**6250 X8J**	**5670 X8JH**	**6730 X8J**	**6550 X8J**	**6320 X8JH**	**5250 X8J**	**4250 X8J**
Antimony	2.7	GWSoilIng	**0.490 JL**	<0.0950 R	**0.190 U**	<0.0950 R	**0.310 JL**	<0.0950 R	<0.0950 R	<0.0950 R	**0.320 JL**	<0.0950 R	<0.0950 R	**0.120 U**	**0.210 U**
Arsenic	5.9	TX-SP Bkgd	**1.40 JL**	**4.10 JL**	**1.70 JL**	**4.90 JL**	**4.80 JL**	**4.60 JL**	**5.10 JL**	**4.10 JL**	**5.80 JL**	**4.70 JL**	**4.30 JL**	<0.0880 UJL	**0.310 U**
Barium	300	TX-SP Bkgd	**44.7 J**	**60.9 JH**	**42.7 J**	**52.2 J**	**50.4 J**	**59.2 JH**	**54.4 JH**	**42.8 JH**	**69.3 JH**	**64.3 JH**	**67.5 J**	**50.1 J**	**44.1 J**
Beryllium	1.5	TX-SP Bkgd	**0.620 JL**	**0.680 JL**	**0.700 JL**	**0.740 JL**	**0.710 JL**	**0.880 JL**	**0.760 JL**	**0.600 JL**	**0.940 JL**	**0.920 JL**	**0.890 JL**	**0.720 JL**	**0.650 JL**
Cadmium	0.75	GWSoilIng	**0.330 JL**	**0.340 JL**	**0.310 JL**	**0.320 JL**	**0.400 JL**	**0.270 JL**	**0.290 JL**	**0.250 JL**	**0.470 JL**	**0.420 JL**	**0.690 JL**	**0.500 JL**	**0.430 JL**
Calcium	--		**1460 X8J**	**6840 X8J**	**1330 X8J**	**1640 X8JH**	**1700 X8JH**	**9840 X8J**	**1850 X8J**	**1990 X8JL**	**3960 X8J**	**4820 X8J**	**6740 X8JH**	**4500 X8J**	**3500 X8J**
Chromium (total)	1200	GWSoilIng	**7.50 JL**	**6.80 JL**	**6.60 JL**	**8.40 JL**	**8.50 JL**	**7.90 JL**	**8.30 JL**	**6.70 J**	**8.60 JL**	**7.90 JL**	**8.00 JL**	**6.20 JL**	**5.10 JL**
Cobalt	7	TX-SP Bkgd	**3.30 JL**	**3.50 JL**	**3.40 JL**	**3.70 JL**	**4.50 JL**	**4.50 JL**	**4.00 JL**	**3.40 JL**	**5.00 JL**	**5.10 JL**	**5.30 JL**	**3.60 JL**	**3.50 JL**
Copper	520	GWSoilIng	**21.3 J**	**14.7 JH**	**13.5 J**	**14.9 JL**	**20.4 JL**	**14.0 JH**	**14.3 JH**	**12.7 J**	**20.6 JH**	**18.3 JH**	**165 JL**	**19.9 J**	**15.7 J**
Iron	--		**10400 X8J**	**8110 X8**	**10200 X8J**	**12600 X8JL**	<14.0 X8UJL	**17400 X8**	**14300 X8**	**10600 X8JL**	**16800 X8**	**16000 X8**	**16800 X8JL**	**11700 X8J**	**8030 X8J**
Lead	15	TX-SP Bkgd	**77.0 JL**	**21.7 JL**	**20.3 JH**	**19.5 JL**	**61.5 JL**	**16.8 JL**	**19.7 JL**	**19.5 JL**	**40.8 JL**	**24.1 JL**	**37.8 JL**	**40.0 JH**	**43.2 JH**
Magnesium	--		**1350 X8JL**	**1960 X8**	**1290 X8J**	**1600 X8J**	**1520 X8J**	**3210 X8**	**1590 X8**	**1760 X8JL**	**2870 X8**	**3560 X8**	**4430 X8J**	**3020 X8J**	**2400 X8J**
Manganese	580	GWSoilIng	**150 X8J**	**160 X8**	**148 X8J**	**170 X8JH**	**170 X8JH**	**194 X8**	**179 X8**	**148 X8JH**	**223 X8**	**223 X8**	**245 X8JH**	**179 X8J**	**162 X8J**
Molybdenum	2.5	GWSoilIng	**0.340 JL**	**0.240 JL**	**0.230 JL**	**0.290 JL**	**0.350 JL**	**0.350 JL**	**0.290 JL**	**0.300 JL**	**0.400 JL**	**0.380 JL**	**0.440 JL**	**0.350 JL**	**0.300 JL**
Nickel	79	GWSoilIng	**5.90 JL**	**6.80 JL**	**5.90 JL**	**7.00 JL**	**6.70 JL**	**8.70 JL**	**7.20 JL**	**5.80 JL**	**8.70 JL**	**9.30 JL**	**10.3 JL**	**7.40 JL**	**6.00 JL**
Potassium	--		**1740 X8J**	**1940 X8**	**1570 X8JH**	**2060 X8JH**	**1930 X8JH**	**1780 X8**	**1920 X8**	**1690 X8JH**	**1960 X8**	**2010 X8**	**2020 X8JH**	**1500 X8JH**	**1350 X8JH**
Selenium	1.1	GWSoilIng	**0.390 JL**	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**101 X8JL**	**185 X8JL**	**131 X8JL**	**176 X8JL**	**127 X8JL**	**202 X8JL**	**154 X8JL**	**139 X8JL**	**199 X8JL**	**207 X8JL**	**227 X8JL**	**132 X8JL**	**109 X8JL**
Thallium	0.87	GWSoilIng	<0.206 UJL	**0.310 JL**	<0.206 UJL	<0.206 UJL	**0.210 JL**	**0.400 JL**	**0.230 JL**	<0.206 UJL	**0.390 JL**	**0.380 JL**	**0.360 JL**	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	**12.2 JL**	**11.2 JL**	**10.7 JL**	**14.7 JL**	**14.1 JL**	**14.9 JL**	**15.4 JL**	**13.0 J**	**16.8 JL**	**16.0 JL**	**16.7 JL**	**11.1 JL**	**9.30 JL**
Zinc	1200	GWSoilIng	**37.6 JL**	**32.8 JL**	**32.9 JL**	**36.5 JL**	**38.3 JL**	**48.9 JL**	**37.2 JL**	**32.4**	**55.1 JL**	**53.8 JL**	**75.1 JL**	**53.2 JL**	**45.5 JL**
Mercury	0.04	TX-SP Bkgd	**0.0340 J**	**0.0310 J**	**0.0220 J**	**0.0260 J**	**0.0300 J**	**0.0210 J**	**0.0250 J**	**0.0230 J**	**0.0260 J**	**0.0230 J**	**0.0270 J**	**0.0210 J**	**0.0220 J**
1,2-Dinitrobenzene	--		**0.868**	**1.68**	**0.836**	**1.92**	**1.87**	**1.69**	**1.7**	**1.86**	**1.68**	**1.69**	**1.86**	**0.807**	**0.821**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 UJL	<0.0800 U	<0.0800 UJL	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 UJL	<0.0800 UJL
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-CU060-01 N	CR-MIS-CU068-01 N	CR-MIS-CW058-01 N	CR-MIS-CW072-01 N	CR-MIS-CX066-01 N	CR-MIS-CY057-01 N	CR-MIS-CY059-01 N	CR-MIS-CY069-01 N	CR-MIS-CY070-01 N	CR-MIS-CZ056-01 N	CR-MIS-CZ058-01 N	CR-MIS-CZ058-02 FD	CR-MIS-CZ058-03 FT
			2/8/2011	2/8/2011	2/9/2011	2/9/2011	2/8/2011	2/14/2011	2/14/2011	2/10/2011	2/15/2011	2/14/2011	2/14/2011	2/14/2011	2/14/2011
			Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum
Aluminum	64000	TotSoilComb2	**6550 X8**	**4680 X8**	**6840 X8JH**	**3990 X8JH**	**5950 X8**	**6920 X8**	**6160 X8**	**5680 X8JH**	**4040 X8J**	**6780 X8**	**6210 X8**	**6310 X8**	**7020 X8**
Antimony	2.7	GWSoilIng	**0.110 JL**	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R
Arsenic	5.9	TX-SP Bkgd	<0.0880 UJL	**3.30 JL**	**4.40 JL**	**3.30 JL**	**4.10 JL**	**0.400 JL**	**1.70 JL**	**4.50 JL**	<0.0880 UJL	**1.20 JL**	**2.30 JL**	**1.70 JL**	**1.20 JL**
Barium	300	TX-SP Bkgd	**70.6 JL**	**45.1 JL**	**67.3 J**	**37.2 J**	**55.3 JL**	**63.1 JL**	**56.9 JL**	**58.5 J**	**36.7 J**	**60.5 JL**	**58.0 JL**	**58.1 JL**	**57.1 JL**
Beryllium	1.5	TX-SP Bkgd	**0.92**	**0.63**	**0.840 JL**	**0.530 JL**	**0.73**	**0.760 JL**	**0.680 JL**	**0.760 JL**	**0.490 JL**	**0.740 JL**	**0.720 JL**	**0.750 JL**	**0.730 JL**
Cadmium	0.75	GWSoilIng	**0.58**	**0.290 J**	**0.520 JL**	**0.250 JL**	**0.350 J**	**0.510 JL**	**0.470 JL**	**0.490 JL**	**0.260 JL**	**0.590 JL**	**0.530 JL**	**0.530 JL**	**0.530 JL**
Calcium	--		**4290 X8JL**	**1750 X8JL**	**3950 X8JH**	**1470 X8JH**	**2600 X8JL**	**3000 X8JL**	**2350 X8JL**	**2830 X8JH**	**1670 X8J**	**3430 X8JL**	**2500 X8JL**	**3280 X8JL**	**2690 X8JL**
Chromium (total)	1200	GWSoilIng	**8.40 JL**	**8.00 JL**	**7.60 JL**	**5.30 JL**	**7.60 JL**	**7.40 JL**	**6.70 JL**	**8.90 JL**	**11.0 JL**	**7.00 JL**	**8.10 JL**	**6.80 JL**	**8.70 JL**
Cobalt	7	TX-SP Bkgd	**5.40 JL**	**3.40 JL**	**4.60 JL**	**3.10 JL**	**4.00 JL**	**4.10 JL**	**4.00 JL**	**4.00 JL**	**2.80 JL**	**4.30 JL**	**3.80 JL**	**3.80 JL**	**3.90 JL**
Copper	520	GWSoilIng	**23.1 JL**	**12.9 JL**	**20.7 JL**	**11.5 JL**	**15.8 JL**	**19.4 JH**	**17.1 JL**	**17.7 JL**	**11.2 J**	**20.2 JL**	**19.4 JL**	**18.7 JL**	**19.4 JL**
Iron	--		**16800 X8**	**16100 X8**	**15600 X8JL**	**10200 X8JL**	**16800 X8**	**13400 X8**	**9520 X8**	**14300 X8JL**	**7580 X8J**	**12500 X8**	**9400 X8**	**9670 X8**	**12600 X8**
Lead	15	TX-SP Bkgd	**48.2 J**	**33.0 J**	**34.3 JL**	**17.8 JL**	**24.6 J**	**24.5 J**	**24.8 J**	**27.5 JL**	**16.9 JL**	**31.7 J**	**28.2 J**	**30.3 J**	**30.5 J**
Magnesium	--		**3560 X8JL**	**1830 X8JL**	**3440 X8J**	**1540 X8J**	**2110 X8JL**	**2890 X8J**	**2180 X8JL**	**2360 X8J**	**1550 X8JL**	**2960 X8JL**	**2310 X8JL**	**2340 X8JL**	**2470 X8JL**
Manganese	580	GWSoilIng	**253 X8J**	**159 X8J**	**251 X8JH**	**145 X8JH**	**192 X8J**	**213 X8J**	**194 X8**	**207 X8JH**	**133 X8J**	**204 X8**	**207 X8**	**197 X8**	**197 X8**
Molybdenum	2.5	GWSoilIng	**0.420 JL**	**0.350 JL**	**0.390 JL**	**0.300 JL**	**0.320 JL**	**0.230 JL**	**0.170 JL**	**0.430 JL**	**0.380 JL**	**0.180 JL**	**0.260 JL**	**0.180 JL**	**0.230 JL**
Nickel	79	GWSoilIng	**9.60 JL**	**7.20 JL**	**8.60 JL**	**5.40 JL**	**7.90 JL**	**8.00 JL**	**7.60 JL**	**8.20 JL**	**7.90 JL**	**8.00 JL**	**7.80 JL**	**7.10 JL**	**7.80 JL**
Potassium	--		**2020 X8**	**1460 X8**	**2070 X8JH**	**1300 X8JH**	**1680 X8**	**2150 X8**	**1820 X8**	**1800 X8JH**	**1220 X8J**	**1960 X8**	**1830 X8**	**1870 X8**	**1990 X8**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	**0.330 JL**	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**232 X8**	**136 X8**	**229 X8JL**	**165 X8JL**	**176 X8**	**167 X8JL**	**191 X8JL**	**193 X8JL**	**107 X8JL**	**202 X8JL**	**180 X8JL**	**144 X8JL**	**175 X8JL**
Thallium	0.87	GWSoilIng	<0.206 UJL	**0.270 JL**	**0.270 JL**	**0.250 JL**	**0.320 JL**	**0.530 JL**	**0.470 JL**	<0.206 UJL	<0.206 UJL	**0.470 JL**	**0.550 JL**	**0.600 JL**	**0.520 JL**
Vanadium	50	TX-SP Bkgd	**17.9 JL**	**11.6 JL**	**14.9 JL**	**10.4 JL**	**15.2 JL**	**13.3 JL**	**11.2 JL**	**13.4 JL**	**9.50 JL**	**12.2 JL**	**11.4 JL**	**11.6 JL**	**13.3 JL**
Zinc	1200	GWSoilIng	**63.2 JL**	**39.5 JL**	**55.5 JL**	**35.2 JL**	**45.3 JL**	**50.0 JL**	**42.9 JL**	**49.6 JL**	**33.5 JL**	**51.3 JL**	**45.7 JL**	**44.6 JL**	**46.1 JL**
Mercury	0.04	TX-SP Bkgd	**0.0220 J**	**0.0180 J**	**0.0240 J**	**0.0180 J**	**0.0210 J**	**0.0260 J**	**0.0190 J**	**0.0220 J**	**0.0220 J**	**0.0290 J**	**0.0220 J**	**0.0210 J**	**0.0200 J**
1,2-Dinitrobenzene	--		**1.65**	**1.7**	**1.87**	**1.88**	**1.68**	**0.898**	**0.935**	**1.87**	**0.858**	**0.936**	**0.922**	**0.932**	**0.952**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 UJL	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-CZ062-01 N	CR-MIS-CZ071-01 N	CR-MIS-CZ072-01 N	CR-MIS-DA059-01 N	CR-MIS-DA068-01 N	CR-MIS-DA069-01 N	CR-MIS-DB059-01 N	CR-MIS-DB061-01 N	CR-MIS-DB070-01 N	CR-MIS-DB072-01 N	CR-MIS-DC062-01 N	CR-MIS-DC063-01 N	CR-MIS-DC067-01 N
			2/14/2011	2/10/2011	2/10/2011	2/15/2011	2/10/2011	2/10/2011	2/15/2011	2/14/2011	2/10/2011	2/10/2011	2/14/2011	2/14/2011	2/11/2011
			High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum
Aluminum	64000	TotSoilComb2	**6310 X8**	**5340 X8JH**	**4700 X8JH**	**4650 X8J**	**3970 X8J**	**3600 X8J**	**5270 X8J**	**7540 X8**	**3940 X8J**	**4500 X8J**	**7370 X8**	**6890 X8**	**3260 X8JH**
Antimony	2.7	GWSoilIng	<0.0950 R	<0.0950 R	<0.0950 R	**0.140 U**	**0.180 U**	**0.260 U**	<0.0950 R	**1.50 JL**	**0.250 U**	**0.200 U**	<0.0950 R	<0.0950 R	<0.0950 R
Arsenic	5.9	TX-SP Bkgd	**5.80 JL**	**4.70 JL**	**4.00 JL**	**0.900 JL**	**0.650 JL**	**0.380 JL**	<0.0880 UJL	**1.70 JL**	**0.420 JL**	**0.580 JL**	**1.30 JL**	**2.20 JL**	**2.60 JL**
Barium	300	TX-SP Bkgd	**59.2 JL**	**50.1 J**	**48.9 J**	**41.1 J**	**40.0 J**	**38.2 J**	**47.6 J**	**54.7 JL**	**40.2 J**	**50.7 J**	**56.0 JL**	**57.1 JL**	**33.6 J**
Beryllium	1.5	TX-SP Bkgd	**0.730 JL**	**0.700 JL**	**0.700 JL**	**0.570 JL**	**0.590 JL**	**0.550 JL**	**0.640 JL**	**0.790 JL**	**0.670 JL**	**0.800 JL**	**0.750 JL**	**0.780 JL**	**0.450 JL**
Cadmium	0.75	GWSoilIng	**0.560 JL**	**0.330 JL**	**0.360 JL**	**0.350 JL**	**0.320 JL**	**0.340 JL**	**0.320 JL**	**0.540 JL**	**0.320 JL**	**0.410 JL**	**0.560 JL**	**0.610 JL**	**0.240 JL**
Calcium	--		**2660 X8JL**	**2120 X8JH**	**1880 X8JH**	**1400 X8J**	**1830 X8J**	**1560 X8J**	**2380 X8J**	**2060 X8JL**	**1610 X8J**	**2480 X8J**	**2030 X8JL**	**2030 X8JL**	**1630 X8JH**
Chromium (total)	1200	GWSoilIng	**6.90 JL**	**6.70 JL**	**6.30 JL**	**5.80 JL**	**5.10 JL**	**6.30 JL**	**6.20 JL**	**7.70 JL**	**5.40 JL**	**5.70 JL**	**7.80 JL**	**8.20 JL**	**4.40 JL**
Cobalt	7	TX-SP Bkgd	**3.80 JL**	**3.90 JL**	**3.70 JL**	**3.00 JL**	**3.00 JL**	**2.90 JL**	**3.60 JL**	**3.60 JL**	**3.10 JL**	**3.90 JL**	**3.70 JL**	**4.00 JL**	**2.50 JL**
Copper	520	GWSoilIng	**26.4 JH**	**13.8 JL**	**14.1 JL**	**15.5 J**	**12.7 J**	**12.1 J**	**14.4 J**	**21.6 JH**	**13.0 J**	**17.0 J**	**26.7 JH**	**47.3 JH**	**11.6 JL**
Iron	--		**13500 X8**	**12900 X8JL**	**12000 X8JL**	**9580 X8J**	**7650 X8J**	**7740 X8J**	**11900 X8J**	**13300 X8**	**10300 X8J**	**12000 X8J**	**13800 X8**	**11200 X8**	**6910 X8JL**
Lead	15	TX-SP Bkgd	**28.7 J**	**415 JL**	**22.8 JL**	**26.4 JL**	**25.0 JH**	**20.9 JH**	**25.0 JL**	**82.0 J**	**98.9 JH**	**27.7 JH**	**35.3 J**	**41.6 J**	**25.4 JL**
Magnesium	--		**2470 X8J**	**1990 X8J**	**1650 X8J**	**1250 X8JL**	**1590 X8J**	**1570 X8J**	**2120 X8JL**	**1870 X8J**	**1640 X8J**	**2180 X8J**	**1860 X8J**	**1820 X8J**	**1470 X8J**
Manganese	580	GWSoilIng	**206 X8J**	**183 X8JH**	**176 X8JH**	**143 X8J**	**145 X8J**	**153 X8J**	**169 X8J**	**195 X8J**	**147 X8J**	**182 X8J**	**204 X8J**	**208 X8J**	**124 X8JH**
Molybdenum	2.5	GWSoilIng	**0.280 JL**	**0.320 JL**	**0.330 JL**	**0.270 JL**	**0.270 JL**	**0.330 JL**	**0.320 JL**	**0.240 JL**	**0.260 JL**	**0.340 JL**	**0.210 JL**	**0.300 JL**	**0.260 JL**
Nickel	79	GWSoilIng	**7.60 JL**	**6.70 JL**	**6.20 JL**	**5.00 JL**	**5.40 JL**	**6.00 JL**	**6.30 JL**	**6.80 JL**	**5.50 JL**	**6.80 JL**	**6.80 JL**	**7.20 JL**	**4.60 JL**
Potassium	--		**1920 X8**	**1670 X8JH**	**1590 X8JH**	**1340 X8J**	**1270 X8JH**	**1220 X8JH**	**1540 X8J**	**2050 X8**	**1360 X8JH**	**1570 X8JH**	**2040 X8**	**1990 X8**	**1120 X8JH**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	<0.244 UJL	**0.410 JL**	<0.244 UJL	<0.244 UJL	**0.510 JL**	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**164 X8JL**	**173 X8JL**	**176 X8JL**	**118 X8JL**	**96.5 X8JL**	**135 X8JL**	**136 X8JL**	**155 X8JL**	**107 X8JL**	**137 X8JL**	**150 X8JL**	**138 X8JL**	**145 X8JL**
Thallium	0.87	GWSoilIng	**0.470 JL**	**0.260 JL**	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	**0.380 JL**	<0.206 UJL	<0.206 UJL	**0.520 JL**	**0.490 JL**	**0.220 JL**
Vanadium	50	TX-SP Bkgd	**13.7 JL**	**13.3 JL**	**12.2 JL**	**11.2 JL**	**9.00 JL**	**8.50 JL**	**11.5 JL**	**14.3 JL**	**9.30 JL**	**10.6 JL**	**14.3 JL**	**15.0 JL**	**8.20 JL**
Zinc	1200	GWSoilIng	**49.5 JL**	**42.4 JL**	**41.1 JL**	**35.3 JL**	**37.4 JL**	**37.3 JL**	**42.6 JL**	**45.5 JL**	**36.5 JL**	**46.1 JL**	**47.6 JL**	**52.2 JL**	**30.6 JL**
Mercury	0.04	TX-SP Bkgd	**0.0210 J**	**0.0210 J**	**0.0200 J**	**0.0300 J**	**0.0220 J**	**0.0200 J**	**0.0230 J**	**0.0220 J**	**0.0170 J**	**0.0190 J**	**0.0230 J**	**0.0220 J**	**0.0190 J**
1,2-Dinitrobenzene	--		**0.872**	**1.87**	**1.84**	**0.828**	**0.82**	**0.826**	**0.836**	**0.884**	**0.829**	**0.833**	**0.874**	**0.953**	**1.66**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 UJL	<0.0800 UJL	<0.0800 UJL	<0.0800 UJL	<0.0800 U	<0.0800 UJL	<0.0800 UJL	<0.0800 U	<0.0800 U	<0.0800 UJL
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-DD058-01 N	CR-MIS-DD072-01 N	CR-MIS-DE065-01 N	CR-MIS-DE067-01 N	CR-MIS-DE071-01 N	CR-MIS-DE072-01 N	CR-MIS-DF056-01 N	CR-MIS-DF063-01 N	CR-MIS-DF066-01 N	CR-MIS-DG064-01 N	CR-MIS-DG067-01 N	CR-MIS-DG070-01 N	CR-MIS-DG072-01 N
			2/10/2011	**2/14/2011**	**2/11/2011**	**2/14/2011**	**2/14/2011**	**2/14/2011**	**2/15/2011**	**2/11/2011**	**2/14/2011**	**2/11/2011**	**2/15/2011**	**2/11/2011**	**2/11/2011**
			Low Stratum	**High Stratum**	**Low Stratum**	**High Stratum**	**High Stratum**	**High Stratum**	**Low Stratum**	**Low Stratum**	**High Stratum**	**Low Stratum**	**High Stratum**	**High Stratum**	**High Stratum**
Aluminum	64000	TotSoilComb2	**3950 X8J**	**6350 X8**	**4700 X8J**	**6420 X8**	**5720 X8**	**5930 X8**	**5820 X8J**	**4900 X8J**	**5170 X8**	**5420 X8J**	**4800 X8J**	**5070 X8J**	**4920 X8J**
Antimony	2.7	GWSoilIng	**0.210 U**	**0.300 U**	**0.530 JL**	**0.130 U**	**0.400 U**	**0.760 JL**	<0.0950 R	**0.110 U**	<0.0950 R	<0.0950 R	<0.0950 R	**14.1 JL**	**0.330 U**
Arsenic	5.9	TX-SP Bkgd	**1.50 JL**	**0.200 U**	**0.410 JL**	<0.0880 UJL	**0.300 JL**	**0.410 U**	**1.80 JL**	**0.290 JL**	**1.20 JL**	**0.360 JL**	**0.230 JL**	**0.880 JL**	**0.410 U**
Barium	300	TX-SP Bkgd	**36.3 J**	**55.4 JL**	**48.7 J**	**54.5 JL**	**48.1 JL**	**51.1 JL**	**46.4 J**	**45.2 J**	**46.6 JL**	**50.0 J**	**45.0 J**	**38.5 J**	**39.6 J**
Beryllium	1.5	TX-SP Bkgd	**0.580 JL**	**0.690 JL**	**0.580 JL**	**0.700 JL**	**0.630 JL**	**0.680 JL**	**0.670 JL**	**0.630 JL**	**0.630 JL**	**0.650 JL**	**0.600 JL**	**0.620 JL**	**0.640 JL**
Cadmium	0.75	GWSoilIng	**0.310 JL**	**0.500 JL**	**0.320 JL**	**0.500 JL**	**0.410 JL**	**0.560 JL**	**0.340 JL**	**0.330 JL**	**0.510 JL**	**0.370 JL**	**0.320 JL**	**0.300 JL**	**0.290 JL**
Calcium	--		**1390 X8J**	**2690 X8JL**	**2590 X8J**	**3070 X8JL**	**1960 X8JL**	**2260 X8JL**	**1470 X8J**	**2920 X8J**	**1800 X8JL**	**2020 X8J**	**1820 X8J**	**1470 X8J**	**1630 X8J**
Chromium (total)	1200	GWSoilIng	**5.40 JL**	**6.80 JL**	**6.00 JL**	**7.30 JL**	**6.90 JL**	**22.0 JL**	**7.20 JL**	**6.10 JL**	**5.80 JL**	**6.90 JL**	**6.60 JL**	**5.60 JL**	**5.80 JL**
Cobalt	7	TX-SP Bkgd	**2.80 JL**	**3.70 JL**	**3.40 JL**	**3.90 JL**	**3.50 JL**	**3.70 JL**	**3.50 JL**	**3.50 JL**	**3.50 JL**	**3.80 JL**	**3.80 JL**	**3.30 JL**	**3.20 JL**
Copper	520	GWSoilIng	**12.2 J**	**37.8 JH**	**14.5 J**	**23.9 JH**	**31.8 JH**	**37.8 JL**	**15.6 J**	**15.2 J**	**20.9 JH**	**16.0 J**	**16.4 J**	**17.2 J**	**17.5 J**
Iron	--		**7120 X8J**	**10200 X8**	**10400 X8J**	**13000 X8**	**13900 X8J**	**13100 X8**	**11500 X8J**	**11400 X8J**	**111 X8**	**12400 X8J**	**12100 X8J**	**10000 X8J**	**7980 X8J**
Lead	15	TX-SP Bkgd	**20.3 JH**	**194 J**	**110 JL**	**64.9 J**	**218 J**	**327 J**	**25.7 JL**	**43.1 JL**	**52.1 J**	**28.8 JL**	**29.6 JL**	**5030 JH**	**69.2 JH**
Magnesium	--		**1200 X8J**	**2310 X8J**	**1540 X8JL**	**2450 X8J**	**2010 X8J**	**2390 X8JL**	**1390 X8JL**	**1790 X8JL**	**1840 X8J**	**1760 X8JL**	**1690 X8JL**	**1480 X8J**	**1550 X8J**
Manganese	580	GWSoilIng	**129 X8J**	**206 X8J**	**193 X8J**	**202 X8J**	**185 X8J**	**193 X8**	**156 X8J**	**155 X8J**	**174 X8J**	**170 X8J**	**164 X8J**	**136 X8J**	**141 X8J**
Molybdenum	2.5	GWSoilIng	**0.220 JL**	**0.210 JL**	**0.360 JL**	**0.230 JL**	**0.220 JL**	**0.610 JL**	**0.270 JL**	**0.290 JL**	**0.200 JL**	**0.380 JL**	**0.380 JL**	**0.230 JL**	**0.230 JL**
Nickel	79	GWSoilIng	**4.70 JL**	**7.30 JL**	**6.00 JL**	**8.00 JL**	**7.00 JL**	**14.8 JL**	**5.70 JL**	**6.40 JL**	**6.10 JL**	**6.60 JL**	**6.50 JL**	**5.90 JL**	**5.60 JL**
Potassium	--		**1240 X8JH**	**1890 X8**	**1420 X8J**	**1910 X8**	**1680 X8**	**1820 X8**	**1670 X8J**	**1450 X8J**	**1620 X8**	**1630 X8J**	**1540 X8J**	**1450 X8JH**	**1450 X8JH**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	**0.490 JL**	<0.244 UJL	<0.244 UJL	<0.244 UJL	**0.520 JL**	**0.370 JL**	<0.244 UJL	**0.580 JL**	**0.330 JL**	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**120 X8JL**	**148 X8JL**	**124 X8JL**	**188 X8JL**	**161 X8JL**	**155 X8JL**	**129 X8JL**	**145 X8JL**	**205 X8JL**	**100 X8JL**	**110 X8JL**	**118 X8JL**	**101 X8JL**
Thallium	0.87	GWSoilIng	<0.206 UJL	**0.470 JL**	<0.206 UJL	**0.400 JL**	**0.360 JL**	**0.540 JL**	<0.206 UJL	<0.206 UJL	**0.330 JL**	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	**9.10 JL**	**12.6 JL**	**11.4 JL**	**13.6 JL**	**11.7 JL**	**11.6 JL**	**13.2 JL**	**11.4 JL**	**10.7 JL**	**13.4 JL**	**12.4 JL**	**10.5 JL**	**10.2 JL**
Zinc	1200	GWSoilIng	**33.7 JL**	**49.6 JL**	**36.5 JL**	**48.9 JL**	**41.9 JL**	**48.1 JL**	**36.4 JL**	**41.9 JL**	**44.8 JL**	**41.0 JL**	**39.8 JL**	**35.8 JL**	**37.2 JL**
Mercury	0.04	TX-SP Bkgd	**0.0210 J**	**0.0190 J**	**0.0220 J**	**0.0190 J**	**0.0200 J**	**0.0150 J**	**0.0260 J**	**0.0170 J**	**0.0210 J**	**0.0210 J**	**0.0230 J**	**0.0210 J**	**0.0190 J**
1,2-Dinitrobenzene	--		**0.833**	**0.901**	**0.833**	**0.848**	**0.848**	**0.872**	**0.896**	**0.844**	**0.937**	**0.798**	**0.857**	**0.857**	**0.812**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN			<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	--	GWSoilIng	<0.0800 UJL	<0.0800 U	<0.0800 UJL	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 UJL	<0.0800 U	<0.0800 UJL	<0.0800 UJL	<0.0800 U	<0.0800 UJL
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-DH055-01 N	CR-MIS-DH068-01 N	CR-MIS-DI054-01 N	CR-MIS-DI069-01 N	CR-MIS-DI069-02 FD	CR-MIS-DI069-03 FT	CR-MIS-DI070-01 N	CR-MIS-DJ071-01 N	CR-MIS-DJ071-02 FD	CR-MIS-DJ071-03 FT	CR-MIS-DK056-01 N	CR-MIS-DK065-01 N	CR-MIS-DK065-02 FD
			2/10/2011	2/14/2011	2/10/2011	2/14/2011	2/14/2011	2/14/2011	2/11/2011	2/11/2011	2/11/2011	2/11/2011	2/10/2011	2/11/2011	2/11/2011
			Low Stratum	High Stratum	Low Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	High Stratum	Low Stratum	Low Stratum	Low Stratum
Aluminum	64000	TotSoilComb2	**4510 X8JH**	**5820 X8**	**4360 X8J**	**5620 X8**	**5420 X8**	**5270 X8**	**4120 X8J**	**5470 X8J**	**3700 X8J**	**5580 X8J**	**5400 X8J**	**4550 X8J**	**4680 X8J**
Antimony	2.7	GWSoilIng	<0.0950 R	<0.0950 R	**0.290 U**	<0.0950 R	<0.0950 R	<0.0950 R	**0.0950 U**	**0.250 U**	**0.170 U**	**0.180 U**	**0.150 U**	<0.0950 R	<0.0950 R
Arsenic	5.9	TX-SP Bkgd	**4.30 JL**	**0.590 JL**	**1.20 JL**	**1.50 JL**	**1.60 JL**	**1.10 JL**	**0.520 JL**	<0.0880 UJL	**0.660 JL**	**0.540 JL**	**1.10 JL**	<0.0880 UJL	<0.0880 UJL
Barium	300	TX-SP Bkgd	**49.3 J**	**48.6 JL**	**44.1 J**	**46.7 JL**	**46.2 JL**	**46.1 JL**	**37.1 J**	**43.6 J**	**34.9 J**	**49.6 J**	**51.0 J**	**41.6 J**	**44.4 J**
Beryllium	1.5	TX-SP Bkgd	**0.720 JL**	**0.620 JL**	**0.540 JL**	**0.620 JL**	**0.620 JL**	**0.600 JL**	**0.560 JL**	**0.700 JL**	**0.560 JL**	**0.750 JL**	**0.630 JL**	**0.600 JL**	**0.640 JL**
Cadmium	0.75	GWSoilIng	**0.390 JL**	**0.410 JL**	**0.320 JL**	**0.420 JL**	**0.400 JL**	**0.420 JL**	**0.280 JL**	**0.250 JL**	**0.230 JL**	**0.260 JL**	**0.460 U**	**0.170 JL**	**0.190 JL**
Calcium	--		**6850 X8JH**	**1880 X8JL**	**3260 X8J**	**1730 X8JL**	**1750 X8JL**	**1660 X8JL**	**1450 X8J**	**1990 X8J**	**1490 X8J**	**2020 X8J**	**3060 X8J**	**5630 X8J**	**6130 X8J**
Chromium (total)	1200	GWSoilIng	**5.60 JL**	**6.10 JL**	**5.50 JL**	**6.30 JL**	**6.00 JL**	**5.90 JL**	**5.30 JL**	**6.30 JL**	**5.40 JL**	**6.90 JL**	**8.00 JL**	**5.10 JL**	**5.70 JL**
Cobalt	7	TX-SP Bkgd	**3.70 JL**	**3.50 JL**	**3.70 JL**	**3.60 JL**	**3.40 JL**	**3.20 JL**	**2.70 JL**	**3.20 JL**	**2.90 JL**	**3.50 JL**	**5.00 JL**	**2.90 JL**	**3.30 JL**
Copper	520	GWSoilIng	**14.6 JL**	**10.4 J**	**10.9 J**	**23.5 JL**	**17.7 JL**	**17.3 JL**	**14.5 J**	**13.0 J**	**11.6 J**	**14.3 J**	**16.0 J**	**10.7 J**	**10.8 J**
Iron	--		**12200 X8JL**	**12500 X8J**	**10100 X8J**	**11300 X8**	**8740 X8**	**8870 X8**	**7390 X8J**	**12100 X8J**	**10000 X8J**	**12100 X8J**	**12600 X8J**	**9780 X8J**	**11200 X8J**
Lead	15	TX-SP Bkgd	**23.0 JL**	**26.3 J**	**19.0 JH**	**44.0 J**	**32.9 J**	**33.4 J**	**45.9 JH**	**28.5 JH**	**23.9 JH**	**27.3 JH**	**25.9 JH**	**13.5 JL**	**14.5 JL**
Magnesium	--		**3170 X8J**	**2030 X8JL**	**1900 X8J**	**1760 X8JL**	**1760 X8JL**	**1660 X8JL**	**1410 X8J**	**1740 X8J**	**1340 X8J**	**1830 X8J**	**2260 X8J**	**1920 X8JL**	**2040 X8JL**
Manganese	580	GWSoilIng	**191 X8JH**	**176 X8**	**157 X8J**	**162 X8**	**161 X8**	**160 X8**	**124 X8J**	**144 X8J**	**119 X8J**	**161 X8J**	**195 X8J**	**132 X8J**	**146 X8J**
Molybdenum	2.5	GWSoilIng	**0.360 JL**	**0.130 JL**	**0.290 JL**	**0.170 JL**	**0.190 JL**	**0.180 JL**	**0.230 JL**	**0.260 JL**	**0.280 JL**	**0.350 JL**	**0.340 JL**	**0.310 JL**	**0.350 JL**
Nickel	79	GWSoilIng	**6.80 JL**	**6.50 JL**	**7.40 JL**	**6.40 JL**	**6.20 JL**	**6.10 JL**	**5.00 JL**	**6.30 JL**	**5.30 JL**	**6.80 JL**	**9.80 JL**	**5.40 JL**	**5.80 JL**
Potassium	--		**1430 X8JH**	**1840 X8**	**1410 X8JH**	**1740 X8**	**1680 X8**	**1660 X8**	**1360 X8JH**	**1600 X8JH**	**1260 X8JH**	**1760 X8JH**	**1610 X8JH**	**1400 X8J**	**1460 X8J**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	**0.320 JL**	<0.244 UJL	**0.350 U**	<0.244 UJL	**0.270 JL**
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**158 X8JL**	**161 X8JL**	**139 X8JL**	**153 X8JL**	**169 X8JL**	**126 X8JL**	**114 X8JL**	**140 X8JL**	**108 X8JL**	**143 X8JL**	**137 X8JL**	**153 X8JL**	**149 X8JL**
Thallium	0.87	GWSoilIng	**0.280 JL**	**0.390 JL**	<0.206 UJL	<0.206 UJL	**0.380 JL**	**0.290 JL**	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-SP Bkgd	**11.9 JL**	**11.1 JL**	**10.5 JL**	**10.9 JL**	**10.6 JL**	**10.6 JL**	**8.80 JL**	**11.3 JL**	**8.50 JL**	**12.1 JL**	**13.8 JL**	**10.2 JL**	**11.6 JL**
Zinc	1200	GWSoilIng	**48.9 JL**	**27.9 JL**	**61.9 JL**	**40.0 JL**	**37.4 JL**	**37.3 JL**	**34.2 JL**	**38.5 JL**	**33.2 JL**	**40.7 JL**	**73.7 JL**	**36.0 JL**	**36.8 JL**
Mercury	0.04	TX-SP Bkgd	**0.0200 J**	**0.0160 J**	**0.0170 J**	**0.0180 J**	**0.0180 J**	**0.0160 J**	**0.0170 J**	**0.0160 J**	**0.0150 J**	**0.0150 J**	**0.0200 J**	**0.0150 U**	**0.0150 U**
1,2-Dinitrobenzene	--		**1.83**	**0.909**	**0.846**	**0.927**	**0.902**	**0.907**	**0.845**	**0.846**	**0.856**	**0.862**	**0.824**	**0.848**	**0.853**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	**0.600 X7J**	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 UJL	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 UJL	<0.0800 UJL	<0.0800 UJL
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-MIS-DK065-03 FT	CR-MIS-DL071-01 N	CR-MIS-DR063-01 N	CR-MIS-DT051-01 N	CR-MIS-DV066-01 N	CR-MIS-DV066-02 FD	CR-MIS-DV066-03 FT	CR-MIS-DV068-01 N
			2/11/2011	2/10/2011	2/11/2011	2/10/2011	2/11/2011	2/11/2011	2/11/2011	2/11/2011
			Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum
Aluminum	64000	TotSoilComb2	**4090 X8J**	**3790 X8J**	**6830 X8JH**	**6440 X8J**	**6130 X8JH**	**6040 X8JH**	**5560 X8JH**	**6610 X8JH**
Antimony	2.7	GWSoilIng	<0.0950 R	**0.130 U**	<0.0950 R	**0.280 U**	<0.0950 R	<0.0950 R	<0.0950 R	<0.0950 R
Arsenic	5.9	TX-SP Bkgd	<0.0880 UJL	**0.470 JL**	**4.40 JL**	**1.10 JL**	**4.40 JL**	**4.40 JL**	**3.80 JL**	**5.10 JL**
Barium	300	TX-SP Bkgd	**40.8 J**	**35.7 J**	**61.6 J**	**59.0 J**	**60.6 J**	**58.7 J**	**49.9 J**	**57.7 J**
Beryllium	1.5	TX-SP Bkgd	**0.590 JL**	**0.550 JL**	**0.670 JL**	**0.510 JL**	**0.590 JL**	**0.570 JL**	**0.510 JL**	**0.640 JL**
Cadmium	0.75	GWSoilIng	**0.180 JL**	**0.190 JL**	**0.270 JL**	**0.290 JL**	**0.460 JL**	**0.430 JL**	**0.380 JL**	**0.450 JL**
Calcium	--		**5320 X8J**	**1720 X8J**	**30200 X8JH**	**30400 X8J**	**11800 X8JH**	**10800 X8JH**	**8440 X8JH**	**8800 X8JH**
Chromium (total)	1200	GWSoilIng	**5.10 JL**	**4.80 JL**	**6.90 JL**	**5.60 JL**	**7.90 JL**	**7.20 JL**	**6.40 JL**	**7.40 JL**
Cobalt	7	TX-SP Bkgd	**2.90 JL**	**2.60 JL**	**3.50 JL**	**2.50 JL**	**3.50 JL**	**3.70 JL**	**3.20 JL**	**4.10 JL**
Copper	520	GWSoilIng	**10.3 J**	**9.10 J**	**15.3 JL**	**13.3 J**	**18.6 JL**	**18.0 JL**	**15.5 JL**	**19.1 JL**
Iron	--		**15700 X8J**	**6680 X8J**	**11600 X8JL**	**6480 X8J**	**11900 X8JL**	**12100 X8JL**	**10500 X8JL**	**14000 X8JL**
Lead	15	TX-SP Bkgd	**13.6 JL**	**15.2 JH**	**16.0 JL**	**28.5 JH**	**27.5 JL**	**31.2 JL**	**23.8 JL**	**26.9 JL**
Magnesium	--		**1920 X8JL**	**1310 X8J**	**6860 X8J**	**4770 X8J**	**4720 X8J**	**4950 X8J**	**3820 X8J**	**4870 X8J**
Manganese	580	GWSoilIng	**135 X8J**	**114 X8J**	**190 X8JH**	**130 X8J**	**200 X8JH**	**200 X8JH**	**163 X8JH**	**202 X8JH**
Molybdenum	2.5	GWSoilIng	**0.300 JL**	**0.210 JL**	**0.210 JL**	<0.0740 UJL	**0.360 JL**	**0.330 JL**	**0.280 JL**	**0.340 JL**
Nickel	79	GWSoilIng	**5.20 JL**	**4.80 JL**	**7.00 JL**	**5.40 JL**	**7.50 JL**	**7.30 JL**	**6.40 JL**	**7.90 JL**
Potassium	--		**1360 X8J**	**1280 X8JH**	**1920 X8JH**	**1600 X8JH**	**1850 X8JH**	**1910 X8JH**	**1680 X8JH**	**1920 X8JH**
Selenium	1.1	GWSoilIng	**0.280 JL**	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium	--		**164 X8JL**	**105 X8JL**	**168 X8JL**	**115 X8JL**	**207 X8JL**	**186 X8JL**	**184 X8JL**	**216 X8JL**
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 UJL	**0.300 JL**	<0.206 UJL	**0.290 JL**	<0.206 UJL	**0.300 JL**	**0.270 JL**
Vanadium	50	TX-SP Bkgd	**10.4 JL**	**8.30 JL**	**12.4 JL**	**9.20 JL**	**11.9 JL**	**12.6 JL**	**10.9 JL**	**13.4 JL**
Zinc	1200	GWSoilIng	**34.5 JL**	**28.8 JL**	**38.6 JL**	**30.8 JL**	**46.6 JL**	**41.1 JL**	**37.5 JL**	**43.8 JL**
Mercury	0.04	TX-SP Bkgd	**0.0160 U**	**0.0150 J**	**0.0270 J**	**0.0270 J**	**0.0240 J**	**0.0270 J**	**0.0250 J**	**0.0220 J**
1,2-Dinitrobenzene	--		**0.856**	**0.85**	**1.88**	**0.826**	**1.65**	**1.63**	**1.65**	**1.85**
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U	<0.0800 X7U
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 X7U	<0.0850 X7U	**0.0900 X7J**	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U	<0.0850 X7U
PETN	--		<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U	<0.579 X7U
RDX	0.018	GWSoilIng	<0.0800 UJL	<0.0800 UJL	<0.0800 U	<0.0800 UJL	<0.0800 UJL	<0.0800 UJL	<0.0800 UJL	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Bold = analyte detected
Shaded = analyte detected above PCL, or not detected with detection limit above PCL
Refer to Table 4-1 for a listing of Residential Soil PCLs
-- = TRRP Tier I Residential Soil PCL not selected for this project
J = Estimated
JH = Estimated, potentially biased high

JL = Estimated, potentially biased low
N = Normal; FD = field duplicate; FR = field replicate; FT = field triplicate
R = Rejected
U = Not detected at the stated detection limit
X7 = TCEQ does not offer accreditation for analyte
X8 = Laboratory is not accredited for analyte by this method, although accreditation is offered

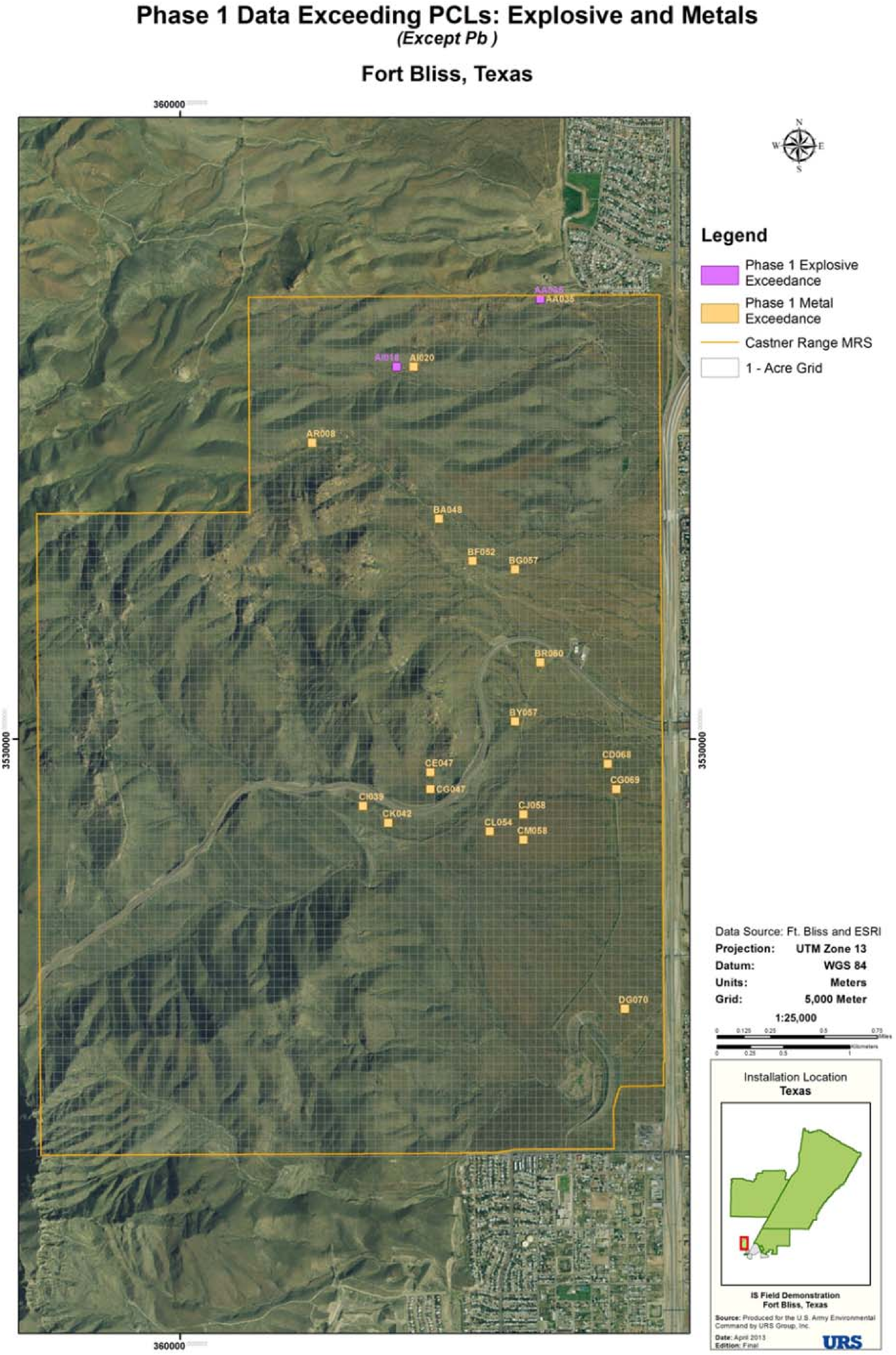

Figure 4-17. Phase 1 Data Exceeding PCLs: Explosives and Metals (Excluding Lead)

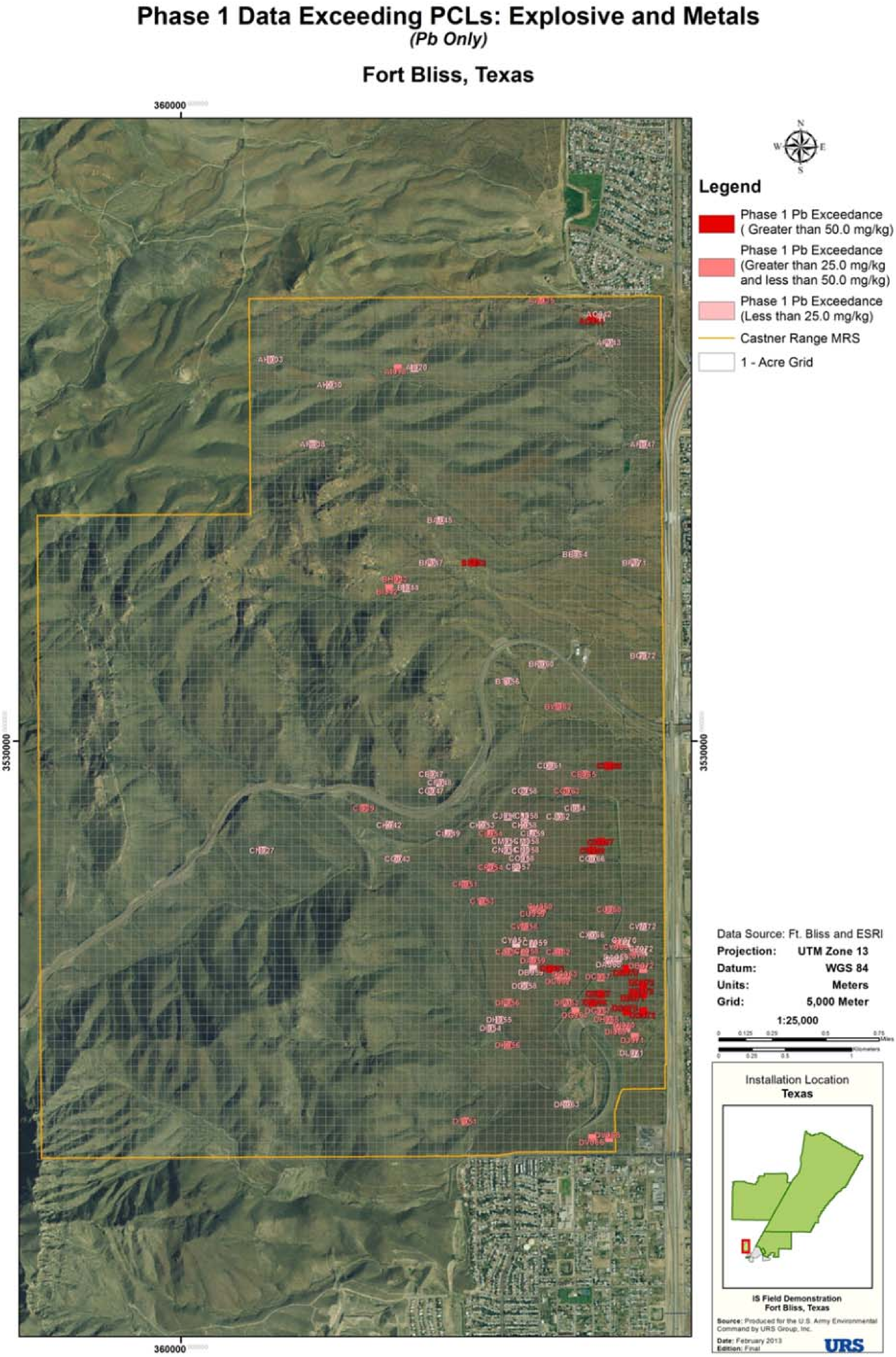

Figure 4-18. Phase 1 Data Exceeding PCLs: Explosives and Metals (Lead Only)

Table 4-4. Explosives Analytes and PCLs

Analyte	Abbreviation	CAS Number	TRRP PCLs (mg/kg) [a]			EPA Residential Screening Level[b] (mg/kg)	Analytical Method		Achievable Laboratory Limits	
			Tier 1 Residential Soil PCLs – 30-acre source area		Texas-Specific Background		MDL (mg/kg)	Method QL	LOD (mg/kg)[c]	QL (mg/kg)[c]
			$^{Tot}Soil_{Comb}$	$^{GW}Soil_{Ing}$						
Cyclotetramethylenetetranitramine	HMX	2691-41-0	200	1.2	–	3,800	0.08	NA	0.16	0.5
Cyclotrimethylenetrinitramine	RDX	121-82-4	25	0.018	–	5.5	0.08	NA	0.16	0.5
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	17	0.086	–	19	0.083	NA	0.166	0.5
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	2,000	0.91	–	2,200	0.079	NA	0.158	0.5
1,3-Dinitrobenzene	1,3-DNB (2,4-DNB)	99-65-0	6.3	0.0038	–	6.1	0.0635	NA	0.127	0.5
Trinitrophenylmethylnitramine	Tetryl; Nitramine	479-45-8	34	0.55	–	240	0.091	NA	0.182	0.5
2-Amino-4,6-dinitrotoluene	2-A-4,6-DNT	35572-78-2	9.3	0.05	–	150	0.075	NA	0.15	0.5
4-Amino-2,6-dinitrotoluene	4-A-2,6-DNT	19406-51-0	8.9	0.033	–	150	0.075	NA	0.15	0.5
2,6-Dinitrotoluene	2,6-DNT	606-20-2	6.9	0.0024	–	61	0.083	NA	0.166	0.5
2,4-Dinitrotoluene	2,4-DNT	121-14-2	6.9	0.0027	–	1.6	0.083	NA	0.166	0.5
Nitroglycerin	NG	55-63-0	NA	NA	–	6.1	0.085	NA	0.17	0.5

NA = Not Available
QL = Quantitation Limit
LOD = Limit of Detection

[a] TRRP Tier 1 Residential Protective Concentration Levels (PCLs) for a 30-acre source area, March 2010.

[b] Master_sl_table_run_NOV_2010. Available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm, Accessed December 16, 2010.

[c] The achievable LODs and QLs are based upon APPL's studies. QLs are equivalent to the LOQ. LOQs should be at least 3 times lower, but ideally 10 times lower than the applicable screening levels. mg/kg = µg/g

🟨	Most Conservative PCL

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Table 4-5. Metals Detection Summary

Metal	Summary of Exceedences
Aluminum	No detection exceeded the PCL
Antimony	**2 detected concentrations exceeded PCL**
Arsenic	**8 detected concentrations exceeded PCL**
Barium	**1 detected concentration exceeded PCL; possible outlier**
Beryllium	**7 detected concentrations exceeded PCL**
Cadmium	**1 detected concentration exceeded PCL**
Chromium (Total)	No detection exceeded the PCL
Cobalt	No detection exceeded the PCL
Copper	No detection exceeded the PCL
Lead	**Majority of results exceeded PCL**
Manganese	No detection exceeded the PCL
Mercury	**3 detected concentration exceeded PCL**
Molybdenum	**1 detected concentration exceeded PCL**
Nickel	No detection exceeded the PCL
Selenium	No detection exceeded the PCL
Silver	**4 detected concentrations exceeded the PCL**
Thallium	**1 detected concentration exceeded PCL**
Vanadium	No detection exceeded the PCL
Zinc	No detection exceeded the PCL

4.5.3.2 Background Data

Following the collection and analysis of the Phase 1 background samples, the Army determined that the northern location (Figure 4-4) was in an area that qualified for the Formerly Used Defense Sites (FUDS) program. This determination called into question the assumption that the area had not been contaminated by historic range and demolition activities. It was determined that the location could not be confirmed to be free of prior contamination, and the data were excluded from the background population.

In a preliminary statistical analysis of the background data, it was observed that the background concentrations from the southern location (Figure 4-5) provided only a few results higher than the Texas-specific background levels (Table 4-6). Further review of TRRP and EPA Unified Guidance indicated that at least 15 data points would be needed to establish site-specific background concentrations, so it was decided to collect additional background sampling data in the Phase 2 sampling (see Section 4.6).

4.5.3.3 Correlation of Munitions Debris to Munitions Constituents

The Phase 1 data were preliminarily examined to determine the possible correlation between MD density, as mapped during the WAA project (URS 2012), and MC concentrations. Data on MD density estimates were available for the entire study area, whereas data on MC concentrations were available only for those units that were sampled. If a strong correlation between MD density and MC concentration was found, then MD density might be used to estimate MC concentrations in non-sampled units.

Table 4-6. Background Data from the Southern Area

Analyte	Background South 01 N	Background South 02 FD	Background South 03 FR	Average	Texas-Specific Background
	2/8/2011	2/8/2011	2/8/2011		
Aluminum	**4,760**	**4,860**	**3,790**	4,470	30,000
Antimony	**0.22**	*Data Rejected*	*Data Rejected*	0.2	1.0
Arsenic	**2.7**	**2.9**	**3**	2.9	5.9
Barium	**40**	**45**	**35**	40	300
Beryllium	**0.37**	**0.39**	**0.32**	0.4	1.5
Cadmium	**0.38**	**0.31**	**0.32**	0.3	--
Chromium (total)	**5.3**	**4.6**	**4.3**	4.7	30
Cobalt	**2.3**	**2.3**	**2.1**	2.2	7.0
Copper	**15**	**13**	**12**	13	15
Lead	**26**	**18**	**19**	20.8	15
Manganese	**179**	**183**	**151**	171	300
Mercury	**0.03**	**0.03**	**0.03**	0.03	0.04
Molybdenum	**0.12**	**0.12**	**0.96**	0.40	2.5[a]
Nickel	**4.1**	**4.1**	**3.7**	4.0	10
Selenium	<0.24	<0.24	<0.24	<0.24	0.3
Silver	**0.31**	**0.36**	**0.27**	0.31	0.24[a]
Thallium	**0.43**	**0.37**	**0.28**	0.36	--
Vanadium	**9.5**	**9.8**	**9.2**	9.5	50
Zinc	**38**	**31**	**35**	35	30

All units are Mg/lg

[a] In the absence of a Texas-specific background value, the TRRP Residential Soil $^{GW}Soil_{Ing}$ PCL value on a 30-acre source area was used.

Two criteria were used to select representative metals for which this correlation was analyzed. One, the metal should be expected to be associated with the types of munitions that were used at this range. Second, among the metals that may be associated with munitions, the selected metal should be detected in many of the sampled units; a rarely detected metal would have insufficient data to analyze the correlation.

Based on these criteria, two candidate metals – lead and copper – were selected to analyze the correlation between MD density and MC concentration. Lead, which was observed to be common throughout the study area, was selected as an indicator of small arms activity. Copper was selected as an indicator of other types of munitions.

In the initial selection of incremental sampling unit locations, a threshold of 500 MD anomalies per acre was used to establish a high stratum and a low stratum. For control, one set of samples was collected from areas with fewer than 500 MD anomalies per acre, and another set of samples from areas with more than 500 MD anomalies per acre. Because one of the intended high stratum units turned out to have fewer than 500 anomalies per acre, and one inaccessible high stratum unit was replaced with a nearby low stratum unit during Phase 1 sampling, the low stratum had a total of 63 samples, and the high stratum had 58 samples. Of these 121 samples, 50 of the sampled units in the low stratum (i.e. fewer than 500 MD anomalies per acre) ended up in areas with no MD anomalies (i.e., MD density = 0); the remaining 71 units contained some MD anomalies (i.e., MD density > 0).

Because outliers can distort estimates of basic statistical parameters, such as the mean and standard deviation, and result in misleading conclusions regarding the differences between data sets, the data were examined for outliers. Two of the 71 units containing MD anomalies had anomalously high lead concentrations and two other units containing MD anomalies had anomalously high copper concentrations. The anomalously high units for lead and copper were not the same units. These anomalously high concentrations were confirmed to be statistical outliers using the Rosner's test, applied at a significance level (*p*) of 5%. The two confirmed outliers in each data set were excluded from the subsequent statistical analysis.

The analyses of correlation were calculated both for the preselected strata and for the presence/absence of MD anomalies (Appendix D). The Texas-specific background value was the PCL for both copper and lead (15 mg/kg for both). The fundamental question of the correlation analyses was: does the presence of MD increase the probability that MC will be found above the background level?

Figure 4-19 shows box-and-whisker plots for a graphical comparison of the two MD density strata, and Table 4-7 shows the basic descriptive statistics for each stratum. The standard deviations in the statistical results suggests that there is another underlying factor affecting copper and lead mean concentration besides MD; it is anticipated that soil type is one likely contributing factor. This also suggests that much of the copper and lead are not derived from MD, which is not surprising, as these are naturally occurring metals.

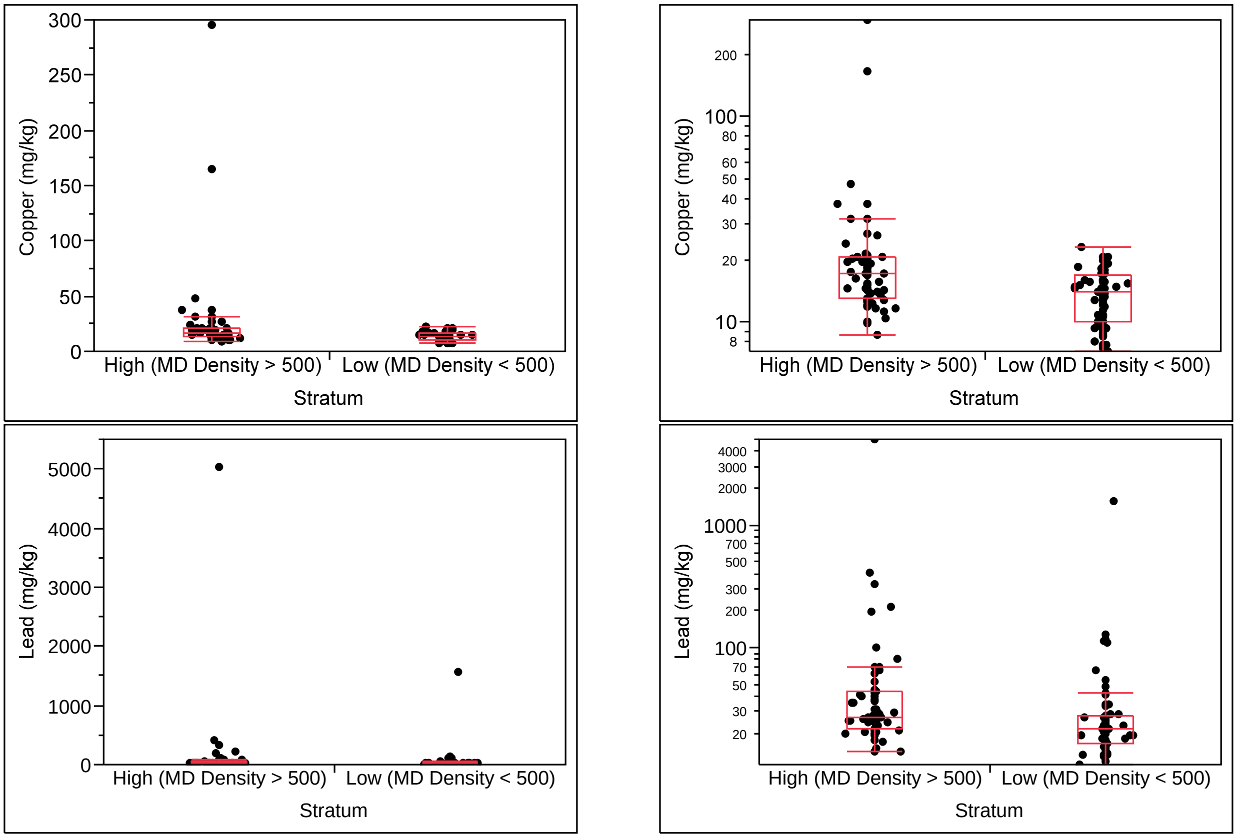


Figure 4-19. Box-and-whisker plots comparing high stratum units (MD density greater than 500 per acre) to low stratum units (MD density less than 500 per acre)

Table 4-7. Basic Statistics by Stratum

Stratum	Copper (mg/kg)			Lead (mg/kg)		
	No. of Samples [a]	Mean	Std Dev	No. of Samples [a]	Mean	Std Dev
High (MD Density >500)	56	18.1	7.5	57	50.8	72.1
Low (MD Density < 500)	63	13.7	3.9	62	29.1	25.5

[a] After excluding outliers.

Figure 4-20 shows box-and-whisker plots for a graphical comparison of the MD and non-MD sampling strata, and Table 4-8 shows the basic descriptive statistics for each stratum, which shows the same relative results as those in Table 4-7. Full statistical results are presented in Appendix D.

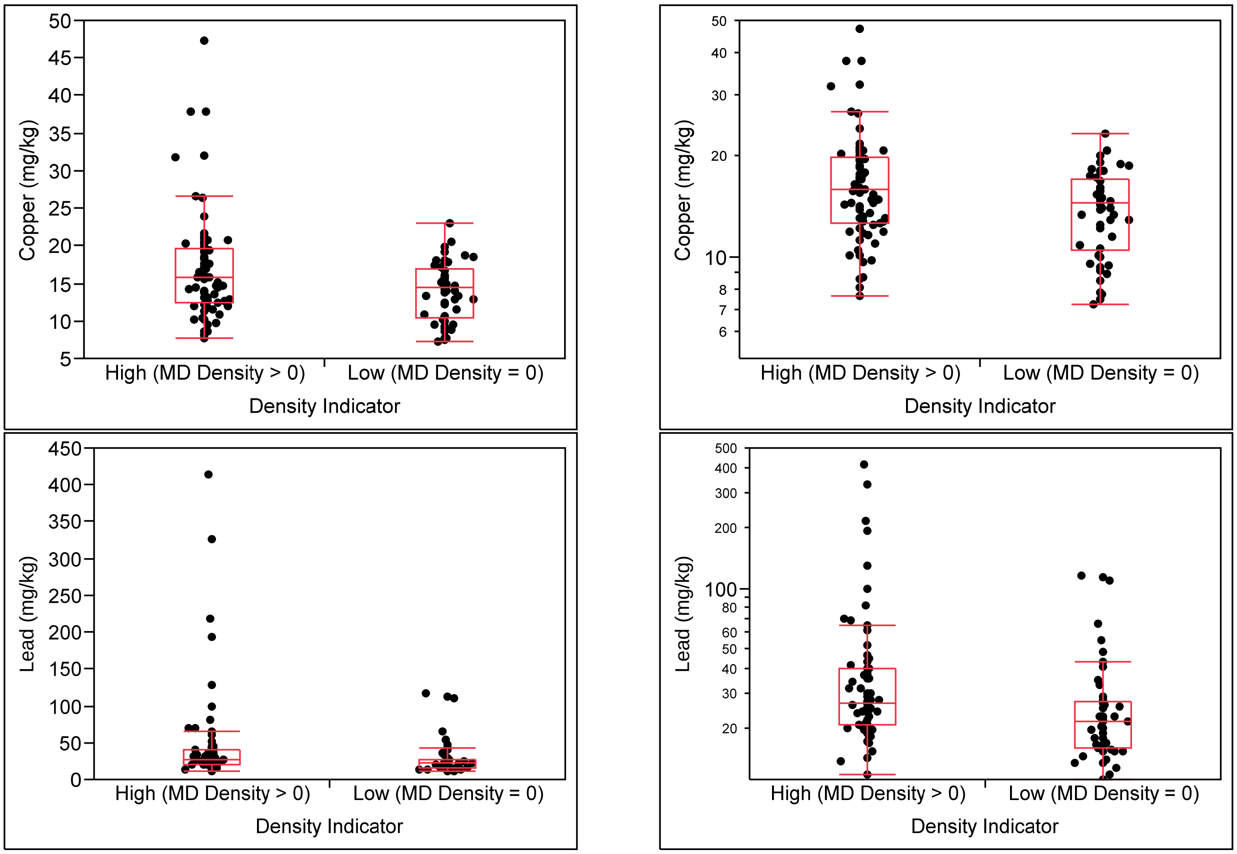


Figure 4-20. Box-and-whisker plots comparing units with MD density greater than 0 to units with MD density of 0 (copper and lead)

Table 4-8. Basic Statistics for MD and Non-MD Units

Density Indicator	Copper (mg/kg)			Lead (mg/kg)		
	No. of Samples [a]	Mean	Std Dev	No. of Samples [a]	Mean	Std Dev
MD Density > 0	69	17.2	7.2	69	47.3	67.1
MD Density = 0	50	13.9	3.8	50	28.7	24.2

[a] After excluding outliers.

An analysis of the statistics reveals the following key findings:

- The mean concentrations are statistically significantly higher in “high” stratum (MD density greater than 500) than in “low” stratum (MD density less than 500). Because one or both data sets did not follow a normal distribution, the non-parametric Wilcoxon Rank Sum test was used to test the differences between the two data sets. The differences between the two data sets were found to be significant at a significance level, *p* of 5%.
- A random sampling unit with MD density greater than 0 has statistically significantly higher mean copper and lead concentrations than a random sampling unit with no MD. Again, the Wilcoxon Rank Sum test was used and the differences between the two data sets were found to be significant at a significance level, *p* of 5%.
- Although the mean concentrations of both analytes are higher in the MD group than the non-MD group, the data distributions of concentrations in the two groups overlap substantially. That is, many of the units in the non-MD group have higher concentrations than many of those in the MD group.
- The probability that copper and lead concentration in a sampling unit exceeds the Texas-specific background is high for both groups; this probability is moderately higher for the MD group than the non-MD group:

	MD Density = 0	**MD Density > 0**
Probability: Copper >15 mg/kg	38%	55%
Probability: Lead >15 mg/kg	84%	94%

- Variability is larger for the MD group than the non-MD group for both copper and lead. This is because some of the sampling units in the MD group have very high concentrations of copper and lead.

Overall there was a low correlation between copper and lead concentrations and MD density (R^2 between copper concentration and MD density is less than 10%; R^2 between lead concentration and MD density is 16%). This was confirmed by the Root Mean Square Error (RMSE) analysis of the regression fit (after excluding two outliers). RMSE between MC concentration and MD density was high (7) for copper and much higher (62) for lead. The preliminary conclusion from the Phase 1 data was that, for unsampled units, MD density would be a poor predictor of MC concentration for both copper and lead.

4.5.3.4 Additional Analyses of Phase 1 Data

Additional analyses were conducted on eight metals selected from the analyte list based on the probability that they represented anthropogenic (i.e., munitions items) sources: arsenic, beryllium, cadmium, chromium (total), copper, lead, nickel, and zinc. Originally antimony was also selected, but because a large fraction of antimony results were rejected during Phase 1 data validation (Appendix B), and because antimony typically co-occurs with lead, it was removed from these analyses.

Phase 1 Incremental Sampling Metals Data versus Soil Type

The influence of the predominant soil type of the sampled grid on the concentrations of selected metals was statistically analyzed. Five soil types were identified for the sampled grids: Chaparral, Chipotle, Crotalus, Missile, and Sotol. The main soil types among the 121 sampled grids were Chipotle (55% of sampled grids) and Missile (29% of sampled grids), as presented on Figure 2-6. Detailed output of the statistical evaluation is included in Appendix D. The key findings of this analysis for each metal are as follows:

- Soil type has a statistically significant effect on arsenic, beryllium, and chromium (total) concentrations and, to a lesser extent, on zinc concentrations.
- Arsenic concentrations were significantly different ($p < 0.01$) across the soil types. The distinct groups of soil types in decreasing order of concentrations appear to be (1) Crotalus, Missile, and Sotol; (2) Chaparral; and (3) Chipotle.
- Beryllium concentrations were significantly different ($p < 0.01$) across the soil types. The distinct groups of soil types in decreasing order of concentrations appear to be (1) Chaparral, Crotalus, and Sotol and (2) Chipotle and Missile.
- Chromium (total) concentrations were significantly different ($p = 0.03$) across the soil types. The distinct groups of soil types in decreasing order of concentrations appear to be (1) Chaparral, Crotalus, Missile, and Sotol and (2) Chipotle.
- Zinc concentrations were statistically not significantly different ($p = 0.1$) across the soil types. However, pairwise comparisons of zinc concentrations among the different soil types showed that zinc concentrations were statistically higher in Sotol than in both Chipotle ($p = 0.04$) and Missile ($p = 0.01$).

A consistent trend for these metals appears to be lower concentrations in Chipotle. Soil type has no significant effect on the concentrations of cadmium, copper, lead, and nickel.

Phase 1 Incremental Sampling Metals Data versus Target Area Category

Potential target areas in the study area were grouped based on the observed density of metallic anomalies and the fraction of these anomalies related to MD (URS 2012). Of the 18 potential target areas on Figure 3-1, no information regarding metallic anomalies and constituent concentrations was available for five areas (Target Areas 11, 14, 15, 16, and 18). These five areas were excluded from the subsequent statistical analysis. The remaining 13 areas were organized into three groups:

- **Target area**: This group included the target areas with high metallic anomaly density and a high percentage of MD. This group included Target Areas 1, 2, 3, and 9.
- **Suspected target area**: This group included the potential target areas with elevated metallic anomaly density, but lower percentage of MD, or vice-versa. This group included Target Areas 4, 6, 7, 8, 10, 12, and 13.
- **Nontarget area**: This group included those areas in which fewer metallic anomalies were observed, with fewer MD. This group included Target Areas 5 and 17. This group also included sample locations not within any designated target area.

Concentrations of each of the eight selected metals were compared statistically across these three groups of target areas. Detailed output of the statistical evaluation is included in Appendix D.

Because concentrations for most metals did not show statistically significant differences between the suspected target areas and nontarget areas, additional statistical analysis was performed in which these two groups were combined into a single group of "suspected-plus-nontarget areas." This combined group was then compared to the target area group. Results from this analysis indicate that:

- Concentrations for cadmium ($p < 0.01$), copper ($p < 0.01$), lead ($p < 0.01$), and nickel ($p = 0.02$) were statistically higher in the target area than the combined group of suspected-plus-nontarget areas. Chromium (total) concentrations were moderately higher ($p = 0.10$) but not statistically significantly higher in the target areas. These metals appear to be correlated to munitions debris in target areas.
- Beryllium concentrations were significantly lower ($p < 0.01$) in the target areas; arsenic concentrations were moderately lower ($p = 0.06$) in the target areas. The concentrations of these two metals do not appear to be impacted by the activities in the target areas.
- Zinc concentrations were statistically no different ($p = 0.60$) between the two groups and may not be related to MD. Zinc concentrations may be naturally occurring or may be a result of some other sources; and they appear to be randomly distributed within the study area irrespective of whether there was any MD at a given location.
- The distinction between suspected and nontarget areas does not appear to be useful since concentrations in the suspect target areas are statistically no different from those in the nontarget areas for six of the eight metals.

Phase 1 Incremental Sampling Metals Data versus Defined Location

Although the data were obtained from randomly selected 1-acre sampling units (within two strata defined by metallic anomaly density), the Phase 1 metals data in specifically defined areas were evaluated. Three arbitrarily defined areas adjacent to current development (see Figure 4-21) were evaluated:

- Area A: 1 mile by 1 mile, situated in the southeast corner of the range.
- Area B: 0.5 mile wide (east-west), situated against the eastern boundary, filling the space between Areas A and C.
- Area C: 0.5 mile wide (east-west), 0.5 mile high (north-south) situated in the northeast corner of the range.

Differences in concentrations of the eight aforementioned metals across these three areas were statistically evaluated. Detailed output of the statistical evaluation is included in Appendix D. The key findings of this analysis are as follows:

- Concentrations of cadmium, copper, and lead are significantly higher in Area A than in Areas B and C. This appears to be a result of a much higher percentage of Area A being in the target area group. The percentage of area defined as target areas is 80% for Area A, 43% in Area B, and 0% in Area C.

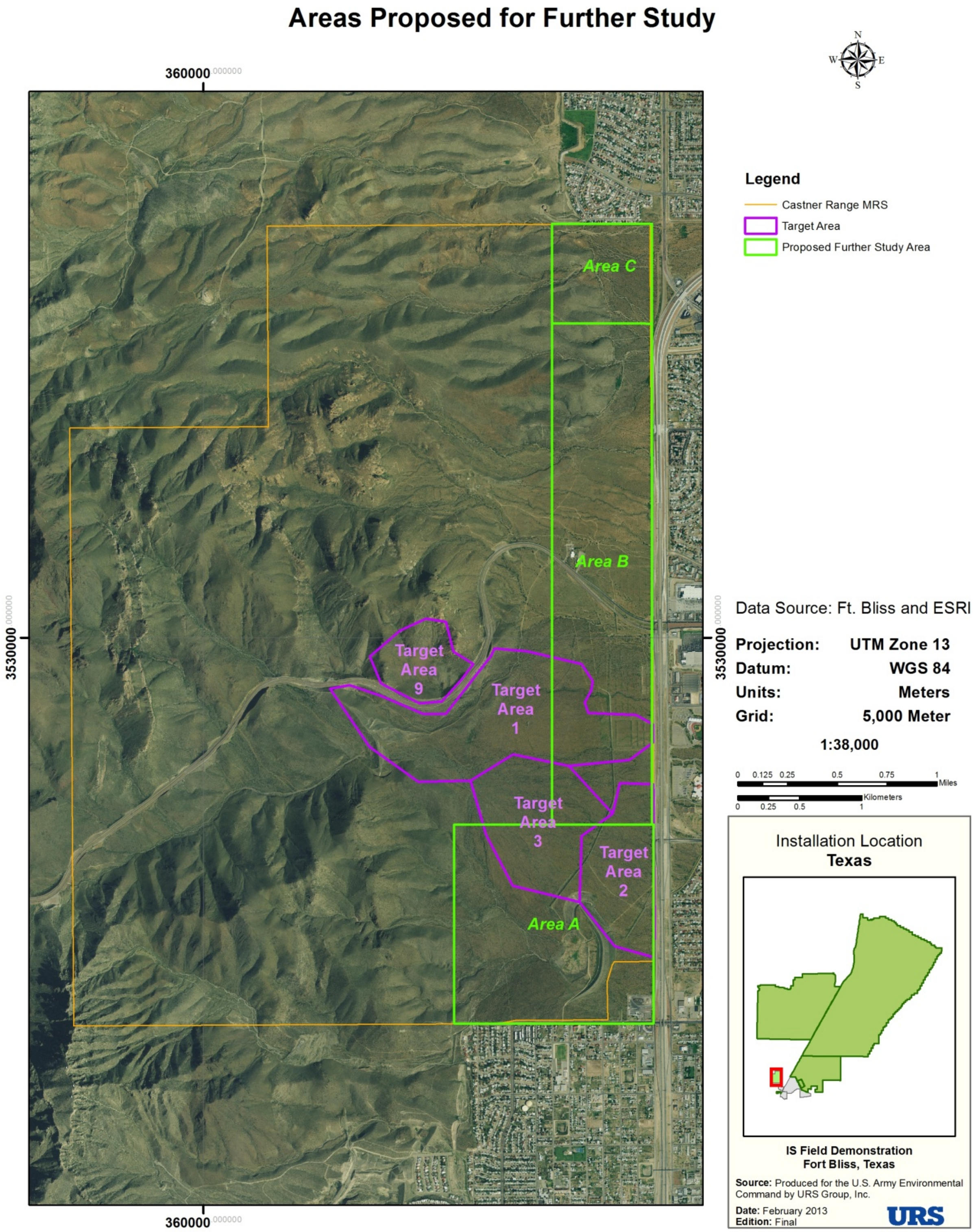


Figure 4-21. Areas Adjacent to Current Development for Further Analyses

- Concentrations of arsenic and beryllium are significantly lower in Area A. This appears to be a result of the much higher percentage of Area A being in the Chipotle soil type than the other two areas. The percentages of Chipotle soils in Areas A, B, and C are 91%, 52%, and 0%, respectively.
- Concentrations of chromium, nickel, and zinc are statistically no different among the three defined areas. The result for chromium might be due to the counteracting influence of soil type and target area. The result for nickel might be due to the influence of some local factors. Zinc appears to be randomly distributed across the study area.

Geostatistical Analysis of Phase 1 Metal Concentrations

The geostatistical method of kriging was used to estimate the spatial extent of the eight metal concentrations in Areas A, B, and C and Target Areas 1, 2, 3, and 9. Kriging is a method of spatial interpolation that allows estimation of concentrations at unsampled locations using concentrations at sampled locations and a model of spatial continuity. In addition to providing estimated concentrations, the kriging method also provides a measure of the uncertainty in the estimated values; namely, the kriged standard deviation of the estimated value. The kriged standard deviation can be used to define error bounds on the estimated value.

For purposes of kriging, a grid of 50 m by 50 m (164 ft by 164 ft) cells was defined over the study area, and kriging estimates were obtained at each of the grid nodes. For all metals except chromium and zinc, separate variograms (see Appendix D) were developed for the target area group and the suspected targets-plus-nontargets group. For these metals, kriging was performed separately for the two groups using only the group-specific data. For chromium and zinc, a single variogram over both groups was developed. Consequently, all data in both groups were used to perform kriging for chromium and zinc.

The kriging results were derived for the defined Areas A, B, and C and Target Areas 1, 2, 3, and 9. For purposes of this study and to assess the nature and extent of contamination in each of these selected areas, the estimated concentrations of each metal were compared to specified levels shown in Table 4-9. Table 4-9 includes two background levels for the metals considered: one is the Texas-specific background value obtained from the TRRP references, and the other is a "provisional background" level, derived from the triplicate background sample collected from the southern background sampling location (Figure 4-5 and Table 4-6). Table 9 also shows the TRRP Tier 1 value for residential soils based on the ${}^{Soil}GW_{Ing}$ pathway. Two values were chosen for kriging (highlighted), to evaluate how the assessment of the area would vary with varying comparison standards.

Table 4-9. Data Comparison Values for Phase 1 Kriging

Analyte	Texas-Specific Background Value (mg/kg)	TRRP Tier 1 Residential Soil Value (mg/kg)	Provisional Background (mg/kg)
Arsenic	**5.9**	2.5	**2.9**
Beryllium	**1.5**	0.92	**0.4**
Cadmium	**0.574**[a]	**0.75**	0.3
Chromium (total)	**30**	**1,200**	4.7
Copper	**15**	**520**	13
Lead	**15**	1.5	**20.8**
Nickel	**10**	**79**	4.0
Zinc	**30**	**1,200**	35

[a] Value from Worksheet 15 of QAPP (URS 2011)

[b] Bolded values used in Phase 1 kriging

A confidence interval (estimated concentration ± standard deviation) was calculated at each grid node and compared to two thresholds: the Texas-specific background value, and either the TRRP PCL or the provisional background value, if that was higher than the PCL. Based on this comparison, one of five possible site assessment conditions was assigned to each grid node:

- Condition 1 (“Clean”): If the estimated value was less than or equal to the comparison threshold, and the estimated value plus estimated standard deviation was also less than or equal to the comparison threshold, the grid point was marked as “clean” (i.e., the comparison threshold is not exceeded). The confidence in this conclusion is high and additional sampling may not be necessary to confirm the result at this node.
- Condition 2 (“Clean/Unresolved”): If the estimated value was less than or equal to the comparison threshold, but the estimated value plus estimated standard deviation was greater than the comparison threshold, the grid point was marked as “clean/unresolved,” and more sampling may be recommended to resolve the uncertainty and better delineate horizontal extent.
- Condition 3 (“Contaminated”): If the estimated value was greater than the comparison threshold and the estimated value minus estimated standard deviation was also greater than the comparison threshold, the grid point was marked as “contaminated” (i.e., concentration exceeds the comparison threshold). The confidence in this conclusion is high and additional sampling may not be necessary to confirm the result at this node.
- Condition 4 (“Contaminated/Unresolved”): If the estimated value was greater than the comparison threshold, but the estimated value minus estimated standard deviation was less than or equal to the comparison threshold, the grid point was marked “contaminated/unresolved,” and more sampling may be recommended to resolve the uncertainty and better delineate horizontal extent.
- Condition 5 (“Unestimable”): If kriging could not be performed at a grid node because of insufficient neighboring data, the node was marked as “unestimable.” In addition, if a grid node was at the edge of the sample data and there was no constraining data, kriging could result in extrapolation. The resulting estimated concentration would have poor reliability, particularly if extrapolation produced a significant artificial trend. Such a grid node was also considered to be unestimable. Areas of unestimable locations may be considered data gaps. Additional sampling would be required in areas to fill these data gaps.

The results of this assessment are displayed in four maps over the selected areas for each of the eight metals.

- Map a: Estimated concentrations.
- Map b: Relative estimated standard deviation, which is equal to the estimated standard deviation divided by the estimated concentration.
- Maps c and d: Site assessment conditions for each of two comparison thresholds shown in Table 4-9.

Figures 4-22 through 4-29 show the maps for each of the eight metals evaluated. A complete description of the kriging process and underlying data are contained in Appendix D.

Figures 4-22 to 4-29 can be used to evaluate whether the current data are adequate to assess the extent of contamination in each selected area. As noted previously, areas identified as clean or contaminated would not likely require additional sampling to confirm the results. However, those concluded to be either clean/unresolved or contaminated/unresolved may require additional sampling to more clearly define horizontal extent and resolve the uncertainty of whether the area is clean or contaminated. Areas concluded to be unestimable may also require additional sampling in order to obtain kriging estimates in those areas.

Additional findings include:

- The average percentage of unestimable area (i.e., area in which no kriging could be performed because of lack of neighborhood data) is relatively small in the mapped areas for all metals. This percentage, averaged over all the mapped areas, is less than 3% for all metals except for beryllium (about 9%).
- The percentage of unestimable area is somewhat larger in Area C for copper (about 21%) and in Target Area 9 for beryllium (about 22%). This is a consequence of the relatively low sampling density in these areas and a spatial pattern of sample concentrations that results in the extrapolation of current sampling data and anomalous kriged estimates. As noted previously, areas of such anomalous estimates of concentrations are treated as unestimable.
- Areas identified to be clean/unresolved, contaminated/unresolved, or unestimable would require additional samples if definitive conclusions are desired regarding whether the area is clean or contaminated. Such areas may be considered to be data gaps. The data gaps are larger for arsenic, if the provisional background level of 2.9 mg/kg is assumed; for copper, if the Texas-specific background level of 15 mg/kg is assumed; and lead, for either of the background levels.
- For copper and zinc, the PCLs are substantially higher than the Texas-specific background levels; the estimated concentrations generally fall between the two thresholds and are generally closer to the Texas-specific background levels. Consequently, for the higher PCLs, almost the entire mapped area is clean/resolved and no additional sampling would be necessary to address unresolved areas.
- For arsenic, the provisional background level is lower than the Texas-specific background and the estimated concentrations are again between the two levels. Consequently, there is a greater percentage of contaminated/unresolved area if the lower provisional background level is assumed. This, in turn, would increase the sampling requirement.

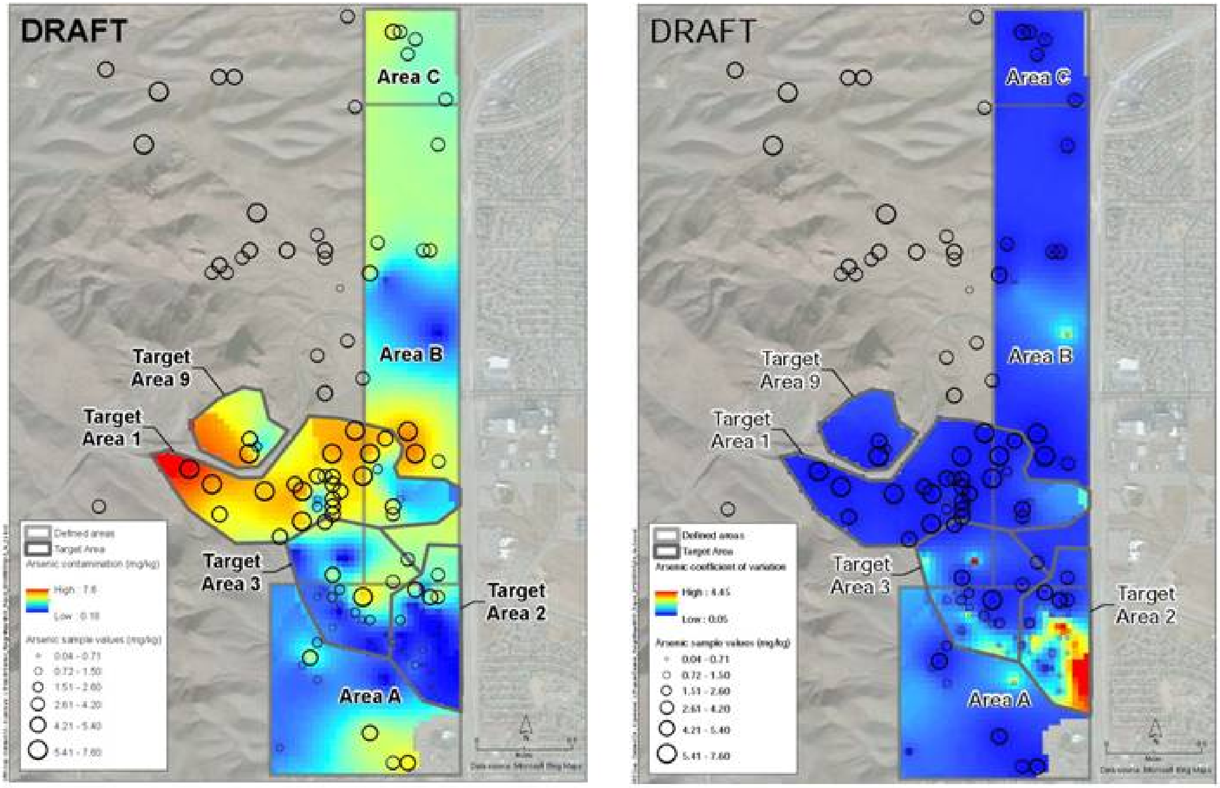


Figure 4-22a: Concentration results for Arsenic

Figure 4-22b: Coefficient of variation for Arsenic

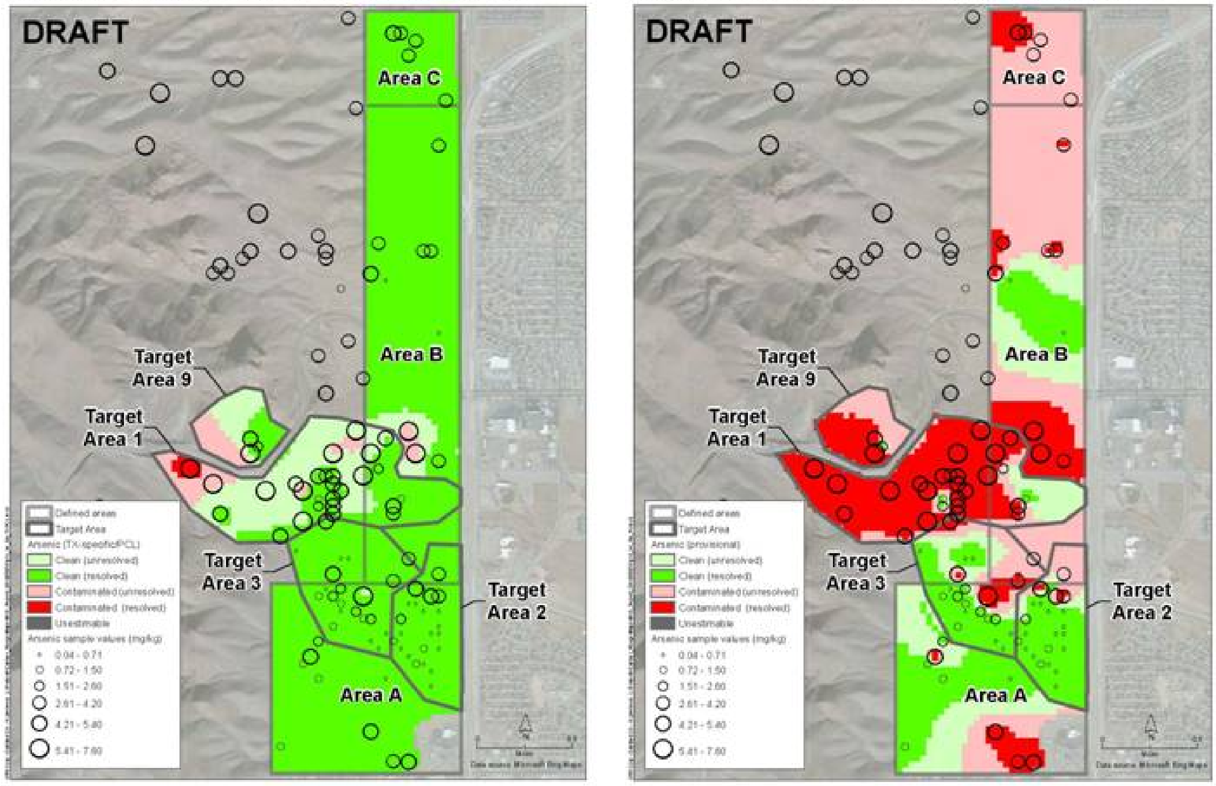


Figure 4-22c: Site Assessment Results for Arsenic
(TX-specific background value = 5.9 mg/kg)

Figure 4-22d: Site Assessment Results for Arsenic
(Provisional background value = 2.9 mg/kg)

Figure 4-22. Phase 1 Data Kriging Results for Arsenic

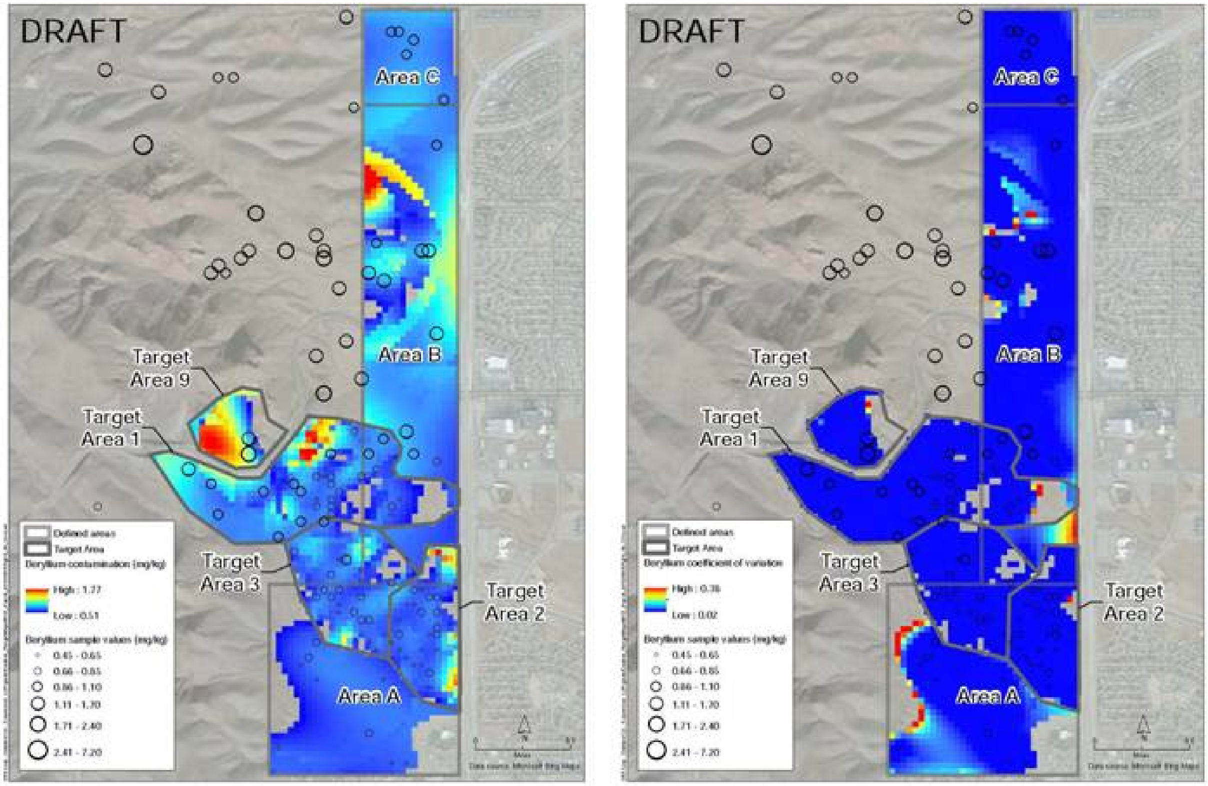


Figure 4-23a: Concentration results for Beryllium
Figure 4-23b: Coefficient of variation for Beryllium

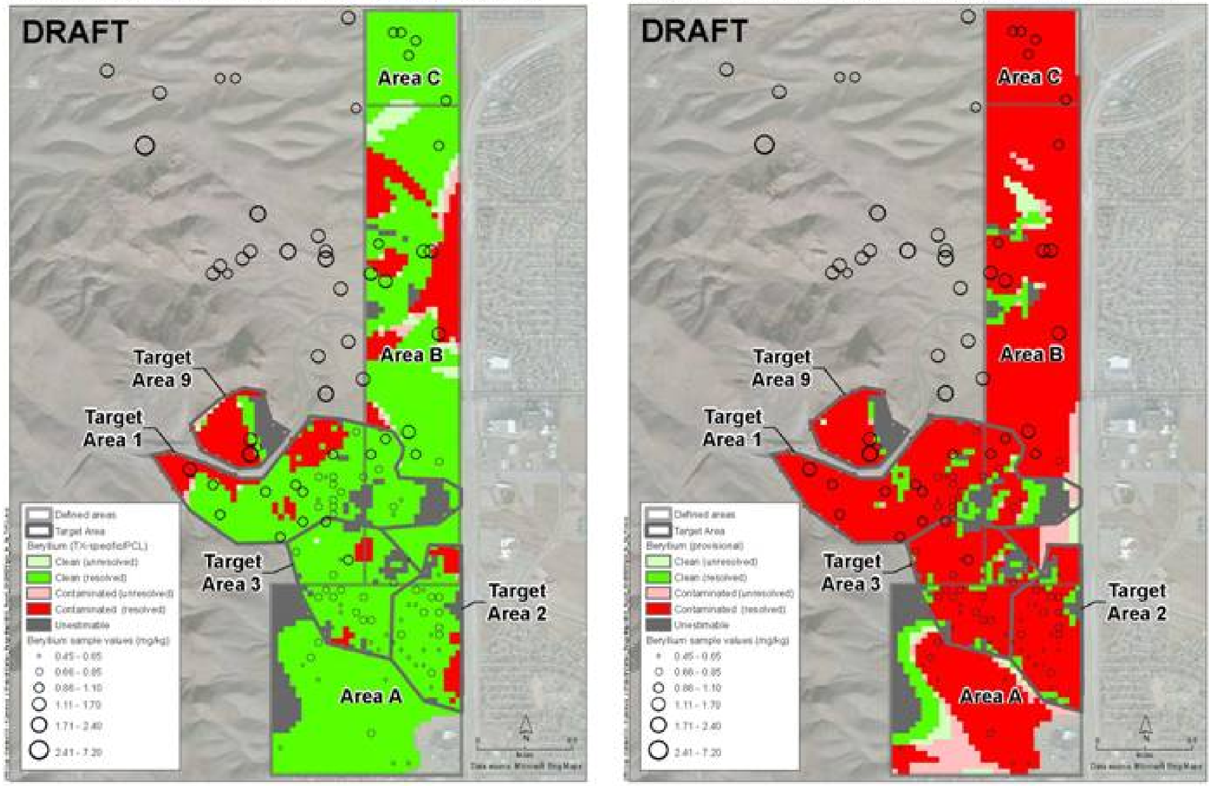


Figure 4-23c: Site Assessment Results for Beryllium
(TX-specific background value = 1.5 mg/kg)
Figure 4-23d: Site Assessment Results for Beryllium
(Provisional background value = 0.4 mg/kg)

Figure 4-23. Phase 1 Data Kriging Results for Beryllium

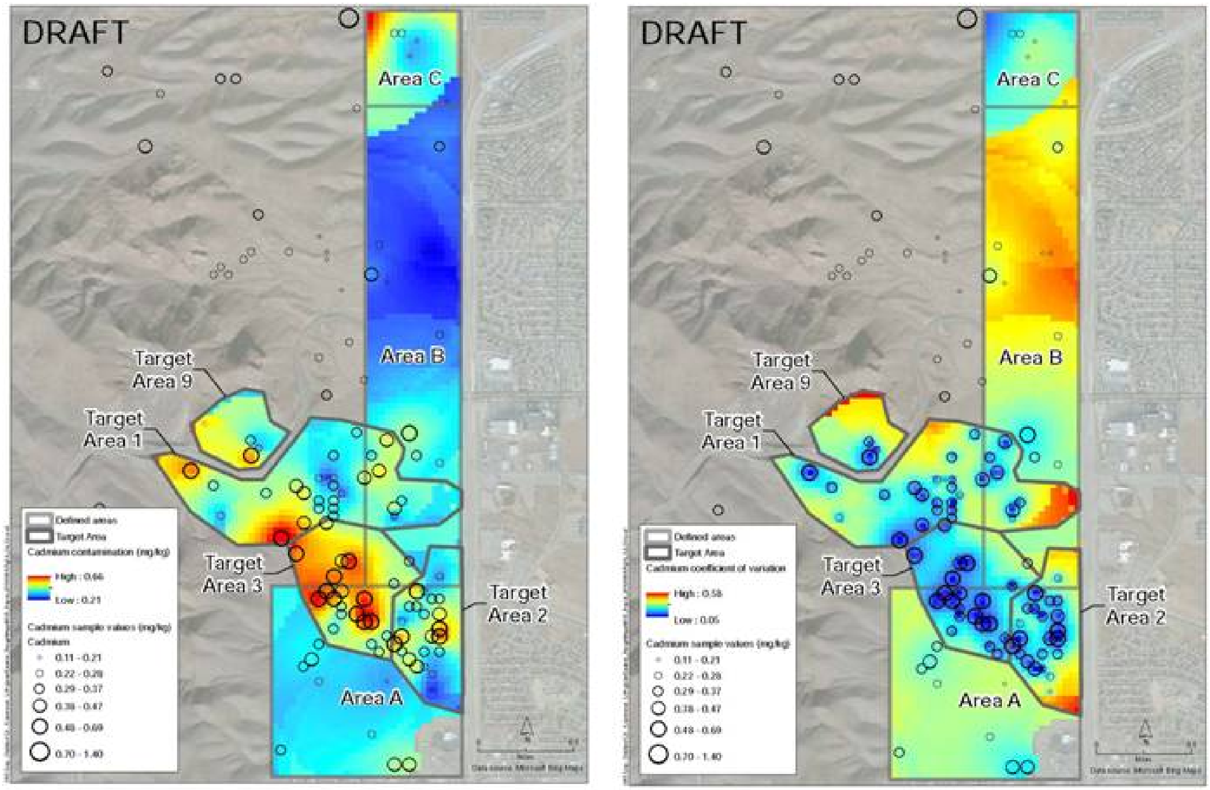


Figure 4-24a: Concentration results for Cadmium

Figure 4-24b: Coefficient of variation for Cadmium

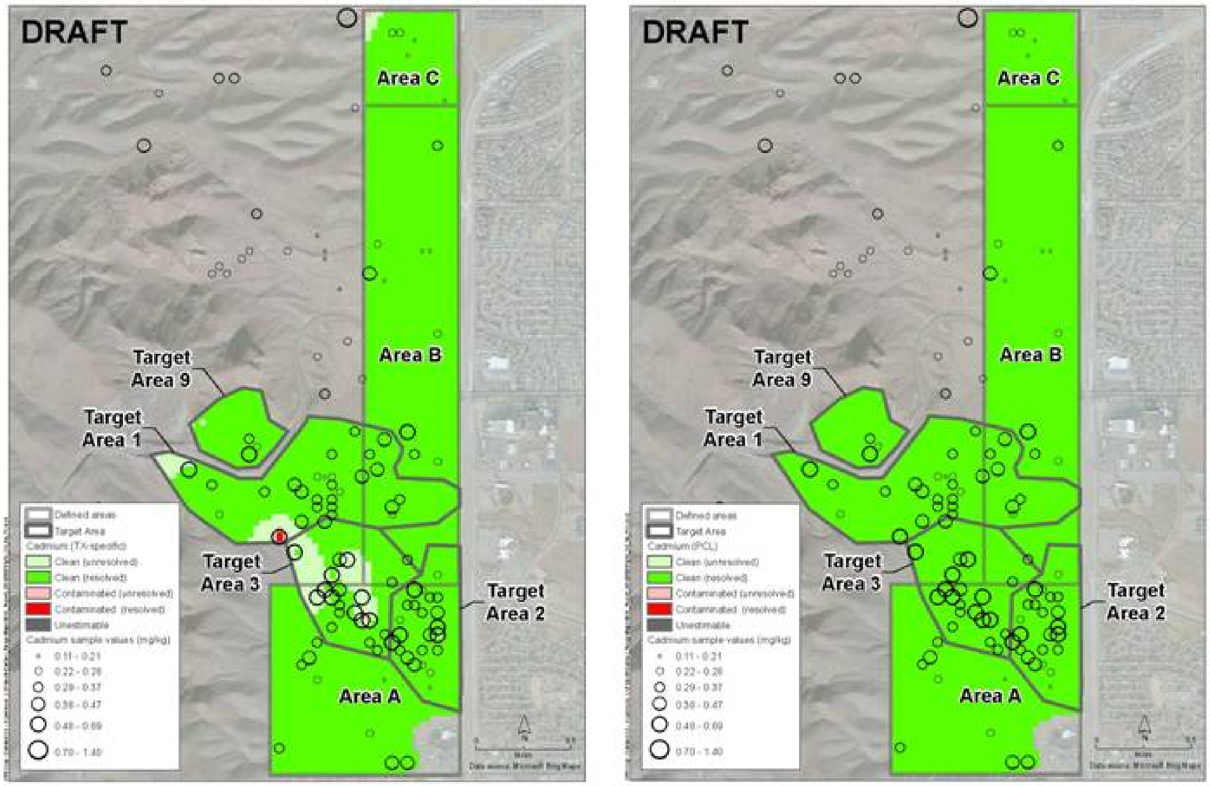


Figure 4-24c: Site Assessment Results for Cadmium
(QAPP Worksheet 15 value = 0.574 mg/kg)

Figure 4-24d: Site Assessment Results for Cadmium
(TRRP Tier 1 residential soil value = 0.75 mg/kg)

Figure 4-24. Phase 1 Data Kriging Results for Cadmium

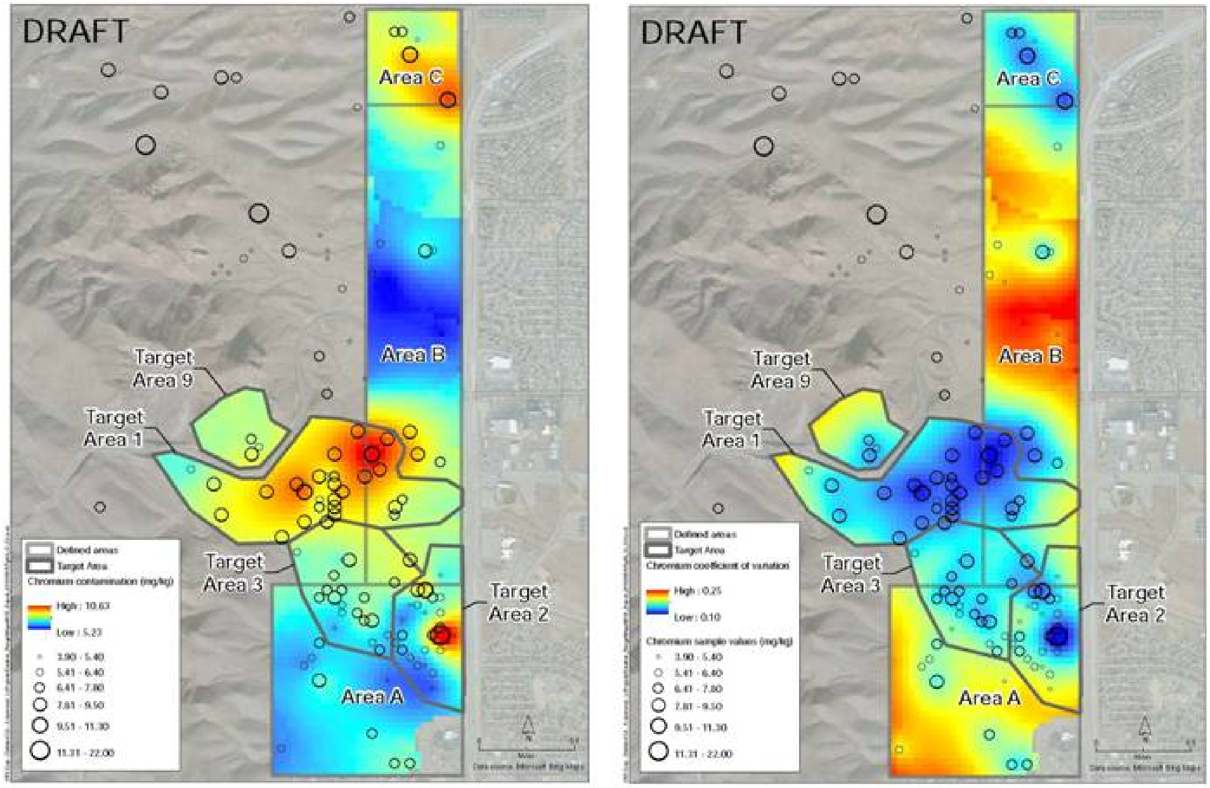


Figure 4-25a: Concentration results for Chromium

Figure 4-25b: Coefficient of variation for Chromium

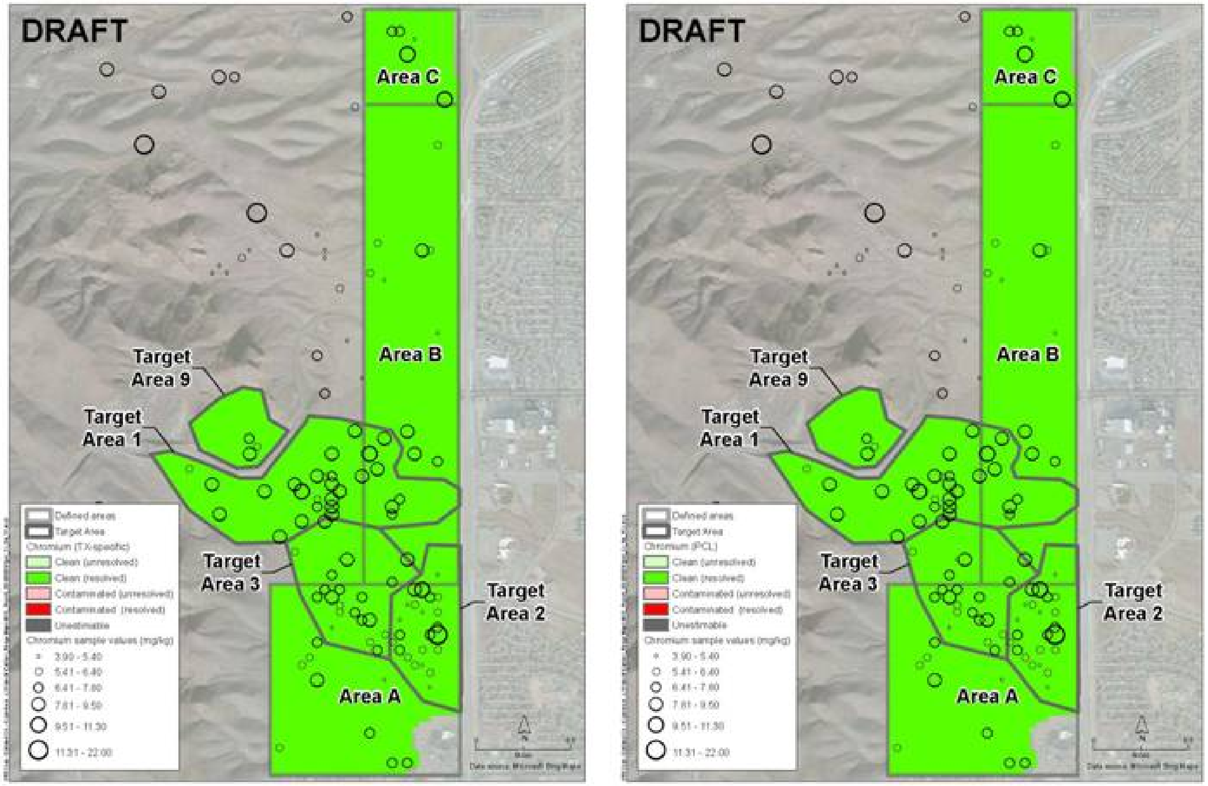


Figure 4-25c: Site Assessment Results for Chromium
(TX-specific background value = 30 mg/kg)

Figure 4-25d: Site Assessment Results for Chromium
(TRRP Tier 1 residential soil value = 1200 mg/kg)

Figure 4-25. Phase 1 Data Kriging Results for Chromium

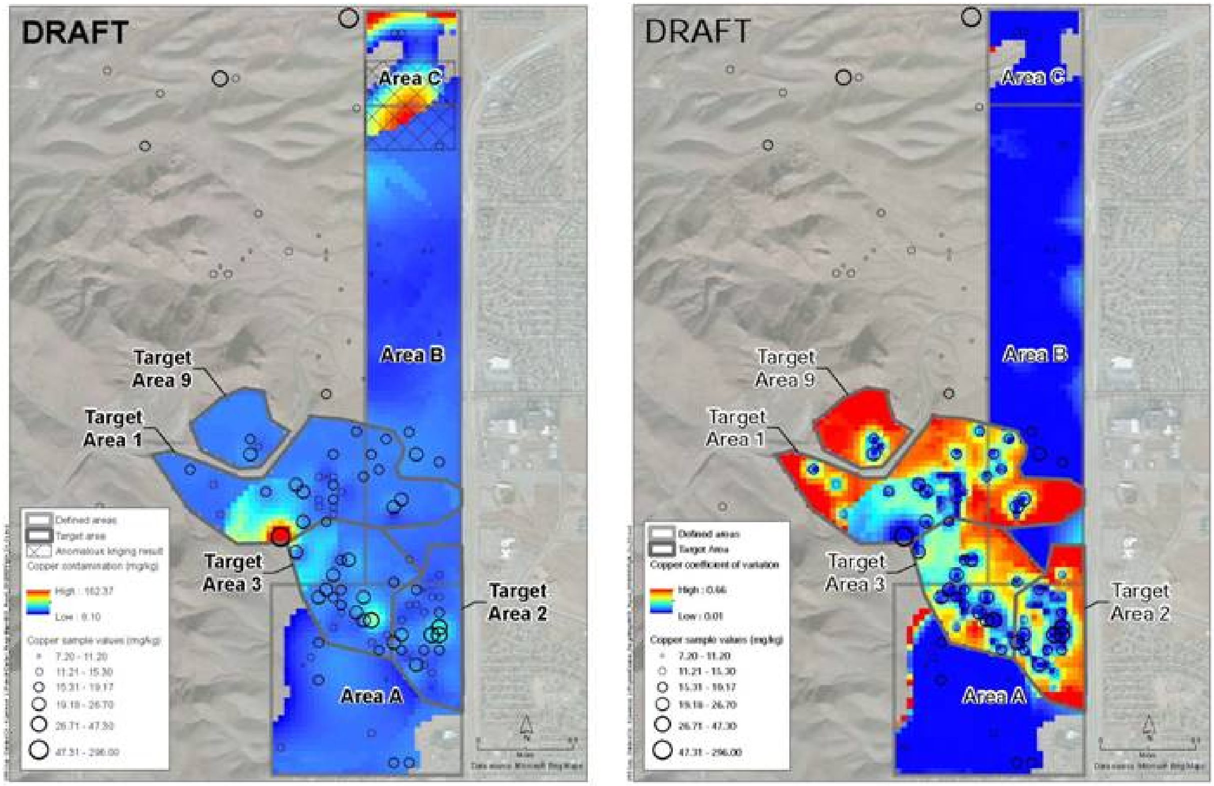


Figure 4-26a: Concentration results for Copper

Figure 4-26b: Coefficient of variation for Copper

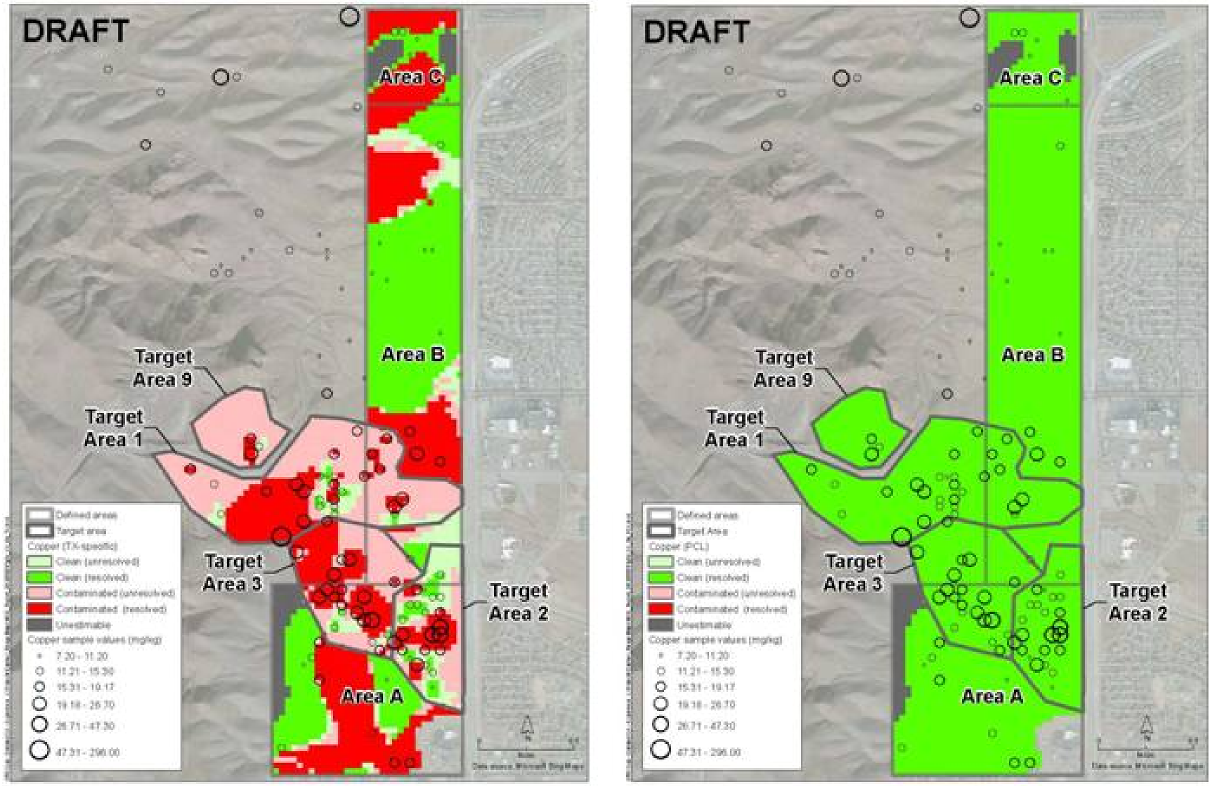


Figure 4-26c: Site Assessment Results for Copper
(TX-specific background value = 15 mg/kg)

Figure 4-26d: Site Assessment Results for Copper
(TRRP Tier 1 residential soil value = 520 mg/kg)

Figure 4-26. Phase 1 Data Kriging Results for Copper

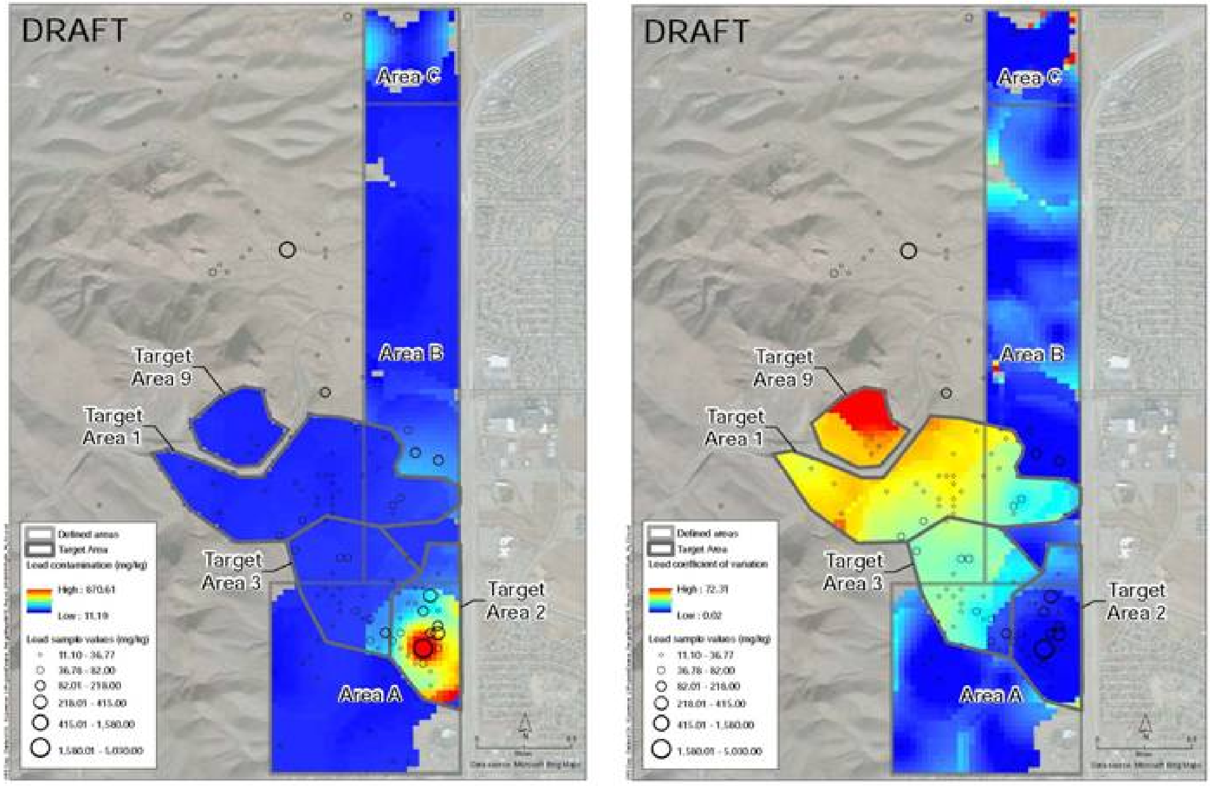


Figure 4-27a: Concentration results for Lead

Figure 4-27b: Coefficient of variation for Lead

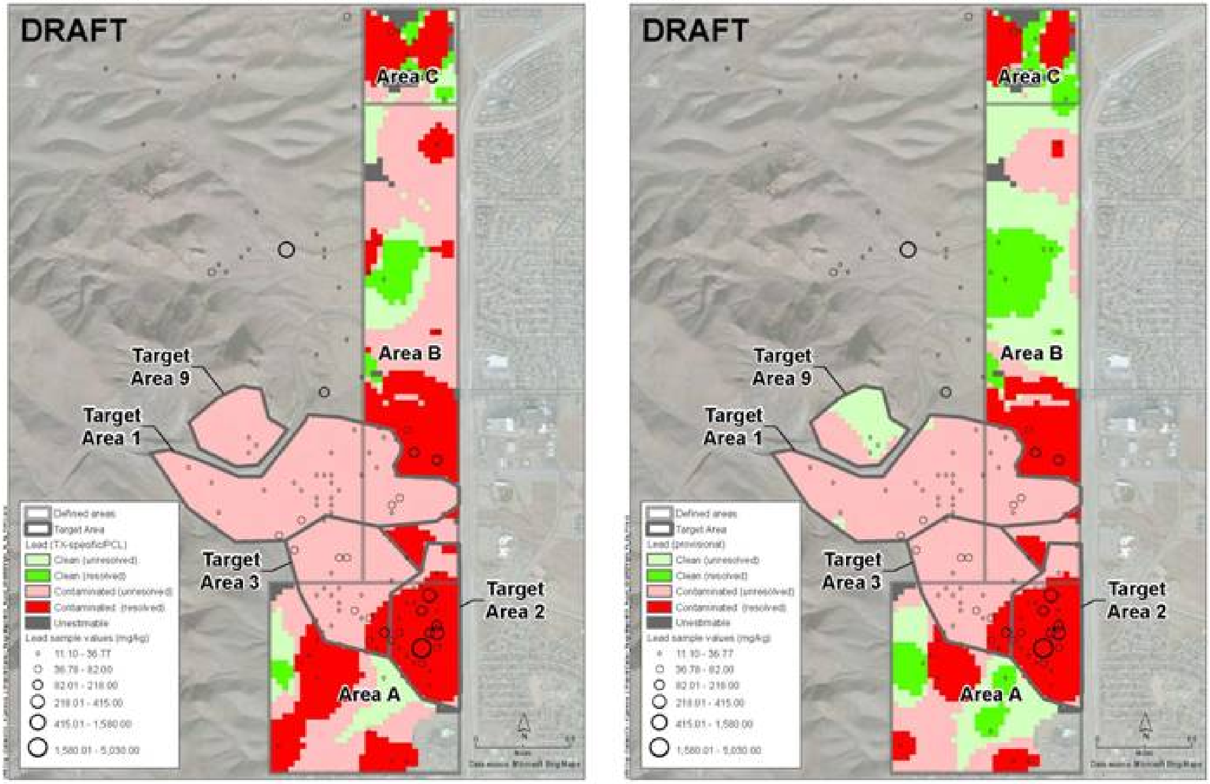


Figure 4-27c: Site Assessment Results for Lead
(TX-specific background value = 15 mg/kg)

Figure 4-27d: Site Assessment Results for Lead
(Provisional background value = 20.8 mg/kg)

Figure 4-27. Phase 1 Data Kriging Results for Lead

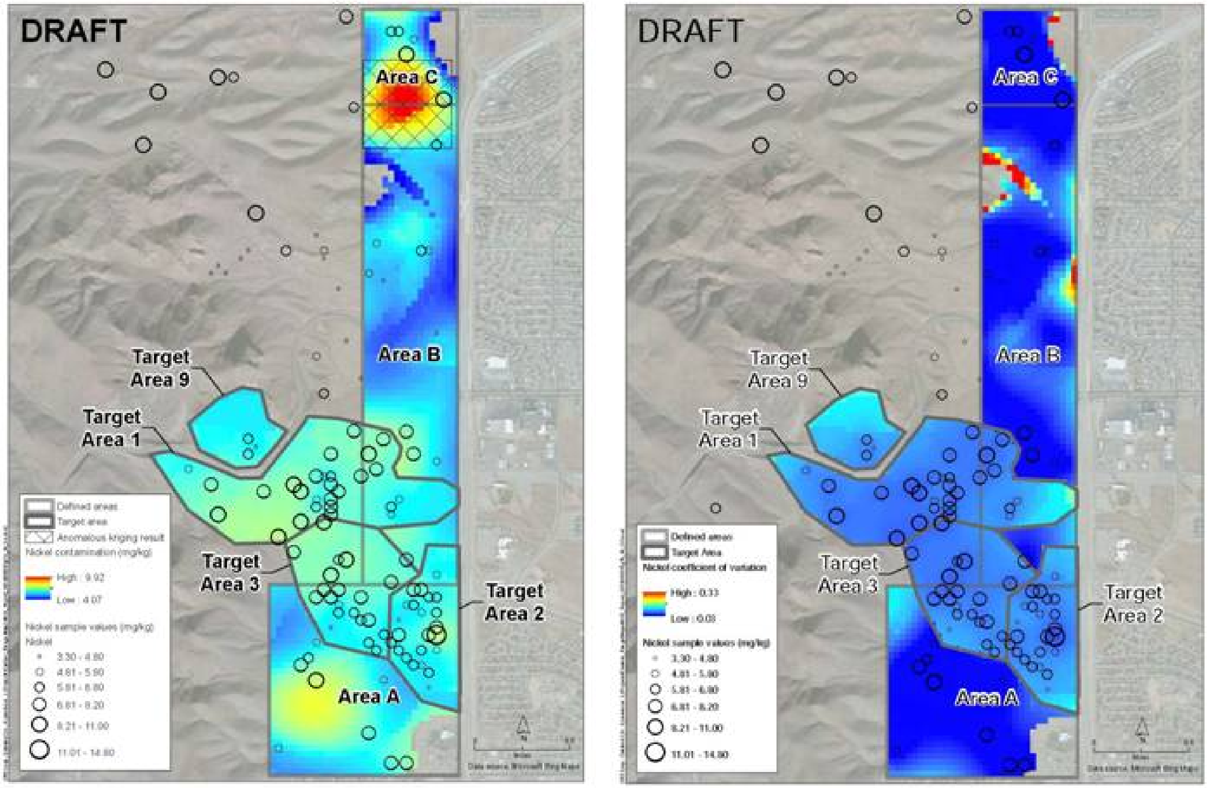


Figure 4-28a: Concentration results for Nickel

Figure 4-28b: Coefficient of variation for Nickel

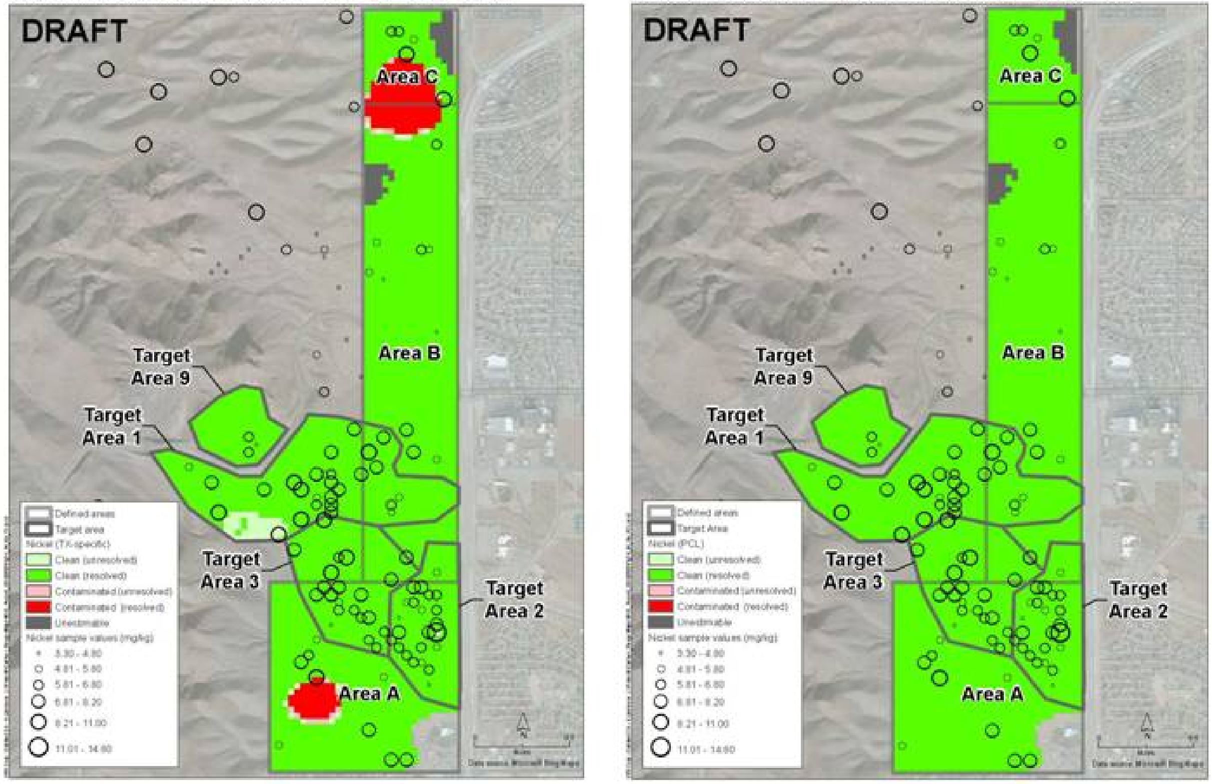


Figure 4-28c: Site Assessment Results for Nickel
(TX-specific background value = 10 mg/kg)

Figure 4-28d: Site Assessment Results for Nickel
(TRRP Tier 1 residential soil value = 79 mg/kg)

Figure 4-28. Phase 1 Data Kriging Results for Nickel

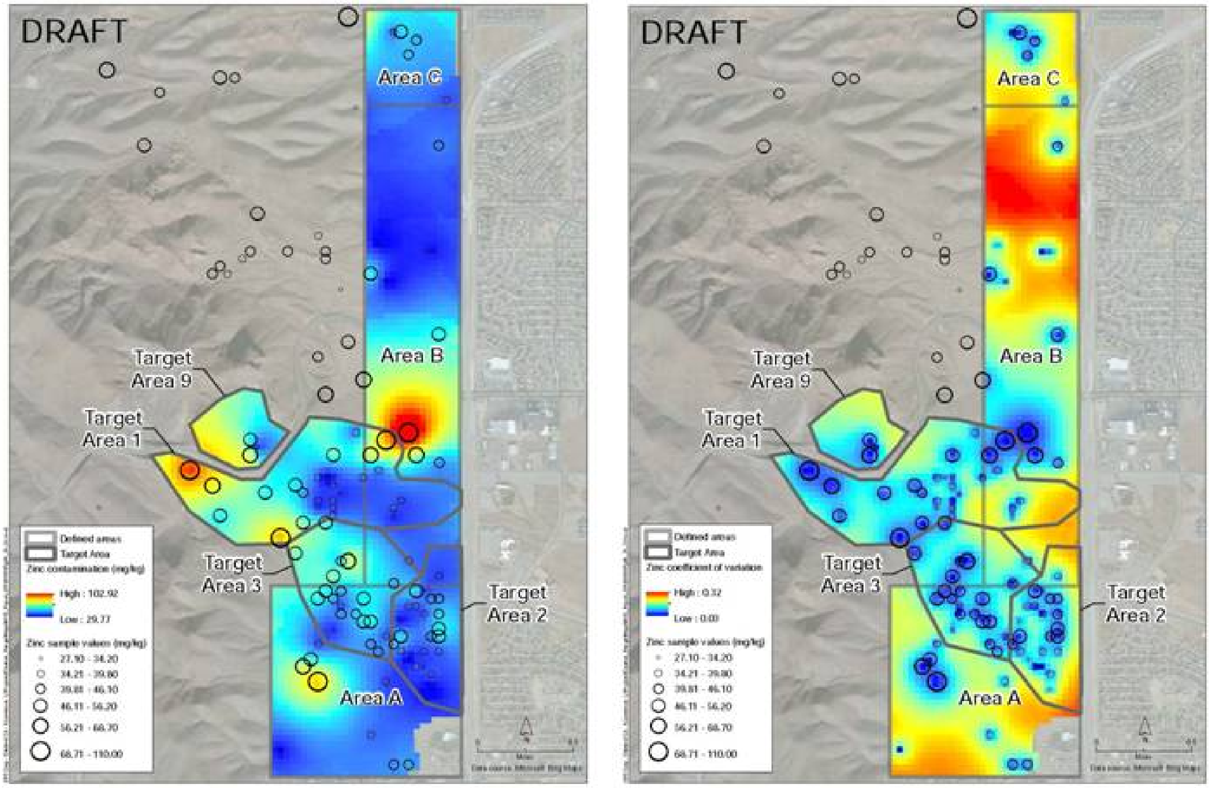


Figure 4-29a: Concentration results for Zinc

Figure 4-29b: Coefficient of variation for Zinc

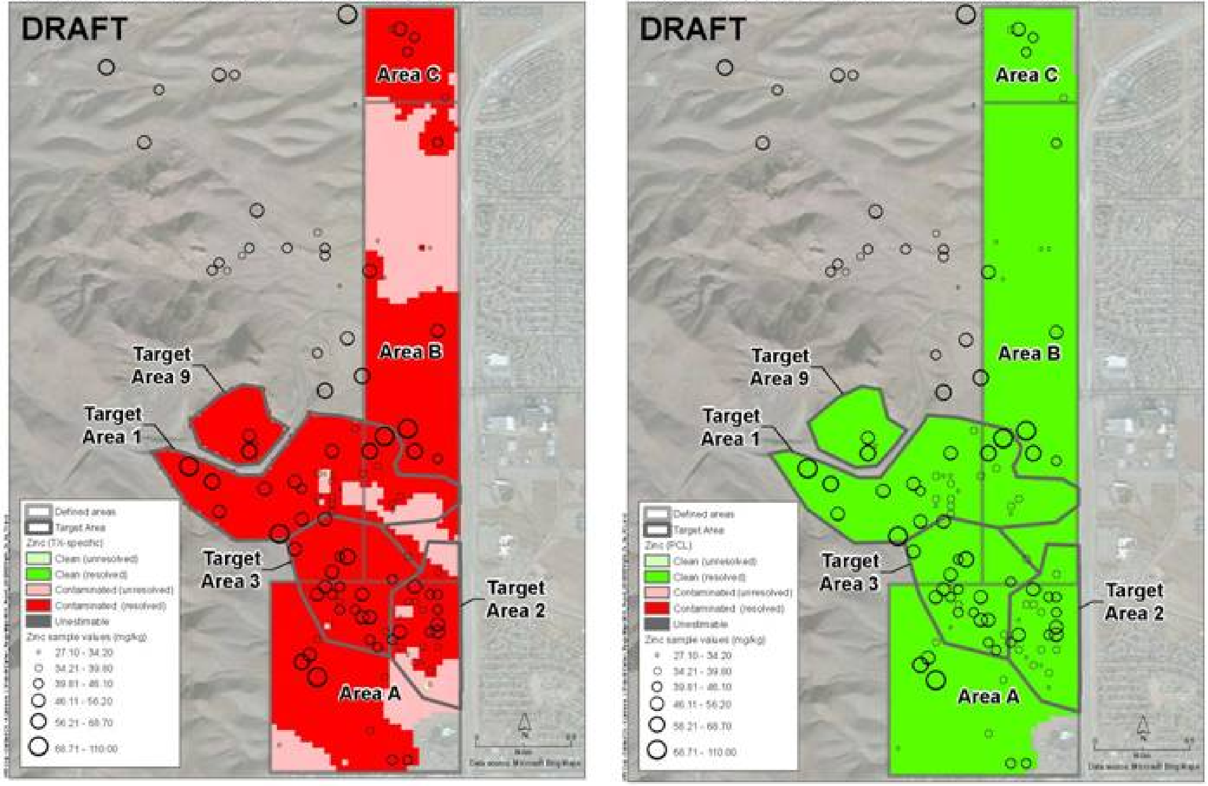


Figure 4-29c: Site Assessment Results for Zinc
(TX-specific background value = 30 mg/kg)

Figure 4-29d: Site Assessment Results for Zinc
(TRRP Tier 1 residential soil value = 1200 mg/kg)

Figure 4-29. Phase 1 Data Kriging Results for Zinc

- Comparisons involving the provisional background levels are preliminary. Further review of TRRP and EPA Unified Guidance indicated that at least 15 data points would be needed to establish site-specific background concentrations, so it was decided to collect additional background data in the Phase 2 sampling event.

4.6 Phase 2 Planning to Fill Data Gaps

Based on the statistical analysis of the Phase 1 round of sampling, the following supplemental sampling (Figure 4-30) was proposed for Phase 2 sampling, scheduled in September 2012:

- **Resolve Areas Adjacent to Current Development (Areas A, B, and C)**: Additional samples were planned to fill in spatial gaps and to increase confidence in the determination of the nature and extent of MCOC found in areas adjacent to current development. The objective of the additional incremental sampling was to increase geospatial coverage to resolve the spatial extent of potentially actionable contamination in Areas A, B, and C. An additional 18 sampling units were placed in unresolved areas to enable resolution of the areas of concern.
- **Resolve Areas in High Confidence Target Areas**: Statistical analysis of the geospatial coverage of high-confidence target areas (Target Areas 1, 2, 3, and 9) indicated that an additional ten sampling units within these areas would increase resolvable acreage.
- **Characterize MCOC Transport**: The analyses showed that target areas may be potential sources of range-related MCOC contamination. Six likely drainages (arroyos immediately outside of the defined area boundary) related to Target Areas 1, 2, 3, and 9 were selected for additional sampling. The total area of these arroyo sampling units remained 1 acre, but they were configured to the width of the drainage channel (Figure 4-31). Elevated MCOC levels in the arroyos might be indicative of transport from the source areas.
- **Beryllium Investigation**: Beryllium was detected in concentrations higher than the TRRP PCL in seven sampling units on the Closed Castner Firing Range. A careful review of beryllium exceedences north of Transmountain Road reveals a potential pattern of transport from four elevated concentrations along an arroyo. The other three exceedences occur in close proximity to Transmountain Road. Eight additional sampling units were planned upgradient, downgradient, and in a nearby drainage to better define this phenomenon.
- **Site-specific Background**: For metals, a background sample size of 15 is needed to meet the criteria of the EPA Unified Guidance. One previous background sample was unknowingly taken in a suspected FUDS location with potential contamination from a former OB/OD unit. Because it could not be definitely confirmed that the location was free of pre-existing contamination, the northern background sample from Phase 1 was not used. Fourteen additional sampling units placed outside of the current Closed Castner Firing Range were located in the Franklin Mountains State Park, north of the range, and one sampled in triplicate. Combined with the southern background sampling data from Phase 1, this provided the 15 primary sample results and QC to meet the conservative EPA Unified Guidance for establishing background, and allowed standard statistical comparisons to be made between site and background data. The inset on Figure 4-30 shows the locations of supplemental background sampling units.

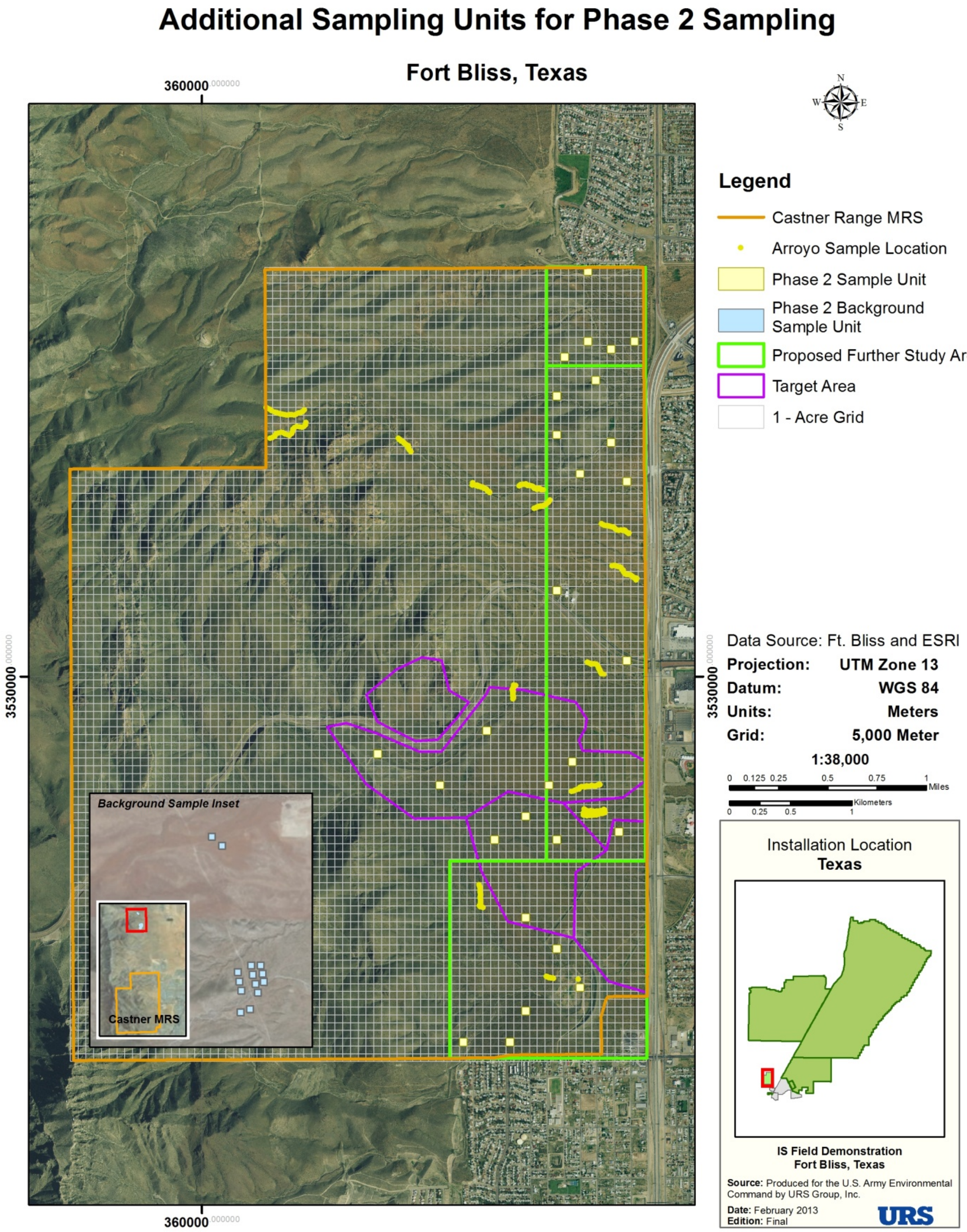


Figure 4-30. Additional Sampling Units Proposed for Phase 2 Sampling

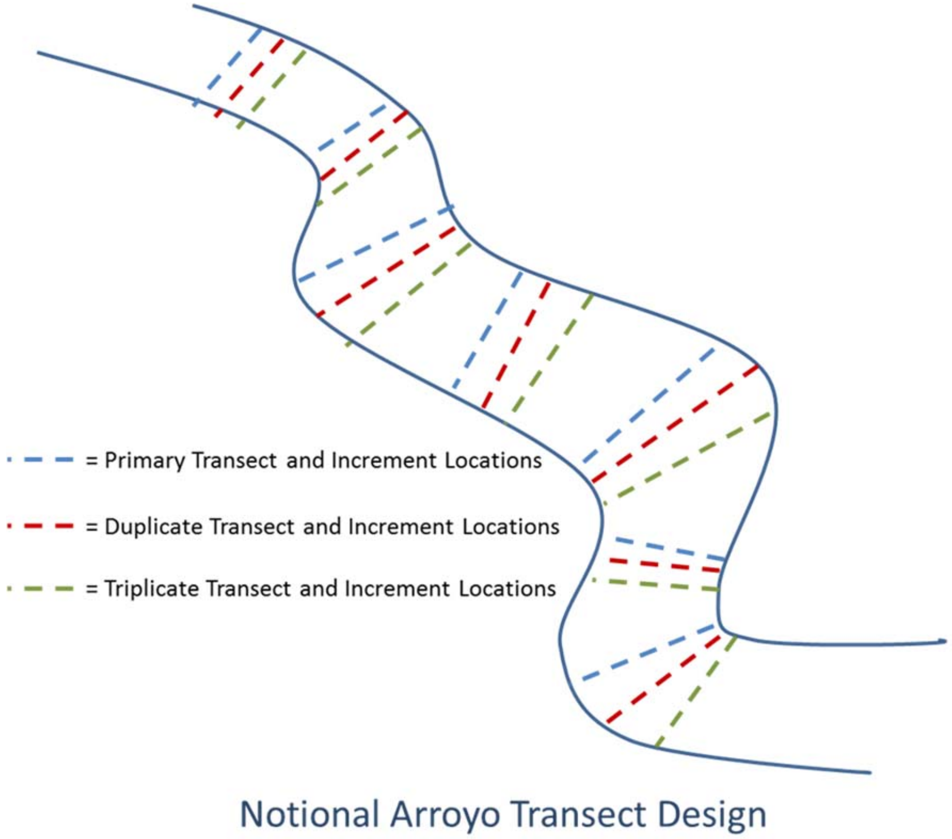


Figure 4-31. Example Layout of an Incremental Sampling Unit in an Arroyo

In summary, the following samples were collected in Phase 2:

- Resolve Areas A, B, or C; or resolve target areas 1, 2, 3 or 9: 28 primary samples
- Characterize MCOC transport: 6 primary samples
- Investigate beryllium: 8 primary samples
- Characterize background: 14 primary samples

Additionally, 6 of these sampling units were sampled in triplicate for QA purposes.

4.7 Phase 2 Sampling

Sampling crews mobilized to the site from September 10 to 14, 2012, to complete the collection of the Phase 2 samples.

The same procedures were followed in the Phase 2 sampling as for the Phase 1 sampling described previously. In two cases during Phase 2 sampling the terrain was too steep or otherwise inaccessible, so a previously selected replacement grid was substituted at the direction of the project manager.

In the case of arroyo sampling, the sampling procedure was modified to collect 100 increments in a 1-acre area that was tailored to the average width of the arroyo being sampled. The following procedures were used:

- The sampling team navigated to the downstream point of the estimated reach of the arroyo to be sampled.
- A measuring tape (Figure 4-32) was used to estimate the width of the arroyo at the downstream point, and the sampling team moved upstream, taking additional measurements where the width of the arroyo appeared to vary. Care was taken to locate the areas within the arroyo where MCOC might be expected to be found if transported. Ideally, these were areas where depositional processes were likely to have concentrated MCOC.

Figure 4-32. The Average Width of the Arroyo was Estimated

- An average arroyo width was calculated from the several measurements, and a length calculated to encompass an area of approximately 1 acre. For example, if the arroyo was estimated to be 50 ft wide, the length required to encompass 1 acre was about 872 ft.
- Once the width and length of the sampling unit were established, 20 uniformly spaced transects were established perpendicular to the centerline of the arroyo, along the whole length (Figure 4-33), with flags marking the locations. Using the previous example of 872 ft, each transect would be spaced approximately 44 ft apart.

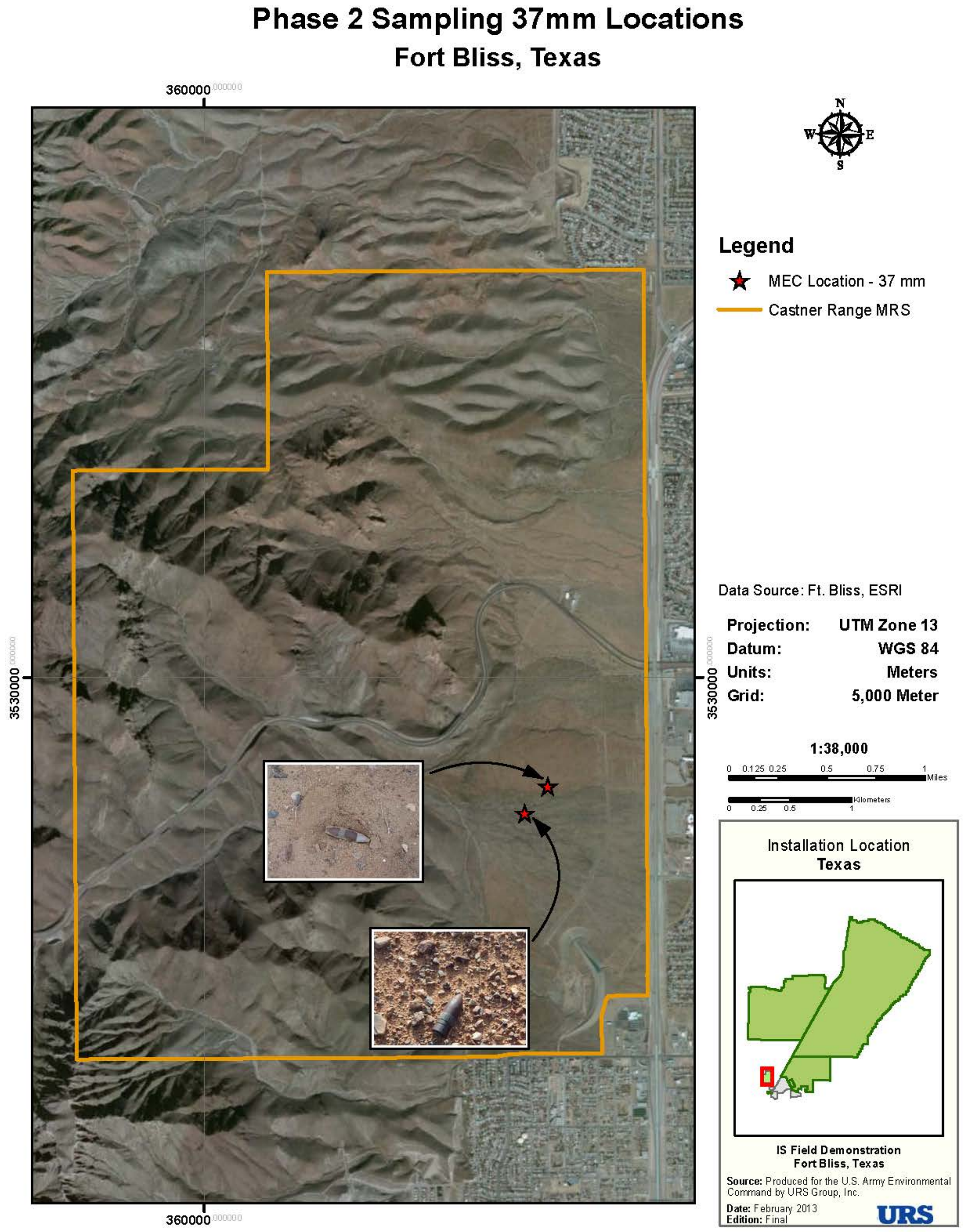
Figure 4-33. Flags Were Used to Mark Endpoints of Arroyo Transects

- Five increments were collected from each transect: one on the center line of the arroyo, at which point a GPS location was recorded; two at the outer endpoints of the transect; and two more approximately midway between the endpoints and the center line, thus achieving 100 increments.
- When arroyos were selected as triplicate sampling units, the duplicate and triplicate sampling transects were parallel to and offset from the primary transect by a distance determined randomly.

During the September 2012 sampling event, two fuzed 37mm projectiles were discovered and disposed on-site by the Fort Bliss EOD personnel. Figure 4-34 shows the locations of the found items.

4.8 Quality Assurance and Control

Triplicate incremental samples were collected from 10% of the 1-acre primary sampling units selected. The concentrations of replicate incremental samples from a sampling unit tend to have low variance and normal distributions, a property not true of data sets collected using discrete samples. As a rule of thumb if the percent RSD (variance) determined from three to five ISM replicates from the same sampling unit is less than 30%, the sampling design and execution are likely to be adequate. As noted previously, Hewitt and others (2008) suggest that if the percent RSD is less than or equal to 30%, a normal distribution could be assumed and meaningful UCLs calculated. Although an RSD less than 30% cannot conclusively demonstrate that a distribution



Source: Produced for the U.S. Army Environmental Command by URS Group, Inc.
Date: February 2013
Edition: Final

Figure 4-34. Location of UXO Items Discovered in September 2012 is normal, a larger RSD would suggest deviations from normality and indicate that the field sampling design or laboratory processing or both were not adequate to control for the effects of distributional or compositional heterogeneity. As such, the RSD was evaluated to assess the effectiveness of the sampling design. The majority of test results varied less than 30%, as described in Appendix B.

Laboratory quality assurance/quality control (QA/QC) samples such as laboratory replicates, matrix spikes, controls, and performance blanks were taken in accordance with standard practice to demonstrate laboratory analytical quality. QA/QC measures implemented in the laboratory to control processing and sample preparation, along with all QA/QC requirements for the project are fully described in the QAPP (URS 2011), and reported in the data usability reports (Appendix B).

5. RESULTS AND DISCUSSION

The Phase 2 samples were analyzed and the data were validated and determined to be useable (Appendix B). The data, as flagged from the validation process, are shown in Table 5-2. The data were evaluated and compared to PCLs to identify any exceedences. The results are tabulated along with the Phase 1 data in Table 5-1 and presented on Figures 5-1 and 5-2.

Table 5-1. Phase 1 and Phase 2 Data Exceedences of Screening Values

Analyte	TRRP PCLs (mg/kg)			EPA Residential Screening Level (mg/kg)	TRRP Eco Benchmark (mg/kg)	Benchmark Source Preliminary	Exceedences			
	Tier 1 Residential Soil PCLs – 30-acre source area		Texas-Specific Bkgrnd				Human, Based on QAPP		Based on Eco Benchmarks	
	$^{Tot}Soil_{Comb}$	$^{GW}Soil_{Ing}$					Ph 1	Ph 2	Ph 1	Ph 2
HMX	200	1.2	–	3,800	0.4	Soil Invertebrate NOEC	0	0	0	0
RDX	25	0.018	–	5.5	0.36	Mammalian NOEC	1[a]	0	1	0
2,4,6-TNT	17	0.086	–	19	1	Mammalian NOEC	0	0	0	0
1,3,5-TNB	2,000	0.91	–	2,200	0.3	Plant NOEC	0	0	0	0
1,3-DNB (2,4-DNB)	6.3	0.0038	–	6.1	0.18	Mammalian NOEC	0	0	0	0
Tetryl; Nitramine	34	0.55	–	240	25	Talmage et al. 1999	0	0	0	0
2-A-4,6-DNT	9.3	0.05	–	150	4	Plant NOEC	0[a]	0	0	0
4-A-2,6-DNT	8.9	0.033	–	150	11	Plant NOEC	0[a]	0	0	0
2,6-DNT	6.9	0.0024	–	61	0.4	Plant NOEC	2[a]	0	0	0
2,4-DNT	6.9	0.0027	–	1.6	2	Plant NOEC	2[a]	0	1	0
Nitroglycerin	NA	NA	–	6.1	1.9	Mammalian NOEC	0	0	0	0
Aluminum	64,000	86,000	30000	77,000	30,000	Background	0	0	0	0
Antimony	15	2.7	1	31	5	Plants	2	2	1	0
Arsenic	24	2.5	5.9	0.39	18	Plants	8	0	0	0
Barium	7,800	220	300	15,000	330	Earthworms	1	0	1	0
Beryllium	38	0.92	1.5	160	10	Plants	7	1	0	0
Cadmium	52	0.75	--	70	32	Plants	1	0	0	0
Chromium (total)	27,000	1,200	30	120,000	30	Background	0	0	0	0
Cobalt	21	3.3	7	23	13	Plants	0	0	0	0
Copper	550	520	15	3,100	61	Earthworms	0	0	2	1
Iron					15,000	Background	–	–	31	4
Lead (inorganic)	500	1.5	15	400	120	Plants	132	32	8	4
Manganese	3,400	580	300	1,800	500	Plants	0	0	0	0
Mercury(pH 4.9)	2.1	0.0039	0.04	5.6	0.1	Earthworms	3	1	1	0
Molybdenum	1600	2.5	--	3,900	2	Plants	1	0	1	0
Nickel	830	79	10	1,500	30	Plants	0	0	0	0
Selenium	310	1.1	0.3	390	1	Plants	0	0	0	0
Silver	95	0.24	--	390	2	Plants	4	0	1	0
Thallium	6.3	0.87	--	--	1	Plants	1	0	0	0
Vanadium	2.9	17	50	5.5	50	Background	0	0	0	0
Zinc	9,900	1,200	30	23,000	120	Earthworms	0	0	0	0

[a] In general, the MDL was above the screening value, but there were some exceedences above the MDL.
NOEC = No Observable Effect Concentration

Table 5-2. Phase 2 Sampling Analytical Data Summary

			CR-IS-AA042-01 N	CR-IS-AJ042-01 N	CR-IS-AJ048-01 N	CR-IS-AK045-01 N	CR-IS-AL039-01 N	CR-IS-AO043-01 N	CR-IS-AQ038-01 N	CR-IS-AT004-01 N	CR-IS-AU005-01 N	CR-IS-AV017-01 N	CR-IS-AV038-01 N	CR-IS-AW045-01 N
			11-Sep-12	11-Sep-12	11-Sep-12	12-Sep-12	12-Sep-12	11-Sep-12	12-Sep-12	11-Sep-12	11-Sep-12	11-Sep-12	12-Sep-12	12-Sep-12
Analyte	**PCL Value**	**PCL Source**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**
Aluminum	64000	TotSoilComb2	**5370 X8**	**5150 X8**	**6030 X8**	**3630 X8**	**8120 X8**	**5720 X8**	**3580 X8**	**5250 X8**	**4970 X8**	**4920 X8**	**4910 X8**	**4010 X8**
Antimony	2.7	GWSoilIng	**0.17 J**	**0.13 J**	**0.16 J**	**0.15 JL**	**0.22 JL**	**0.17 J**	**1.00 JL**	**0.14 J**	**0.098 J**	<0.0950 U	**0.14 JL**	**0.19 JL**
Arsenic	5.9	TX-Sp Bkgd	**0.31 J**	**0.64**	**0.2 J**	**1.4 JL**	<0.0880 U	**1.4**	**1.5 JL**	**2.1**	<0.0880 U	**0.58**	**1.9 JL**	**1.6 JL**
Barium	300	TX-Sp Bkgd	**58.1**	**45.5**	**46.9**	**40.2**	**68.4**	**61.6**	**43.2**	**56.0**	**61.2**	**44.4**	**69.8**	**50.1**
Beryllium	1.5	TX-Sp Bkgd	**0.9**	**0.66**	**0.8**	**0.61 JL**	**0.7**	**0.7**	**0.53 JL**	**1.4**	**1.4**	**1.6**	**0.59 JL**	**0.58 JL**
Cadmium	0.75	GWSoilIng	**0.32 J**	**0.26 J**	**0.37 J**	**0.23 JL**	**0.36 J**	**0.31 J**	**0.18 JL**	**0.42 J**	**0.38 J**	**0.39 J**	**0.22 JL**	**0.28 JL**
Calcium			**35800 X8**	**5240 X8**	**3610 X8**	**8670 X8**	**25600 X8**	**34100 X8**	**20200 X8**	**8390 X8**	**2130 X8**	**2810 X8**	**43700 X8**	**11400 X8**
Chromium (total)	1200	GWSoilIng	**4.2**	**3.6**	**4.7**	**3.6 JL**	**5.8**	**3.9**	**3.0 JL**	**4.7**	**4.0**	**3.5**	**3.0 JL**	**4.0 JL**
Cobalt	7	TX-Sp Bkgd	**2.3**	**1.8**	**2.7**	**2.0 JL**	**2.1**	**2.0**	**1.8 JL**	**3.1**	**2.6**	**2.3**	**1.6 JL**	**2.2 JL**
Copper	520	GWSoilIng	**8.5**	**10.9**	**10.4**	**7.8 JL**	**11.8**	**11.2**	**185 JL**	**10.5**	**9.3**	**8.1**	**10.0 JL**	**10.0 JL**
Iron			**9140 X8**	**13300 X8**	**12700 X8**	**8640 X8**	**12000 X8**	**10400 X8**	**7030 X8**	**13000 X8**	**12600 X8**	**13500 X8**	**7500 X8**	**9010 X8**
Lead	15	TX-Sp Bkgd	**10.7**	**10.5**	**11.7**	**9.7 JL**	**9.8**	**14.0**	**133 JL**	**10.4**	**11.0**	**12.5**	**9.2 JL**	**11.4 JL**
Magnesium			**5630 X8**	**2440 X8**	**3380 X8**	**3060 JLX8**	**5020 X8**	**6180 X8**	**4010 JLX8**	**3300 X8**	**1300 X8**	**1460 X8**	**5920 JLX8**	**3080 JLX8**
Manganese	580	GWSoilIng	**150 X8**	**183 X8**	**206 X8**	**158 X8**	**180 X8**	**169 X8**	**139 X8**	**195 X8**	**321 X8**	**202 X8**	**169 X8**	**162 X8**
Molybdenum	2.5	GWSoilIng	**0.53**	**0.14 J**	**0.38 J**	**0.30 JL**	**0.24 J**	**0.17 J**	**0.17 JL**	**0.45 J**	**0.80**	**0.78**	<0.074 U	**0.23 JL**
Nickel	79	GWSoilIng	**4.6**	**3.8**	**5.4**	**4.2 JL**	**5.1**	**4.1**	**3.7 JL**	**4.9**	**4.1**	**3.7**	**3.6 JL**	**4.5 JL**
Potassium			**1120 X8**	**1060 X8**	**1150 X8**	**808 X8**	**1580 X8**	**1090 X8**	**726 X8**	**1190 X8**	**1200 X8**	**1190 X8**	**997 X8**	**1010 X8**
Selenium	1.1	GWSoilIng	**0.29 J**	**0.31 J**	**0.36 J**	**0.26 JL**	**0.31 J**	**0.33 J**	<0.244 UJL	**0.54**	**0.58**	**0.45 J**	**0.27 JL**	**0.29 JL**
Silver	0.24	GWSoilIng	<0.0360 U	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 U	<0.0360 U	<0.0360 U	**0.072 JL**	<0.0360 UJL
Sodium			**28.5 JX8**	**30.8 JX8**	**32.7 JX8**	**18.0 JLX8**	**40.9 JX8**	**31.9 JX8**	**18.1 JLX8**	**28.7 JX8**	**37.4 JX8**	**33.7 JX8**	**25.8 JLX8**	**23.7 JLX8**
Thallium	0.87	GWSoilIng	<0.206 U	<0.206 U	<0.206 U	<0.206 UJL	<0.206 U	<0.206 U	<0.206 UJL	<0.206 U	<0.206 U	<0.206 U	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-Sp Bkgd	**13.4**	**11.2**	**14.0**	**10.5 JL**	**15.1**	**12.2**	**9.2 JL**	**15.9**	**13.2**	**11.7**	**8.9 JL**	**11.4 JL**
Zinc	1200	GWSoilIng	**33.8**	**20.6**	**31.2**	**21.9 JL**	**23.6**	**21.5**	**39.6 JL**	**24.4**	**32.3**	**37.3**	**17.5 JL**	**22.8 JL**
Mercury	0.04	TX-Sp Bkgd	**0.014 J**	**0.027 J**	**0.017 J**	**0.014 J**	**0.031 J**	**0.024 J**	**0.015 J**	**0.022 J**	**0.018 J**	**0.014 J**	**0.022 J**	**0.015 J**
1,2-Dinitrobenzene	--													
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7
PETN	--		<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-IS-BA066-01 N	CR-IS-BA066-02 FD	CR-IS-BA066-03 FT	CR-IS-BB051-01 N	CR-IS-BB051-02 FD	CR-IS-BB051-03 FT	CR-IS-BB072-01 N	CR-IS-BC058-01 N	CR-IS-BE058-01 N	CR-IS-BG001-01 N	CR-IS-BG002-01 N	CR-IS-BG003-01 N
			10-Sep-12	10-Sep-12	10-Sep-12	12-Sep-12	12-Sep-12	12-Sep-12	10-Sep-12	10-Sep-12	10-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12
			Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Background	Background	Background
Aluminum	64000	TotSoilComb2	**4760 X8**	**4840 X8**	**5570 X8**	**4680 X8**	**6310 X8**	**3470 X8**	**4250 X8**	**4070 X8**	**4210 X8**	**3600 X8**	**8610 X8**	**2730 X8**
Antimony	2.7	GWSoilIng	**1.7**	**3.3**	**4.2**	**0.12 JL**	**0.12 JL**	<0.0950 UJL	**0.11 J**	<0.0950 U	<0.0950 U	**0.16 JL**	**0.32 JL**	<0.0950 UJL
Arsenic	5.9	TX-Sp Bkgd	**1.2**	**1.1**	**1.3**	**0.2 JL**	<0.0880 UJL	**1.3 JL**	**0.86**	**0.20 J**	**0.51**	**0.97 JL**	**3.4 JL**	**1.4 JL**
Barium	300	TX-Sp Bkgd	**47.3**	**46.9**	**50.7**	**42.9**	**47.4**	**36.4**	**39.5**	**36.5**	**37.7**	**47.7**	**62.1**	**37.1**
Beryllium	1.5	TX-Sp Bkgd	**0.7**	**0.7**	**0.8**	**1.3 JL**	**1.3 JL**	**1.1 JL**	**1.1**	**1.0**	**1.4**	**0.41 JL**	**0.57 JL**	**0.45 JL**
Cadmium	0.75	GWSoilIng	**0.28 J**	**0.25 J**	**0.31 J**	**0.34 JL**	**0.34 JL**	**0.26 JL**	**0.27 J**	**0.26 J**	**0.32 J**	**0.24 JL**	**0.32 JL**	**0.25 JL**
Calcium			**13200 X8**	**14100 X8**	**14800 X8**	**3480 JX8**	**6780 JX8**	**3260 JX8**	**1250 X8**	**5490 X8**	**2380 X8**	**7670 X8**	**5600 X8**	**12900 X8**
Chromium (total)	1200	GWSoilIng	**4.0**	**4.0**	**4.3**	**3.5 JL**	**4.0 JL**	**3.0 JL**	**4.0**	**3.5**	**3.3**	**4.3 JL**	**11.1 JL**	**3.0 JL**
Cobalt	7	TX-Sp Bkgd	**1.9**	**1.7**	**2.0**	**2.2 JL**	**2.2 JL**	**2.1 JL**	**2.1**	**1.8**	**2.1**	**1.9 JL**	**2.6 JL**	**1.6 JL**
Copper	520	GWSoilIng	**15.0**	**12.9**	**15.8**	**7.5 JL**	**8.3 JL**	**7.3 JL**	**7.4**	**7.1**	**6.7**	**7.8 JL**	**13.0 JL**	**8.2 JL**
Iron			**8920 X8**	**8800 X8**	**9790 X8**	**12400 X8**	**13300 X8**	**9520 X8**	**10200 X8**	**10000 X8**	**12900 X8**	**7730 X8**	**13500 X8**	**7600 X8**
Lead	15	TX-Sp Bkgd	**91.3**	**150**	**152**	**10.4 JL**	**12.9 JL**	**9.3 JL**	**9.3**	**8.5**	**8.5**	**8.7**	**17.5 JL**	**8.7**
Magnesium			**3010 X8**	**3100 X8**	**3400 X8**	**1480 X8**	**2330 X8**	**1350 X8**	**1160 X8**	**1520 X8**	**1330 X8**	**1970 JLX8**	**2830 JLX8**	**5720 JLX8**
Manganese	580	GWSoilIng	**135 X8**	**135 X8**	**163 X8**	**159 X8**	**214 X8**	**157 X8**	**170 X8**	**129 X8**	**162 X8**	**132 X8**	**196 X8**	**131 X8**
Molybdenum	2.5	GWSoilIng	**0.25 J**	**0.27 J**	**0.31 J**	**0.60**	**0.58**	**0.54**	**0.46 J**	**0.50**	**0.77**	**0.24 JL**	**0.26 JL**	**0.32 JL**
Nickel	79	GWSoilIng	**3.9**	**3.9**	**4.2**	**3.8 JL**	**3.9 JL**	**3.2 JL**	**3.8**	**3.3**	**3.5**	**4.2 JL**	**5.8 JL**	**3.0 JL**
Potassium			**1110 X8**	**1090 X8**	**1210 X8**	**1210 X8**	**1220 X8**	**922 X8**	**1080 X8**	**1010 X8**	**1030 X8**	**902 X8**	**1790 X8**	**706 X8**
Selenium	1.1	GWSoilIng	<0.244 U	**0.39 J**	**0.46 J**	**0.36 JL**	**0.33 JL**	**0.31 JL**	**0.25 J**	<0.244 U	<0.244 U	**0.25 JL**	<0.244 U	**0.28 JL**
Silver	0.24	GWSoilIng	<0.0360 U	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium			**25.1 JX8**	**25.7 JX8**	**27.6 JX8**	**30.4 JLX8**	**32.5 JLX8**	**20.4 JLX8**	**21.3 JX8**	**27.6 JX8**	**32.2 JX8**	**19.2 JLX8**	**42.0 JLX8**	**25.9 JLX8**
Thallium	0.87	GWSoilIng	<0.206 U	<0.206 U	<0.206 U	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 U	<0.206 U	<0.206 U	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-Sp Bkgd	**11.0**	**11.0**	**11.7**	**12.0 JL**	**12.6 JL**	**9.6 JL**	**11.4**	**10.6**	**12.4**	**9.9 JL**	**21.7 JL**	**8.5 JL**
Zinc	1200	GWSoilIng	**23.0**	**23.9**	**30.6**	**29.0 JL**	**28.9 JL**	**24.8 JL**	**24.5**	**23.8**	**28.4**	**16.5 JL**	**27.6 JL**	**17.0 JL**
Mercury	0.04	TX-Sp Bkgd	**0.020 J**	**0.021 J**	**0.019 J**	**0.012 U**	**0.014 U**	**0.010 U**	**0.015 J**	**0.014 J**	<0.010 U	**0.017 U**	**0.019 U**	**0.013 U**
1,2-Dinitrobenzene	--													
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U			
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U			
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U			
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U			
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U			
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U			
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U			
3,5-DNA	--		<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7			
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U			
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U			
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U			
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U			
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U			
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7			
PETN	--		<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7			
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U			
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U			

Analyte	PCL Value	PCL Source	CR-IS-BG004-01 N	CR-IS-BG-005-01 N	CR-IS-BG-006-01 N	CR-IS-BG007-01 N	CR-IS-BG008-01 N	CR-IS-BG009-01 N	CR-IS-BG010-01 N	CR-IS-BG011-01 N	CR-IS-BG012-01 N	CR-IS-BG012-02 FD	CR-IS-BG012-03 FT	CR-IS-BG25-01 N
			14-Sep-12	13-Sep-12	13-Sep-12	12-Sep-12	12-Sep-12	14-Sep-12	14-Sep-12	12-Sep-12	12-Sep-12	12-Sep-12	12-Sep-12	14-Sep-12
			Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
Aluminum	64000	TotSoilComb2	**7380 X8**	**2930 X8**	**3230 X8**	**3360 X8**	**3310 X8**	**8290 X8**	**3380 X8**	**4210 X8**	**3390 X8**	**3870 X8**	**2870 X8**	**8630 X8**
Antimony	2.7	GWSoilIng	**0.27 JL**	**0.17 J**	<0.0950 U	**0.19 JL**	**0.19 JL**	**0.24 JL**	**0.16 JL**	**0.17 JL**	**0.14 JL**	**0.20 JL**	**0.18 JL**	**0.32 JL**
Arsenic	5.9	TX-Sp Bkgd	**3.1 JL**	**0.9**	**3.1**	**1.5 JL**	**1.6 JL**	**3.1 JL**	**0.94 JL**	**1.4 JL**	**1.6 JL**	**1.8 JL**	**1.5 JL**	**5.7 JL**
Barium	300	TX-Sp Bkgd	**52.6**	**38.7**	**39.3**	**41.6**	**46.7**	**59.7**	**49.0**	**63.2**	**44.1**	**52.9**	**39.1**	**62.0**
Beryllium	1.5	TX-Sp Bkgd	**0.52 JL**	**0.4**	**0.4**	**0.44 JL**	**0.38 JL**	**0.57 JL**	**0.37 JL**	**0.44 JL**	**0.45 JL**	**0.5 JL**	**0.41 JL**	**0.51 JL**
Cadmium	0.75	GWSoilIng	**0.27 JL**	**0.22 J**	**0.25 J**	**0.23 JL**	**0.18 JL**	**0.28 JL**	**0.19 JL**	**0.22 JL**	**0.22 JL**	**0.26 JL**	**0.21 JL**	**0.37 JL**
Calcium			**5190 X8**	**5390 X8**	**7720 X8**	**10600 X8**	**8910 X8**	**6580 X8**	**14800 X8**	**22600 X8**	**6370 X8**	**8290 X8**	**6060 X8**	**3410 X8**
Chromium (total)	1200	GWSoilIng	**7.7 JL**	**3.8**	**3.9**	**3.6 JL**	**3.7 JL**	**10.5 JL**	**3.7 JL**	**3.7 JL**	**4.1 JL**	**4.0 JL**	**3.5 JL**	**11.9 JL**
Cobalt	7	TX-Sp Bkgd	**2.4 JL**	**1.7**	**1.8**	**1.8 JL**	**1.6 JL**	**2.6 JL**	**1.8 JL**	**2.0 JL**	**1.8 JL**	**2.0 JL**	**1.6 JL**	**4.9 JL**
Copper	520	GWSoilIng	**10.2 JL**	**7.2**	**7.9**	**8.4 JL**	**6.8 JL**	**11.3 JL**	**7.1 JL**	**8.9 JL**	**7.5 JL**	**8.9 JL**	**7.4 JL**	**19.9 JL**
Iron			**11900 X8**	**6590 X8**	**7670 X8**	**7140 X8**	**7000 X8**	**13000 X8**	**7140 X8**	**8060 X8**	**7470 X8**	**8990 X8**	**6520 X8**	**16000 X8**
Lead	15	TX-Sp Bkgd	**14.3 JL**	**8.5**	**9.0**	**9.3 JL**	**7.9 JL**	**15.1 JL**	**7.3**	**8.7 JL**	**9.1 JL**	**10.2 JL**	**9.0 JL**	**18.1 JL**
Magnesium			**2370 JLX8**	**1650 X8**	**3010 X8**	**3680 JLX8**	**2050 JLX8**	**3010 JLX8**	**3030 JLX8**	**5660 JLX8**	**2740 JLX8**	**3420 JLX8**	**2520 JLX8**	**2330 JLX8**
Manganese	580	GWSoilIng	**158 X8**	**113 X8**	**120 X8**	**145 X8**	**137 X8**	**185 X8**	**129 X8**	**194 X8**	**161 X8**	**189 X8**	**139 X8**	**204 X8**
Molybdenum	2.5	GWSoilIng	**0.30 JL**	**0.23 J**	**0.28 J**	**0.26 JL**	**0.24 JL**	**0.23 JL**	**0.16 JL**	**0.15 JL**	**0.30 JL**	**0.32 JL**	**0.25 JL**	**0.89**
Nickel	79	GWSoilIng	**5.9**	**4.0**	**3.7**	**3.6 JL**	**3.6 JL**	**5.7 JL**	**3.8 JL**	**3.8 JL**	**3.7 JL**	**4.0 JL**	**3.4 JL**	**8.1 JL**
Potassium			**1570 X8**	**782 X8**	**818 X8**	**810 X8**	**708 X8**	**2150 X8**	**867 X8**	**812 X8**	**755 X8**	**834 X8**	**661 X8**	**2310 X8**
Selenium	1.1	GWSoilIng	<0.244 UJL	<0.244 U	<0.244 U	**0.41 JL**	<0.244 U	<0.244 U	**0.26 JL**	<0.244 U	**0.31 JL**	**0.38 JL**	**0.28 JL**	**0.36 JL**
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium			**33.1 JLX8**	**18.1 JX8**	**19.1 JX8**	**17.5 JLX8**	**14.1 JLX8**	**38.4 JLX8**	**21.2 JLX8**	**21.6 JLX8**	**15.6 JLX8**	**17.7 JLX8**	**14.9 JLX8**	**37.4 JLX8**
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 U	<0.206 U	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-Sp Bkgd	**18.8 JL**	**8.7**	**9.6**	**9.1 JL**	**8.3 JL**	**21.5 JL**	**10.3 JL**	**12.2 JL**	**8.8 JL**	**9.9 JL**	**8.0 JL**	**26.7 JL**
Zinc	1200	GWSoilIng	**22.9 JL**	**15.2**	**16.3**	**16.0 JL**	**13.4 JL**	**27.3 JL**	**16.9 JL**	**20.0 JL**	**16.2 JL**	**18.4 JL**	**15.6 JL**	**37.0 JL**
Mercury	0.04	TX-Sp Bkgd	**0.017 U**	**0.017 U**	**0.018 U**	**0.017 J**	**0.020 J**	**0.017 U**	**0.016 U**	**0.020 J**	**0.016 J**	**0.019 J**	**0.017 J**	**0.021 U**
1,2-Dinitrobenzene	--													
1,3,5-Trinitrobenzene	0.91	GWSoilIng												
1,3-Dinitrobenzene	0.0038	GWSoilIng												
2,4,6-Trinitrotoluene	0.086	GWSoilIng												
2,4-Dinitrotoluene	0.0027	GWSoilIng												
2,6-Dinitrotoluene	0.0024	GWSoilIng												
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng												
2-Nitrotoluene	--													
3,5-DNA	--													
3-Nitrotoluene	--													
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng												
4-Nitrotoluene	--													
HMX	1.2	GWSoilIng												
Nitrobenzene	--													
Nitroglycerin	6.1	EPA Res Scrn												
PETN	--													
RDX	0.018	GWSoilIng												
Tetryl	0.55	GWSoilIng												

			CR-IS-BG28-01 N	**CR-IS-BI072-01 N**	**CR-IS-BM073-01 N**	**CR-IS-BP063-01 N**	**CR-IS-BY072-01 N**	**CR-IS-CA070-01 N**	**CR-IS-CE056-01 N**	**CR-IS-CE056-02 FD**	**CR-IS-CE056-03 FT**	**CR-IS-CH054-01 N**	**CR-IS-CK040-01 N**	**CR-IS-CL065-01 N**
	PCL		**14-Sep-12**	**12-Sep-12**	**10-Sep-12**	**12-Sep-12**	**12-Sep-12**	**14-Sep-12**	**13-Sep-12**	**13-Sep-12**	**13-Sep-12**	**13-Sep-12**	**14-Sep-12**	**13-Sep-12**
Analyte	**Value**	**PCL Source**	**Background**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**	**Low Stratum**
Aluminum	64000	TotSoilComb2	**8430 X8**	**2900 X8**	**3810 X8**	**3570 X8**	**2870 X8**	**5340 X8**	**3060 X8**	**2680 X8**	**3470 X8**	**8640 X8**	**8430 X8**	**7930 X8**
Antimony	2.7	GWSoilIng	**0.29 JL**	**0.11 JL**	<0.0950 U	<0.0950 UJL	**0.38 JL**	**0.26 JL**	**0.16 J**	**0.11 J**	**0.22 J**	**0.47 JL**	**0.34 JL**	**0.47 JL**
Arsenic	5.9	TX-Sp Bkgd	**3.8 JL**	**1.3 JL**	**0.47 J**	**0.82 JL**	**1.0 JL**	**4.1 JL**	**1.3**	**2.4**	**1.8**	<0.0880 UJL	**4.5 JL**	<0.0880 UJL
Barium	300	TX-Sp Bkgd	**64.6**	**38.5**	**38.1**	**55.5**	**40.9**	**59.2**	**54.6**	**51.4**	**61.1**	**61.8**	**70.4**	**45.6**
Beryllium	1.5	TX-Sp Bkgd	**0.46 JL**	**0.86 JL**	**1.1**	**1.2 JL**	**0.96 JL**	**1.0 JL**	**0.76**	**0.77**	**0.92**	**0.69 JL**	**0.72 JL**	**0.63 JL**
Cadmium	0.75	GWSoilIng	**0.34 JL**	**0.23 JL**	**0.26 J**	**0.35 JL**	**0.28 JL**	**0.33 JL**	**0.38 J**	**0.36 J**	**0.46 J**	**0.64 JL**	**0.43 JL**	**0.46 JL**
Calcium			**4100 X8**	**1450 X8**	**1620 X8**	**2180 X8**	**1360 X8**	**9400 X8**	**16100 X8**	**18000 X8**	**21800 X8**	**2490 X8**	**3360 X8**	**1590 X8**
Chromium (total)	1200	GWSoilIng	**11.6 JL**	**3.3 JL**	**3.7**	**3.2 JL**	**3.6 JL**	**5.8 JL**	**4.0**	**3.6**	**4.1**	**9.4 JL**	**12.8 JL**	**8.4 JL**
Cobalt	7	TX-Sp Bkgd	**3.1 JL**	**1.7 JL**	**1.5**	**1.7 JL**	**1.6 JL**	**2.4 JL**	**2.4**	**2.7**	**2.7**	**3.2 JL**	**3.7 JL**	**2.8 JL**
Copper	520	GWSoilIng	**15.0 JL**	**6.7 JL**	**6.9**	**9.0 JL**	**13.8 JL**	**8.6 JL**	**10.1**	**9.2**	**10.5**	**23.6 JL**	**15.5 JL**	**15.9 JL**
Iron			**12700 X8**	**8040 X8**	**9460 X8**	**9430 X8**	**7780 X8**	**15100 X8**	**10400 X8**	**10100 X8**	**12700 X8**	**14400 X8**	**15200 X8**	**12600 X8**
Lead	15	TX-Sp Bkgd	**18.1 JL**	**10.0 JL**	**9.8**	**15.9 JL**	**32.0 JL**	**23.6 JL**	**13.3 J**	**11.2 J**	**26.7 J**	**31.8**	**23.6 JL**	**30.5**
Magnesium			**2360 JLX8**	**963 JLX8**	**962 X8**	**1120 JLX8**	**870 JLX8**	**2600 JLX8**	**3170 X8**	**3050 X8**	**3870 X8**	**2240 X8**	**2610 JLX8**	**1630 X8**
Manganese	580	GWSoilIng	**184 X8**	**140 X8**	**133 X8**	**204 X8**	**160 X8**	**260 X8**	**264 X8**	**262 X8**	**316 X8**	**242 X8**	**258 X8**	**182 X8**
Molybdenum	2.5	GWSoilIng	**0.24 JL**	**0.38 JL**	**0.50**	**0.55**	**0.41 JL**	**0.58**	**0.44 J**	**0.50**	**0.52**	**0.38 JL**	**0.27 JL**	**0.25 JL**
Nickel	79	GWSoilIng	**7.0 JL**	**3.3 JL**	**3.2**	**3.3 JL**	**3.2 JL**	**4.5 JL**	**4.5**	**4.2**	**4.7**	**6.4 JL**	**7.1 JL**	**5.7 JL**
Potassium			**2190 X8**	**850 X8**	**1070 X8**	**1120 X8**	**921 X8**	**1480 X8**	**1070 X8**	**979 X8**	**1210 X8**	**1850 X8**	**2270 X8**	**1890 X8**
Selenium	1.1	GWSoilIng	<0.244 UJL	**0.25 JL**	**0.27 J**	**0.38 JL**	<0.244 UJL	<0.244 UJL	**0.44 J**	**0.56**	**0.42 J**	**0.59 JL**	**0.30 JL**	**0.55 JL**
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 U	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium			**35.4 JLX8**	**17.4 JLX8**	**18.1 JX8**	**22.1 JLX8**	**15.8 JLX8**	**67.0 JLX8**	**37.5 JX8**	**37.2 JX8**	**48.3 JX8**	**47.0 JX8**	**56.6 JLX8**	**37.8 JX8**
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 UJL	<0.206 U	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 U	<0.206 U	<0.206 U	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-Sp Bkgd	**21.8 JL**	**8.5 JL**	**9.3**	**8.2 JL**	**8.0 JL**	**17.3 JL**	**10.8**	**10.1**	**12.7**	**20.8 JL**	**26.4 JL**	**17.9 JL**
Zinc	1200	GWSoilIng	**29.7 JL**	**22.1 JL**	**25.1**	**39.1 JL**	**32.7 JL**	**59.0 JL**	**54.0**	**50.2**	**58.1**	**46.8 JL**	**50.1 JL**	**36.5 JL**
Mercury	0.04	TX-Sp Bkgd	**0.026 U**	**0.013 J**	**0.013 J**	**0.015 J**	**0.016 J**	<0.010 U	**0.012 U**	**0.012 U**	**0.011 U**	**0.038 J**	**0.028 U**	**0.028 J**
1,2-Dinitrobenzene	--													
1,3,5-Trinitrobenzene	0.91	GWSoilIng		<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng		<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng		<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng		<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng		<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--			<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--			<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7
3-Nitrotoluene	--			<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--			<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--			<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn		<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7
PETN	--			<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7
RDX	0.018	GWSoilIng		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng		<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-IS-CM072-01 N	CR-IS-CO048-01 N	CR-IS-CO062-01 N	CR-IS-CO062-02 FD	CR-IS-CO062-03 FT	CR-IS-CQ072-01 N	CR-IS-CS059-01 N	CR-IS-CU071-01 N	CR-IS-CV055-01 N	CR-IS-CV063-01 N	CR-IS-DA053-01 N
			14-Sep-12	13-Sep-12	13-Sep-12	13-Sep-12	13-Sep-12	13-Sep-12	13-Sep-12	13-Sep-12	13-Sep-12	13-Sep-12	14-Sep-12
			Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum	Low Stratum
Aluminum	64000	TotSoilComb2	**7320 X8**	**8380 X8**	**6990 X8**	**7990 X8**	**7210 X8**	**7180 X8**	**7150 X8**	**6830 X8**	**6980 X8**	**7140 X8**	**3580 X8**
Antimony	2.7	GWSoilIng	**0.65 JL**	**0.43 JL**	**0.29 JL**	**0.35 JL**	**0.30 JL**	**0.48 JL**	**0.43 JL**	**1.00 JL**	**0.50 JL**	**0.70 JL**	**0.23 JL**
Arsenic	5.9	TX-Sp Bkgd	**3.5 JL**	<0.0880 UJL	<0.0880 UJL	<0.0880 UJL	**0.15 UJL**	<0.0880 UJL	<0.0880 UJL	<0.0880 UJL	<0.0880 UJL	<0.0880 UJL	**1.3 JL**
Barium	300	TX-Sp Bkgd	**52.7**	**48.4**	**45.8**	**48.9**	**51.4**	**56.9**	**55.9**	**48.8**	**57.2**	**58.2**	**42.2**
Beryllium	1.5	TX-Sp Bkgd	**0.66 JL**	**0.67 JL**	**0.62 JL**	**0.62 JL**	**0.68 JL**	**0.64 JL**	**0.65 JL**	**0.63 JL**	**0.60 JL**	**0.68 JL**	**0.55 JL**
Cadmium	0.75	GWSoilIng	**0.40 JL**	**0.47 JL**	**0.40 JL**	**0.44 JL**	**0.45 JL**	**0.59 JL**	**0.58 JL**	**0.52 JL**	**0.66 JL**	**0.64 JL**	**0.39 JL**
Calcium			**3540 X8**	**1970 X8**	**1450 X8**	**1630 X8**	**1610 X8**	**4710 X8**	**4240 X8**	**1870 X8**	**4490 X8**	**3700 X8**	**6690 X8**
Chromium (total)	1200	GWSoilIng	**7.8 JL**	**8.9 JL**	**7.9 JL**	**9.1 JL**	**8.4 JL**	**7.2 JL**	**7.4**	**7.7 JL**	**7.3 JL**	**7.6 JL**	**4.2 JL**
Cobalt	7	TX-Sp Bkgd	**3.2 JL**	**2.9 JL**	**2.8 JL**	**3.0 JL**	**3.2 JL**	**3.3 JL**	**3.5 JL**	**3.2 JL**	**3.1 JL**	**3.3 JL**	**2.7 JL**
Copper	520	GWSoilIng	**14.8 JL**	**13.4 JL**	**11.7 JL**	**12.7 JL**	**13.3 JL**	**15.9 JL**	**16.1 JL**	**15.1 JL**	**17.9 JL**	**16.7 JL**	**11.6 JL**
Iron			**13700 X8**	**13800 X8**	**11800 X8**	**12800 X8**	**13000 X8**	**14700 X8**	**14600 X8**	**14200 X8**	**13900 X8**	**14500 X8**	**9490 X8**
Lead	15	TX-Sp Bkgd	**33.2 JL**	**16.5**	**13.7**	**14.9**	**15.3**	**33.6**	**35.5**	**101.0**	**33.7**	**38.1**	**13.4**
Magnesium			**2720 JLX8**	**1860 X8**	**1570 X8**	**1750 X8**	**1710 X8**	**3650 X8**	**3570 X8**	**2270 X8**	**3460 X8**	**3230 X8**	**3090 JLX8**
Manganese	580	GWSoilIng	**198 X8**	**187 X8**	**177 X8**	**189 X8**	**201 X8**	**236 X8**	**236 X8**	**212 X8**	**226 X8**	**243 X8**	**174 X8**
Molybdenum	2.5	GWSoilIng	**0.21 JL**	**0.25 JL**	**0.23 JL**	**0.20 JL**	**0.26 JL**	**0.25 JL**	**0.26 JL**	**0.27 JL**	**0.27 JL**	**0.28 JL**	**0.23 JL**
Nickel	79	GWSoilIng	**6.4 JL**	**6.1 JL**	**5.6 JL**	**6.1 JL**	**6.0 JL**	**6.7 JL**	**6.9 JL**	**6.1 JL**	**6.4 JL**	**6.6 JL**	**4.9 JL**
Potassium			**2110 X8**	**1850 X8**	**1830 X8**	**1960 X8**	**1900 X8**	**1750 X8**	**1680 X8**	**1720 X8**	**1690 X8**	**1750 X8**	**1090 X8**
Selenium	1.1	GWSoilIng	<0.244 UJL	**0.51 JL**	**0.37 JL**	**0.39 JL**	**0.58 JL**	**0.55 JL**	**0.58 JL**	**0.66 JL**	**0.63 JL**	**0.56 JL**	**0.32 JL**
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Sodium			**63.0 JLX8**	**36.4 JX8**	**28.4 JX8**	**31.4 JX8**	**29.1 JX8**	**77.4 JX8**	**84.8 JX8**	**45.1 JX8**	**72.6 JX8**	**73.7 JX8**	**35.0 JLX8**
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	50	TX-Sp Bkgd	**20.3 JL**	**19.9 JL**	**16.8 JL**	**17.7 JL**	**17.5 JL**	**17.4 JL**	**18.4 JL**	**17.9 JL**	**17.1 JL**	**18.3 JL**	**11.4 JL**
Zinc	1200	GWSoilIng	**36.8 JL**	**31.8 JL**	**28.7 JL**	**30.0 JL**	**29.6 JL**	**39.9 JL**	**41.7 JL**	**36.6 JL**	**40.8 JL**	**41.8 JL**	**27.8 JL**
Mercury	0.04	TX-Sp Bkgd	**0.019 U**	**0.025 J**	**0.023 J**	**0.025 J**	**0.024 J**	**0.021 J**	**0.022 J**	**0.017 J**	**0.029 J**	**0.028 J**	**0.023 U**
1,2-Dinitrobenzene	--												
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7
PETN	--		<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Analyte	PCL Value	PCL Source	CR-IS-DF059-01 N 14-Sep-12 Low Stratum	CR-IS-DJ063-01 N 14-Sep-12 Low Stratum	CR-IS-DN062-01 N 14-Sep-12 Low Stratum	CR-IS-DO066-01 N 12-Sep-12 Low Stratum	CR-IS-DR059-01 N 12-Sep-12 Low Stratum	CR-IS-DR059-02 FD 12-Sep-12 Low Stratum	CR-IS-DR059-03 FT 12-Sep-12 Low Stratum	CR-IS-DV051-01 N 14-Sep-12 Low Stratum	CR-IS-DV057-01 N 14-Sep-12 Low Stratum
Aluminum	64000	TotSoilComb2	**6500 X8**	**6090 X8**	**7600 X8**	**8170 X8**	**3860 X8**	**7120 X8**	**3880 X8**	**4510 X8**	**3690 X8**
Antimony	2.7	GWSoilIng	**0.40 JL**	**0.22 JL**	**0.27 JL**	**0.20 JL**	**0.30 JL**	**0.36 JL**	**0.30 JL**	**1.9 JL**	**0.32 JL**
Arsenic	5.9	TX-Sp Bkgd	**4.2 JL**	**3.2 JL**	**3.8 JL**	**3.8 JL**	**3.1 JL**	**0.8 JL**	**2.9 JL**	**2.3 JL**	**2.7 JL**
Barium	300	TX-Sp Bkgd	**47.1**	**52.0**	**57.5**	**119.0**	**48.6**	**48.5**	**47.0**	**54.2**	**41.0**
Beryllium	1.5	TX-Sp Bkgd	**0.63 JL**	**0.61 JL**	**0.67 JL**	**0.88 JL**	**0.43 JL**	**0.51 JL**	**0.43 JL**	**0.40 JL**	**0.41 JL**
Cadmium	0.75	GWSoilIng	**0.43 JL**	**0.37 JL**	**0.46 JL**	**0.43 JL**	**0.41 JL**	**0.47 JL**	**0.41 JL**	**0.37 JL**	**0.46 JL**
Calcium			**1580 X8**	**6500 X8**	**4320 X8**	**35300 X8**	**2530 X8**	**2000 X8**	**1980 X8**	**5550 X8**	**1970 X8**
Chromium (total)	1200	GWSoilIng	**7.6 JL**	**6.6 JL**	**10.5**	**5.7 JL**	**5.1 JL**	**7.8 JL**	**5.3 JL**	**5.3 JL**	**5.3 JL**
Cobalt	7	TX-Sp Bkgd	**3.0 JL**	**3.1 JL**	**3.5 JL**	**4.2 JL**	**2.5 JL**	**2.8 JL**	**2.5 JL**	**2.8 JL**	**2.4 JL**
Copper	520	GWSoilIng	**32.5 JL**	**15.0 JL**	**15.7 JL**	**16.6 JL**	**14.4 JL**	**15.2 JL**	**14.6 JL**	**18.3 JL**	**15.6 JL**
Iron			**12600 X8**	**12700 X8**	**15400 X8**	**12200 X8**	**8190 X8**	**11200 X8**	**8440 X8**	**8180 X8**	**8250 X8**
Lead	15	TX-Sp Bkgd	**39.5 JL**	**23 JL**	**24.5 JL**	**16.3 JL**	**18.2 JL**	**26.9 JL**	**18.9 JL**	**132.0**	**26.1**
Magnesium			**1560 JLX8**	**2840 JLX8**	**3060 JLX8**	**7560 JLX8**	**1610 JLX8**	**1970 JLX8**	**1540 JLX8**	**2070 JLX8**	**1420 JLX8**
Manganese	580	GWSoilIng	**185 X8**	**192 X8**	**214 X8**	**401 X8**	**187 X8**	**181 X8**	**178 X8**	**164 X8**	**152 X8**
Molybdenum	2.5	GWSoilIng	**0.19 JL**	**0.18 JL**	**0.21 JL**	**0.12 JL**	**0.24 JL**	**0.26 JL**	**0.24 JL**	**0.20 JL**	**0.24 JL**
Nickel	79	GWSoilIng	**5.3 JL**	**5.6 JL**	**7.1 JL**	**7.2 JL**	**5.0 JL**	**6.1 JL**	**5.0 JL**	**6.0 JL**	**4.7 JL**
Potassium			**1590 X8**	**1530 X8**	**2120 X8**	**1900 X8**	**1070 X8**	**1710 X8**	**1050 X8**	**1240 X8**	**1030 X8**
Selenium	1.1	GWSoilIng	**0.30 JL**	<0.244 UJL	<0.244 UJL	**0.56 JL**	**0.33 JL**	**0.57 JL**	**0.37 JL**	**0.55 JL**	**0.37 JL**
Silver	0.24	GWSoilIng	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 UJL
Sodium			**32.2 JLX8**	**48.0 JLX8**	**67.8 JLX8**	**44.5 JLX8**	**16.0 JLX8**	**29.6 JLX8**	**16.1 JLX8**	**23.3 JLX8**	**20.1 JLX8**
Thallium	0.87	GWSoilIng	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 U	<0.206 UJL
Vanadium	50	TX-Sp Bkgd	**19.4 JL**	**17.7 JL**	**23.1 JL**	**14.8 JL**	**11.3 JL**	**15.4 JL**	**11.7 JL**	**12.8 JL**	**12.0 JL**
Zinc	1200	GWSoilIng	**33.4 JL**	**32.9 JL**	**52.1 JL**	**38.0 JL**	**23.6 JL**	**28.7 JL**	**24.3 JL**	**28.3 JL**	**27.1 JL**
Mercury	0.04	TX-Sp Bkgd	**0.022 U**	**0.019 U**	**0.016 U**	**0.043 J**	**0.026 J**	**0.029 J**	**0.028 J**	**0.021 U**	**0.028 U**
1,2-Dinitrobenzene	--										
1,3,5-Trinitrobenzene	0.91	GWSoilIng	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U	<0.0790 U
1,3-Dinitrobenzene	0.0038	GWSoilIng	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U	<0.0630 U
2,4,6-Trinitrotoluene	0.086	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,4-Dinitrotoluene	0.0027	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2,6-Dinitrotoluene	0.0024	GWSoilIng	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U	<0.0830 U
2-Amino-4,6-dinitrotoluene	0.05	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
2-Nitrotoluene	--		<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U	<0.0660 U
3,5-DNA	--		<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7	<0.0800 UX7
3-Nitrotoluene	--		<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U	<0.0710 U
4-Amino-2,6-dinitrotoluene	0.033	GWSoilIng	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
4-Nitrotoluene	--		<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
HMX	1.2	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Nitrobenzene	--		<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U	<0.0750 U
Nitroglycerin	6.1	EPA Res Scrn	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7	<0.0850 UX7
PETN	--		<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7	<0.579 UX7
RDX	0.018	GWSoilIng	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U	<0.0800 U
Tetryl	0.55	GWSoilIng	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U	<0.0910 U

Bold = analyte detected
Shaded = analyte detected above PCL, or not detected with detection limit above PCL
Refer to Table 4-1 for a listing of Residential Soil PCLs
-- = TRRP Tier I Residential Soil PCL not selected for this project
J = Estimated
JH = Estimated, potentially biased high

JL = Estimated, potentially biased low
N = Normal; FD = field duplicate; FR = field replicate; FT = field triplicate
R = Rejected
U = Not detected at the stated detection limit
X7 = TCEQ does not offer accreditation for analyte
X8 = Laboratory is not accredited for analyte by this method, although accreditation is offered

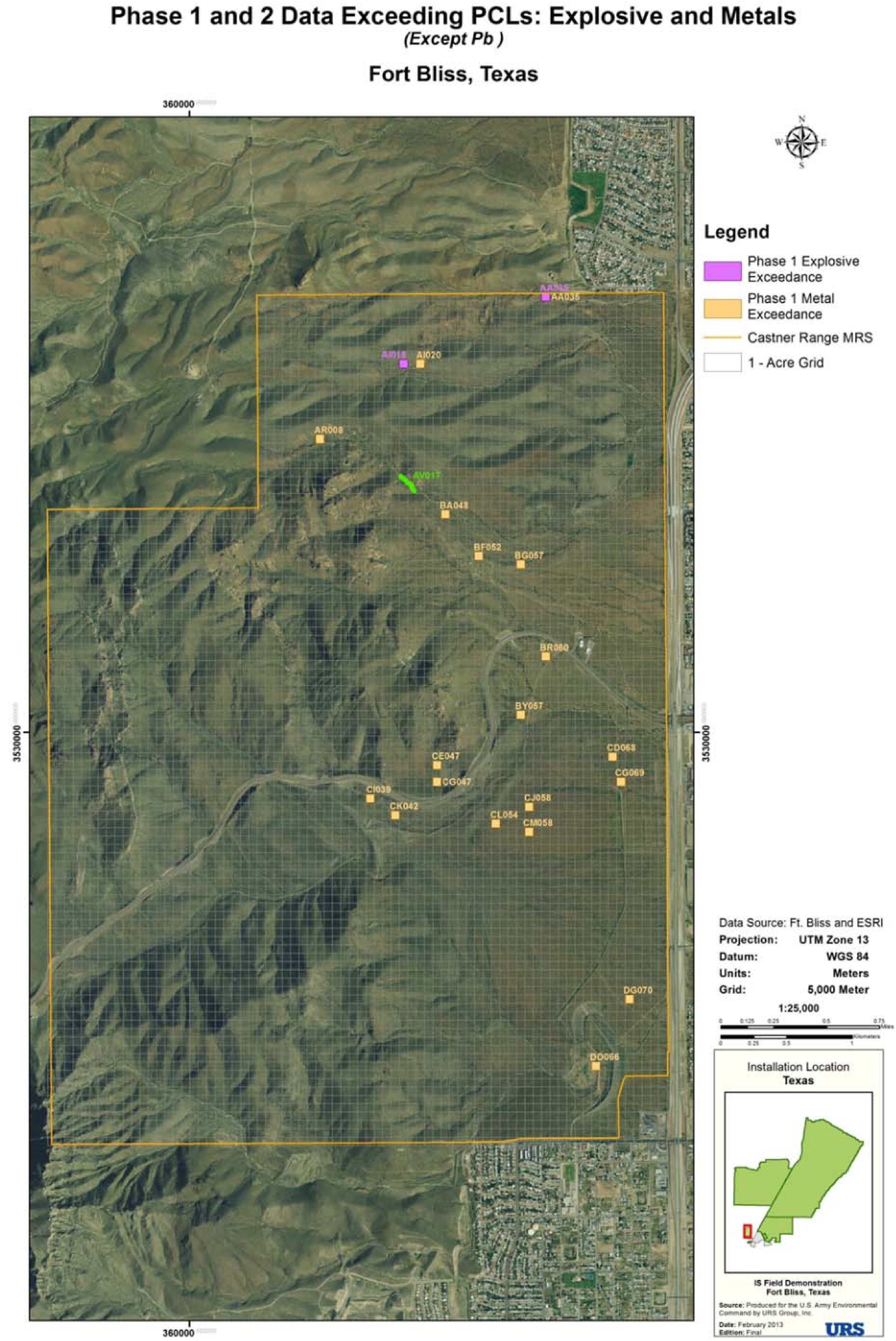


Figure 5-1. Phase 1 and Phase 2 Data Exceeding PCLs: Explosives and Metals (Excluding Lead)

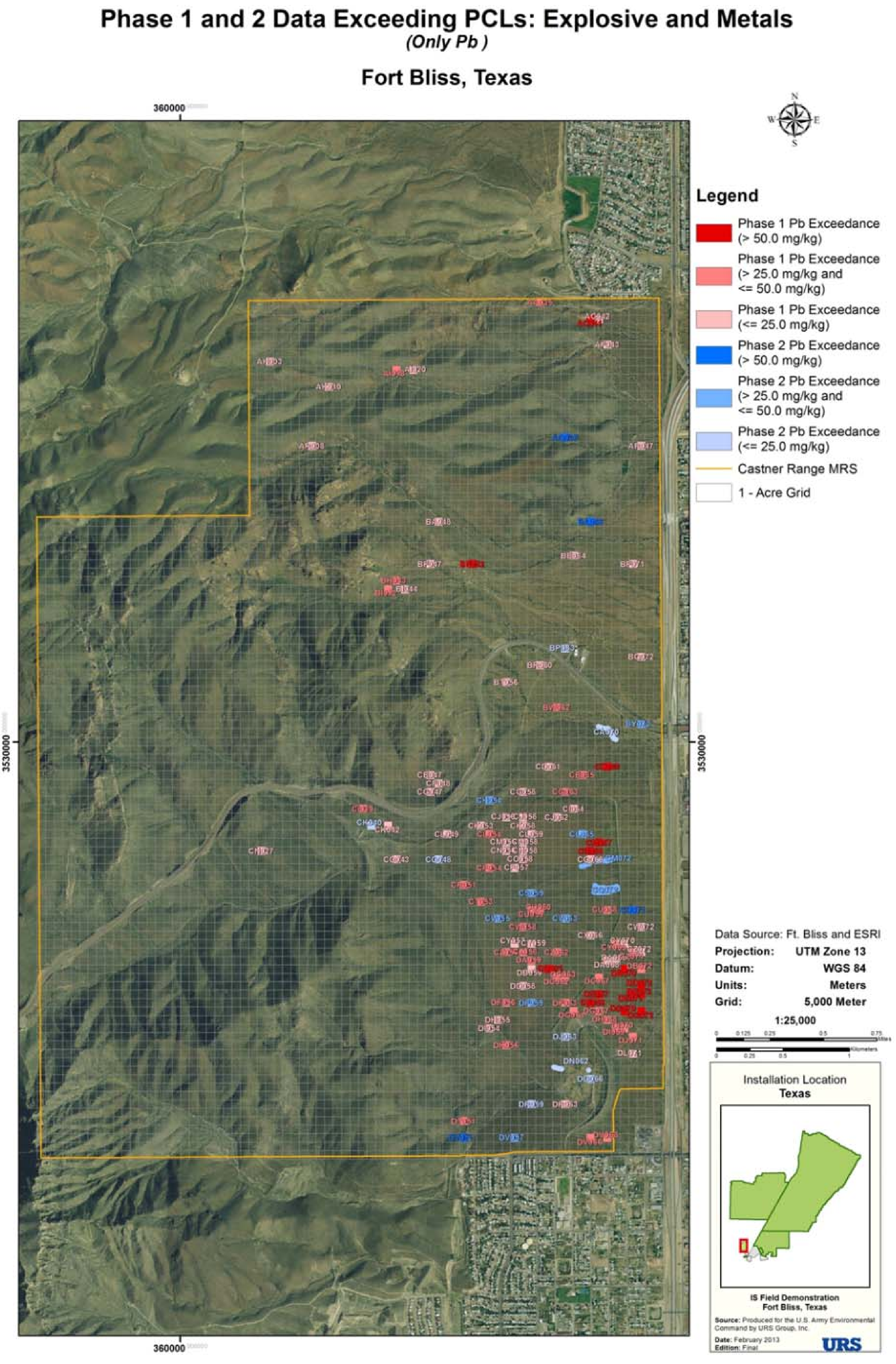


Figure 5-2. Phase 1 and Phase 2 Data Exceeding PCLs: Lead Only

There were no new exceedences of explosives in the Phase 2 data, and very few overall for both rounds (Table 5-2). Phase 2 data included two new exceedences for antimony, one for beryllium, one for mercury, and 32 for lead; these results are similar to the Phase 1 results.

5.1 Updated Statistical Evaluation

The Phase 2 data were used to update the statistical analyses described in Section 4.5.3. The analysis on distribution of metals by soil type, and the analysis comparing metals distribution among Areas A, B, and C, were not updated because the initial analysis answered the original questions. The analysis on distinctions between target areas and suspected target areas plus nontargets areas was updated to the extent needed to re-krig the metals data.

5.1.1 Site-specific Background Calculations

TRRP specifies a method for collecting samples and calculating a site-specific background level. The method includes collecting eight discrete samples per 1/8th acre for residential exposure. The methods utilized for collecting site-specific background levels for the Closed Castner Firing Range were consistent with other sampling procedures involving a 100-increment sample collected across a 1-acre sampling unit. The incremental sample yields a representative concentration, and provides the spatial coverage to meet the required elements of a site-specific background sample.

Background samples were collected to represent both the north and south regions of the site at 15 background locations (one in Phase 1 and 14 more in Phase 2), shown on Figure 5-3. Samples were analyzed for 24 metals. Of these, 19 were statistically evaluated in this report (calcium, iron, magnesium, potassium, and sodium were not evaluated because they are essential human nutrients and would be screened out in an evaluation of risk).

To determine whether the concentration in a given sampling unit exceeds the background level, TCEQ regulations specify the method of hypothesis testing (TCEQ 2007). The null hypothesis is that the means of the sampling unit and representative background area are equal. This is commonly referred to as a population-to-population comparison. However, when the objective is to assess the nature and extent of contamination over a large area, a population-to-population comparison is inappropriate. A more appropriate method is a population-to-point comparison, in which an upper statistical limit of the background population is compared to individual concentrations at many locations. To apply the population-to-point comparison approach,

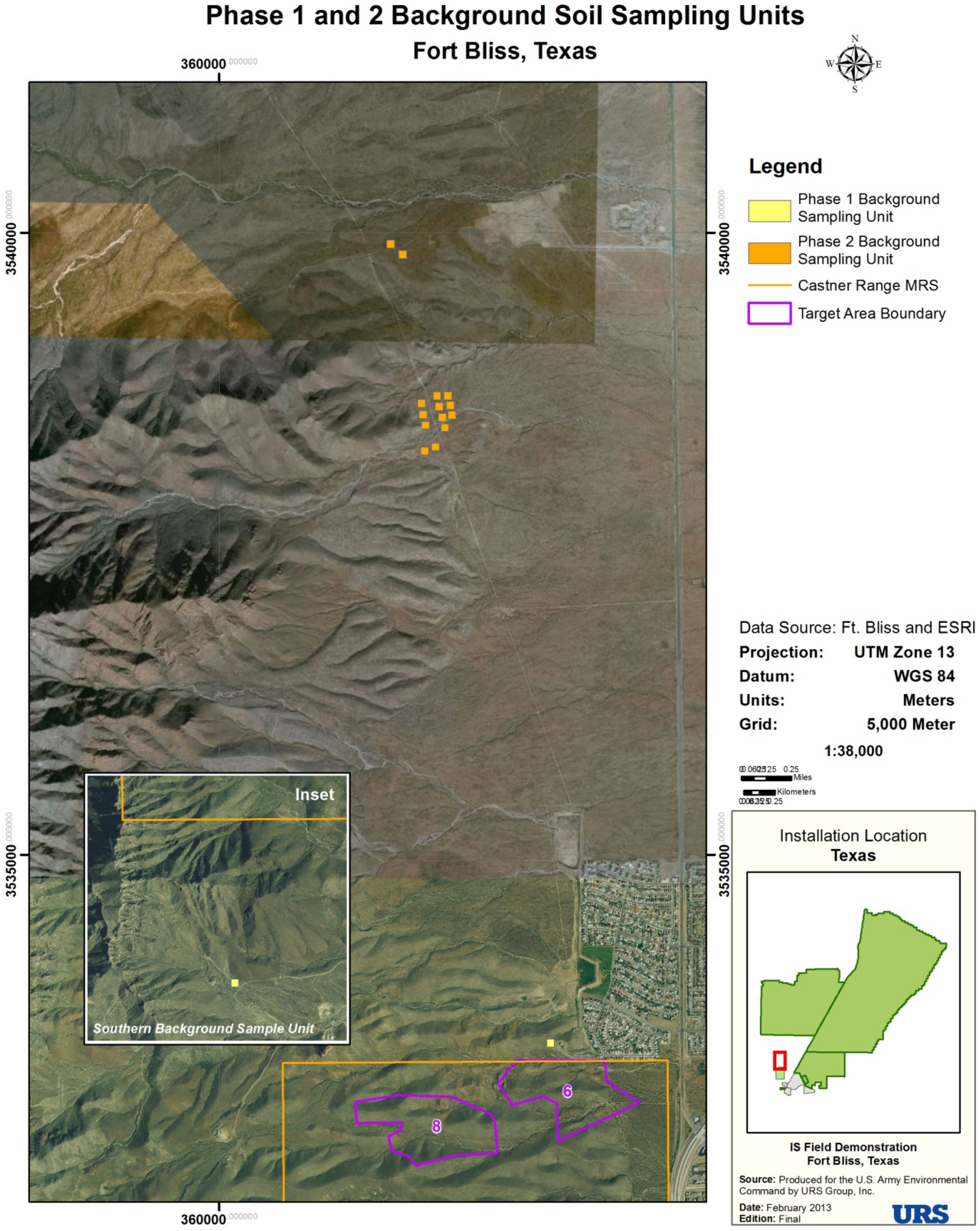


Figure 5-3. Phase 1 and Phase 2 Background Sampling Unit Locations

the background population was defined as the concentrations in the background sampling units. A statistical upper limit of this population was developed to define the background concentration, which may then be compared to the concentration in each ISM sampling unit.

The EPA Unified Guidance (EPA 2009) recommends the use of the upper prediction limit (UPL) as an appropriate background concentration level. Although this guidance is specifically for the statistical analysis of groundwater data, the basic statistical methodology is also applicable for soil sampling data. The details of the calculation process are contained in Appendix E. The background UPLs are tabulated in Table 5-3. For purposes of comparison, the TCEQ PCLs and the Texas-specific background values, where available, are also shown in Table 5-3.

No outliers were identified in the data set. The data set for each metal was examined for fit to a normal distribution, using the Shapiro-Wilk W-test; for normally-distributed data, the UPLs were developed using a parametric method of statistical analysis; for data that did not fit a normal distribution, a nonparametric (distribution-free) method of statistical analysis was used. See Appendix E. Silver and thallium each had only one detection. No statistical analysis was feasible for these two metals. The sample reporting limit of the site values may be used as the UPL for these two metals.

Antimony, mercury and selenium had more than one detection each, but each also included nondetects and required special statistical handling as described in Appendix E.

5.2 Geostatistics and Kriging

As described in Section 4.5.3.4, geostatistical analysis was previously performed to estimate metal concentrations in site areas of interest using the Phase 1 sampling data. The geostatistical analysis was rerun with the combined Phase 1 and Phase 2 data. See Appendix F for the comprehensive report of the geostatistical analyses. The re-analysis was performed for five metals that were identified as potential MCOCs based on an evaluation of the Phase 1 data. These metals were antimony, arsenic, beryllium, cadmium, and lead. Note that no analysis of antimony was performed with Phase 1 data because 77 out of 121 (63%) Phase 1 antimony sample results were rejected due to QA/QC issues. However, none of the 42 Phase 2 antimony sample results were rejected; hence, a valid statistical analysis of the differences between the target and other areas was feasible for antimony using the combined Phase 1 and Phase 2 data.

The geostatistical analysis of combined Phase 1 and Phase 2 data for the five metals of concern confirmed the Phase I conclusion that there are statistically significant differences in mean metal concentrations between the target areas and other (suspected and nontarget) areas. For purposes of kriging, a grid of 50 m by 50 m (164 ft by 164 ft) cells was defined over the study area and kriging estimates were obtained at each of the grid nodes.

As with the prior data analysis, site assessment maps were prepared for the five metals to delineate the extent of potential contamination in Areas A, B, and C and Target Areas 1, 2, 3, and 9. Table 5-4 shows the PCLs used in the current analysis for the five metals.

Table 5-3. Summary of Statistical Background Evaluation Results

Analyte	Total Data Points	Detection Frequency	Mean[a] (mg/kg)	Standard Deviation[a] (mg/kg)	Shapiro-Wilk W Test *p*-value	Statistical Method	UPL (mg/kg)	TRRP PCL (mg/kg)	Texas-Specific Background (mg/kg)
Aluminum	15	100%	5,062	2,400	<0.01	Nonparametric	8,630	86,000	30,000
Antimony	15	80%	0.21	0.06	0.03	Parametric	0.354	2.7	1
Arsenic	15	100%	2.36	1.36	0.04	Parametric	5.68	5.9	5.9
Barium	15	100%	50.0	10.0	0.07	Parametric	74.3	220	300
Beryllium	15	100%	0.448	0.070	0.29	Parametric	0.619	1.5	1.5
Cadmium	15	100%	0.262	0.057	0.34	Parametric	0.401	0.75	--
Chromium(tot)	15	100%	6.07	3.42	<0.01	Nonparametric	11.9	1,200	30
Cobalt	15	100%	2.26	0.85	<0.01	Nonparametric	4.9	3.3	7
Copper	15	100%	10.2	3.7	<0.01	Nonparametric	19.9	520	15
Lead	15	100%	12.1	4.7	<0.01	Nonparametric	20.83	15	15
Manganese	15	100%	157	30	0.3	Parametric	231	580	300
Mercury	15	33%	0.0181	0.0022	>0.05	Parametric	0.0235	0.0039	0.04
Molybdenum	15	100%	0.257	0.063	0.44	Parametric	0.41	--	--
Nickel	15	100%	4.66	1.48	<0.01	Nonparametric	8.1	79	10
Selenium	15	40%	0.276	0.048	>0.05	Parametric	0.393	1.1	0.3
Silver	15	7%	N/A	N/A	N/A	Only 1 detect	Sample reporting limit	0.24	–
Thallium	15	7%	N/A	N/A	N/A	Only 1 detect	Sample reporting limit	0.87	--
Vanadium	15	100%	13.7	6.4	<0.01	Nonparametric	26.7	17	50
Zinc	15	100%	21.8	7.6	0.02	Parametric	40.4	1,200	30

[a] For a data set containing nondetects, the Kaplan-Meier method was used to estimate mean and standard deviation.

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Table 5-4. PCLs Used in Geostatistical Analysis

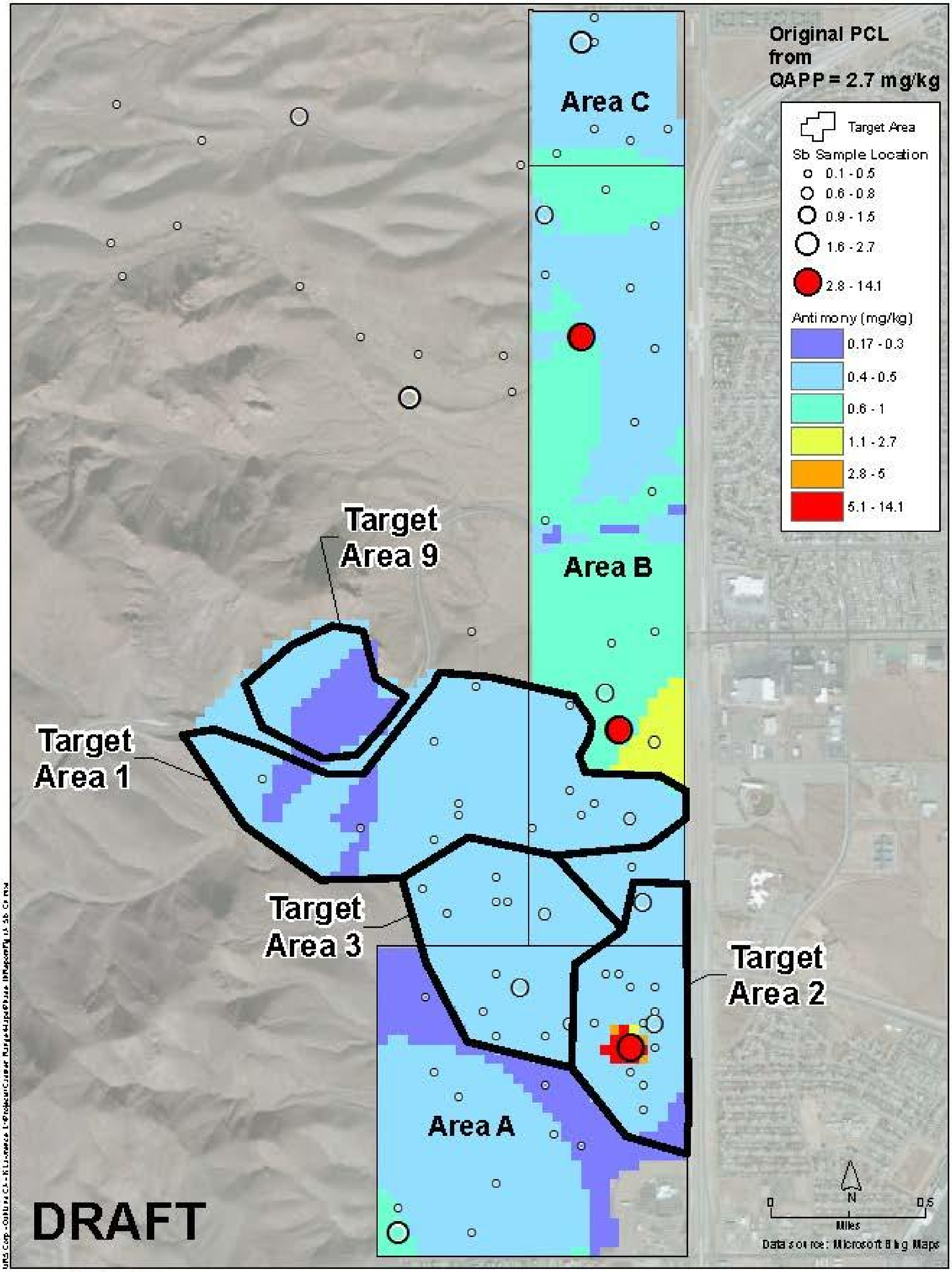
Analyte	PCL from QAPP (mg/kg)
Antimony	2.7
Arsenic	5.9
Beryllium	1.5
Cadmium	0.75
Lead	15

The same approach for calculating the confidence interval (estimated concentration ± standard deviation) was used and the same five possible site assessment conditions (clean, clean/unresolved, contaminated, contaminated/unresolved, unestimable) were assigned to each node as described in Section 4.5.3.4. The results of this assessment are displayed in three maps for each of the five metals:

- Estimated concentrations. For lead and antimony, the spatial extent of hot spots was delineated with an inverse-distance-weighting algorithm to avoid over-weighting the hot spot data, as described in Appendix F;
- Estimated coefficient of variation, which is the estimated standard deviation divided by the estimated concentration; and
- Assessment of site condition based on the selected PCL.

Figures 5-4 through 5-18 show the following:

- Antimony – Almost all the area evaluated is clean (resolved) relative to the PCL. The exception is one hot spot in Target Area 2 that results in about 5% of Target Area 2 being either contaminated (resolved) or contaminated (unresolved). Additionally, two sampling units in Area B had sampled concentrations exceeding the PCL.
- Arsenic – About 7% of Target Area 1 is contaminated (resolved or unresolved). About 32% of Target Area 9 appears to be contaminated (unresolved). Three sampling units in Target Area 1, one in Target Area 9, and two in the southern end of Area B had sampled concentrations exceeding the PCL. All the remaining areas are clean (resolved or unresolved).
- Beryllium – About 60% of Target Area 9 and 3% of Target Area 1 are assessed to be contaminated (resolved or unresolved). These portions include two sampling units in which the sampled concentration exceeds the PCL. All other areas are mostly clean (resolved). With the ambiguous beryllium results discussed in Section 5.3, these results indicate a need for further investigation into possible beryllium sources and extent of contamination.
- Cadmium – All areas are clean (resolved). There is one sampling unit just outside (northwest) of Area C in which the sampled concentration exceeds the PCL. This result is likely related to OB/OD Pit B-1 nearby; however, this sampled concentration did not result in concentrations exceeding the PCL inside Area C. This is likely the result of several very low sampled concentrations within Area C. These low concentrations, when combined with the one high sampled concentration, result in kriged concentrations that are below the PCL.
- Lead – Most of the estimated concentrations exceed the PCL of 15 mg/kg. More than 80% of Areas A and B and all target areas are assessed to be contaminated (resolved or unresolved). For Area C, 58% of the area is clean (unresolved) and 42% is contaminated (resolved or unresolved).



Data source: Microsoft Bing Maps

Figure 5-4. Estimated Antimony Concentrations

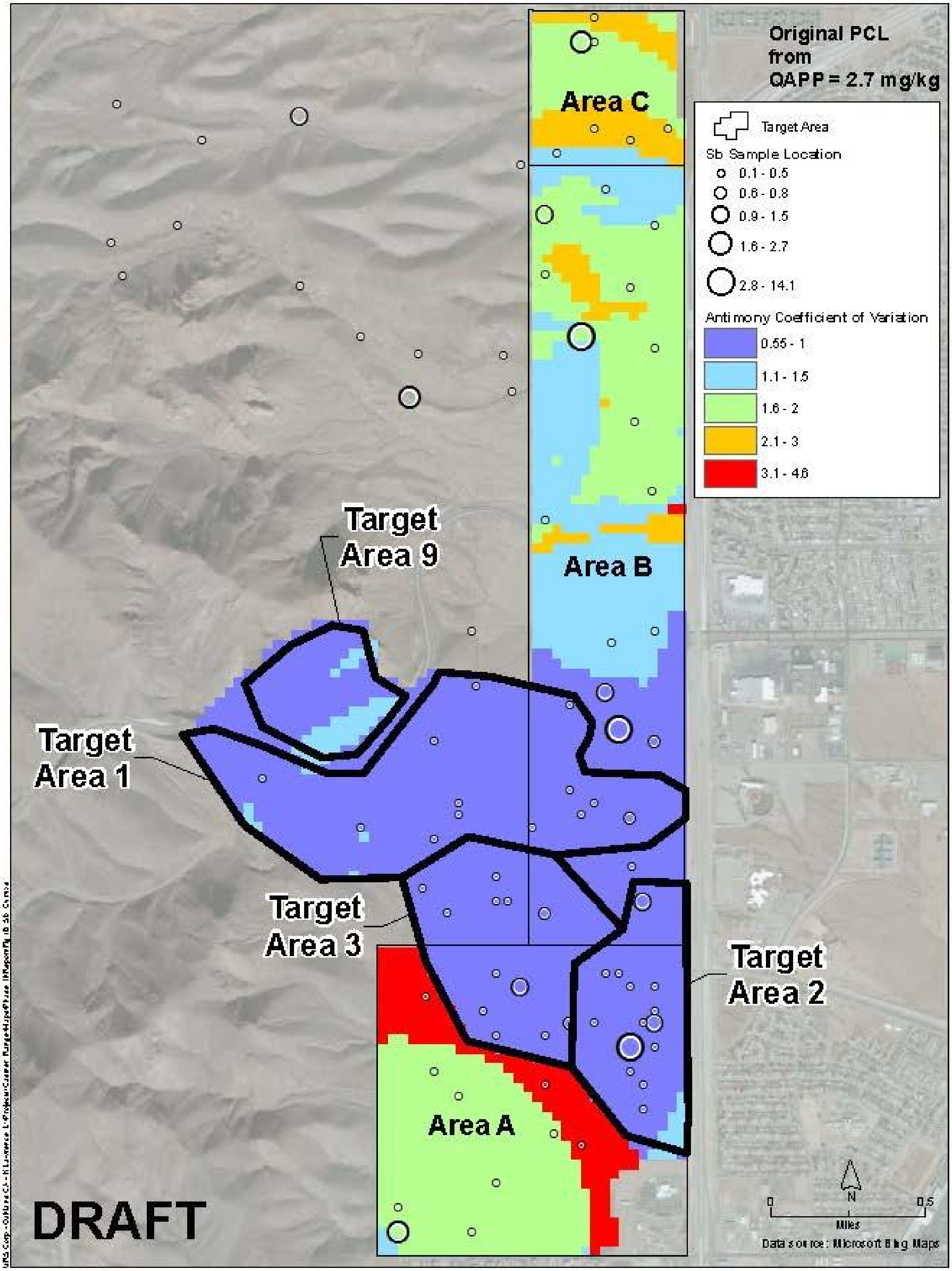


Figure 5-5. Estimated Antimony Coefficient of Variation

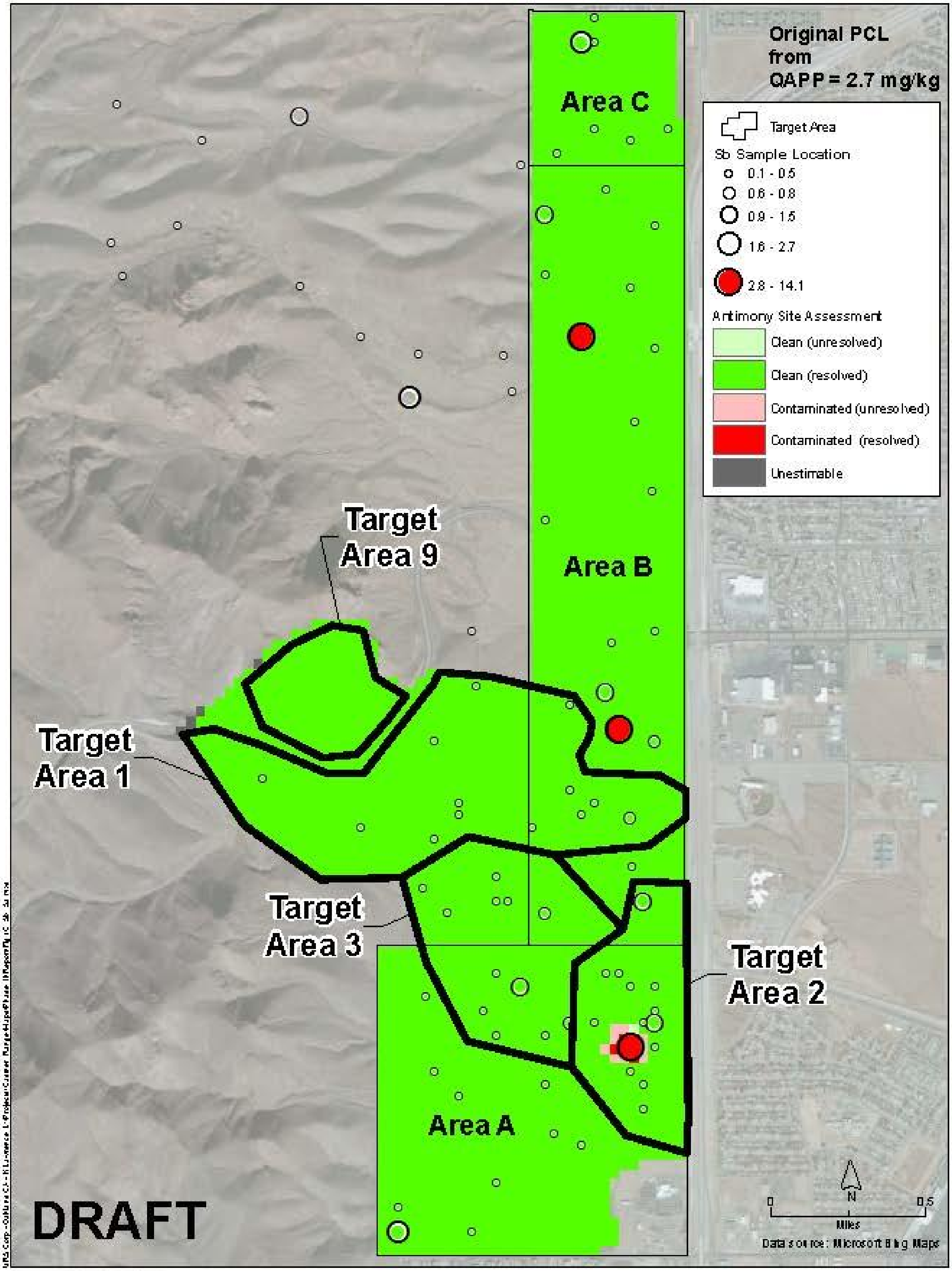


Figure 5-6. Estimated Antimony Site Assessment

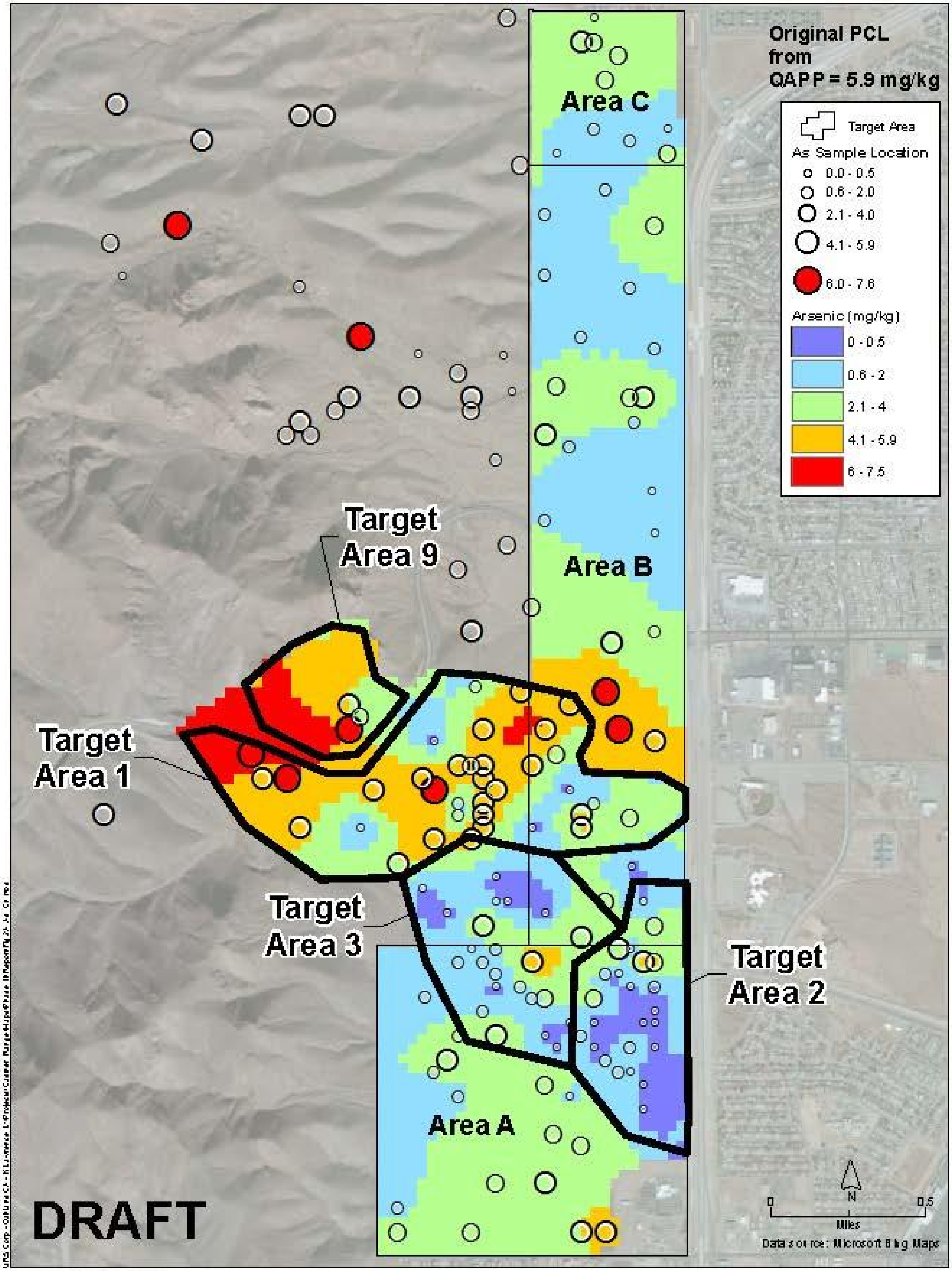


Figure 5-7. Estimated Arsenic Concentrations

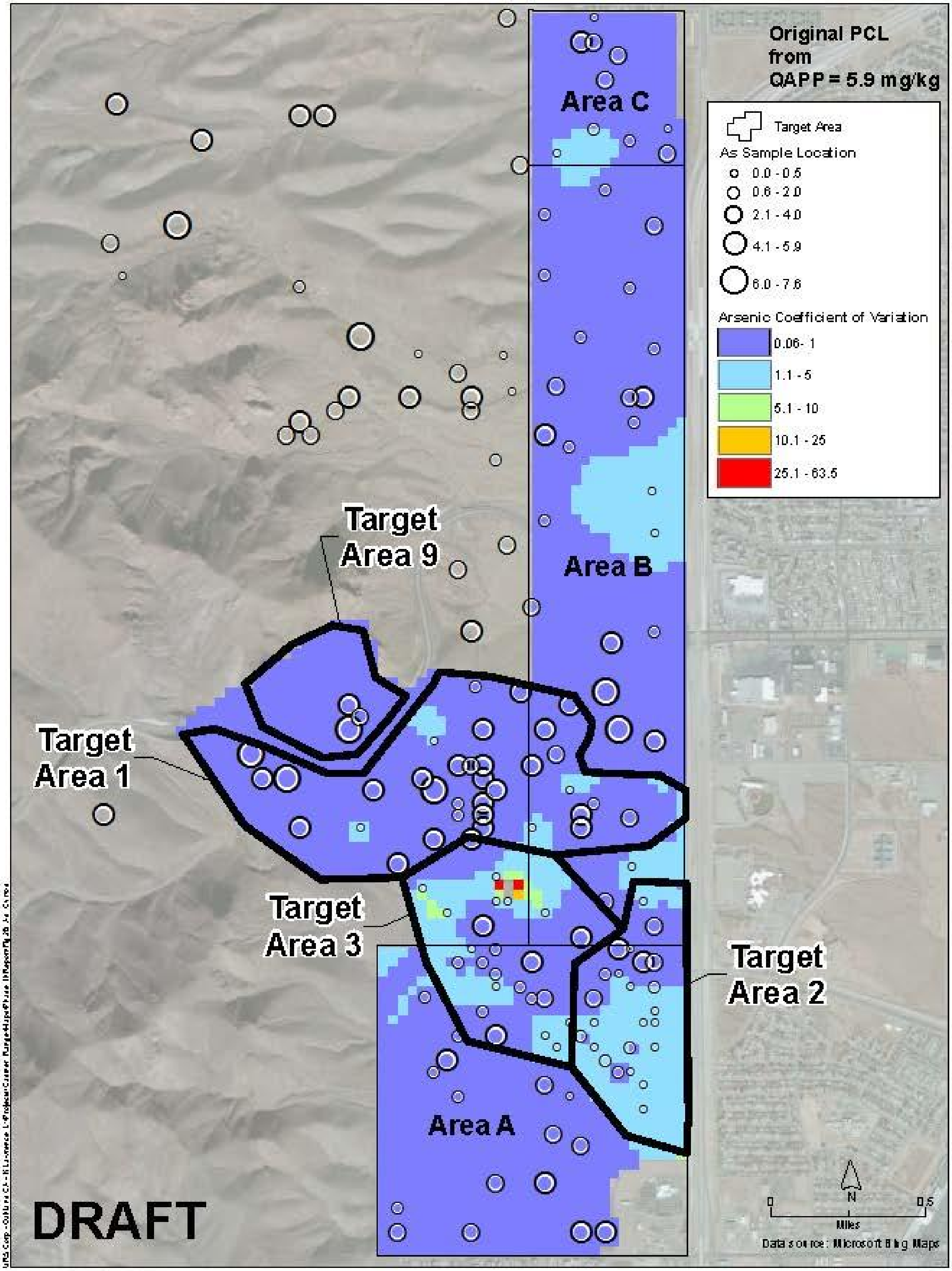


Figure 5-8. Estimated Arsenic Coefficient of Variation

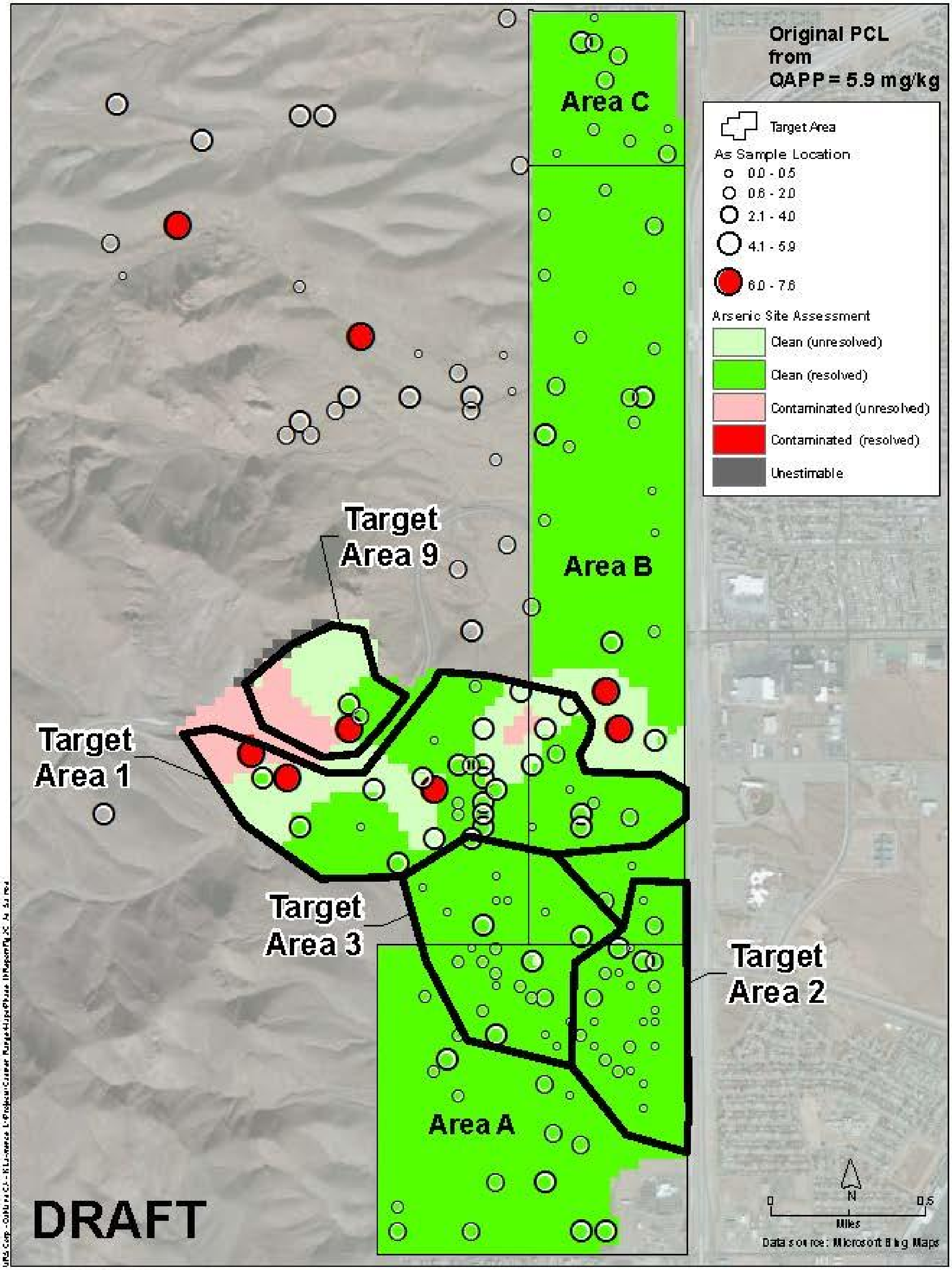


Figure 5-9. Estimated Arsenic Site Assessment

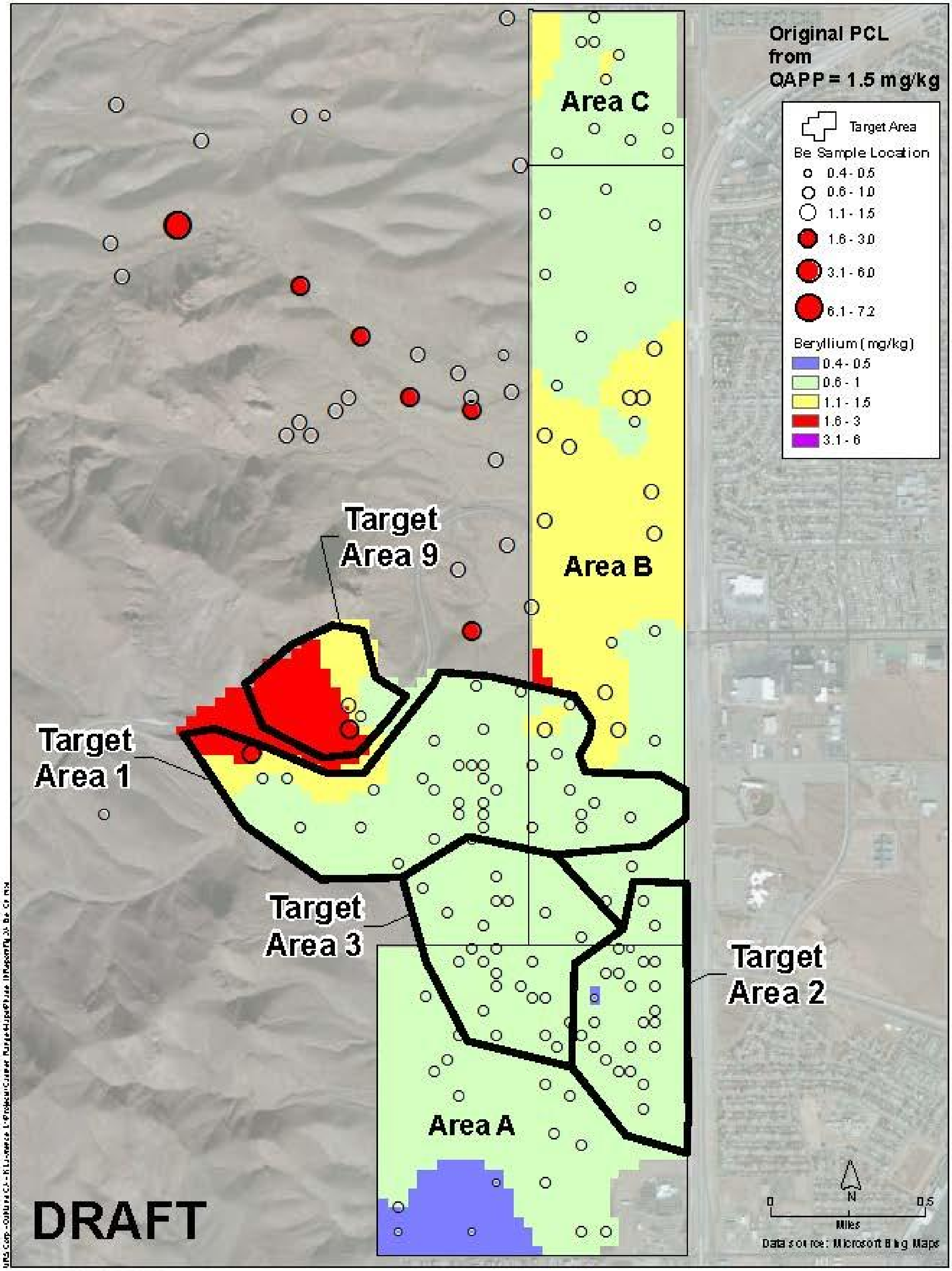


Figure 5-10. Estimated Beryllium Concentrations

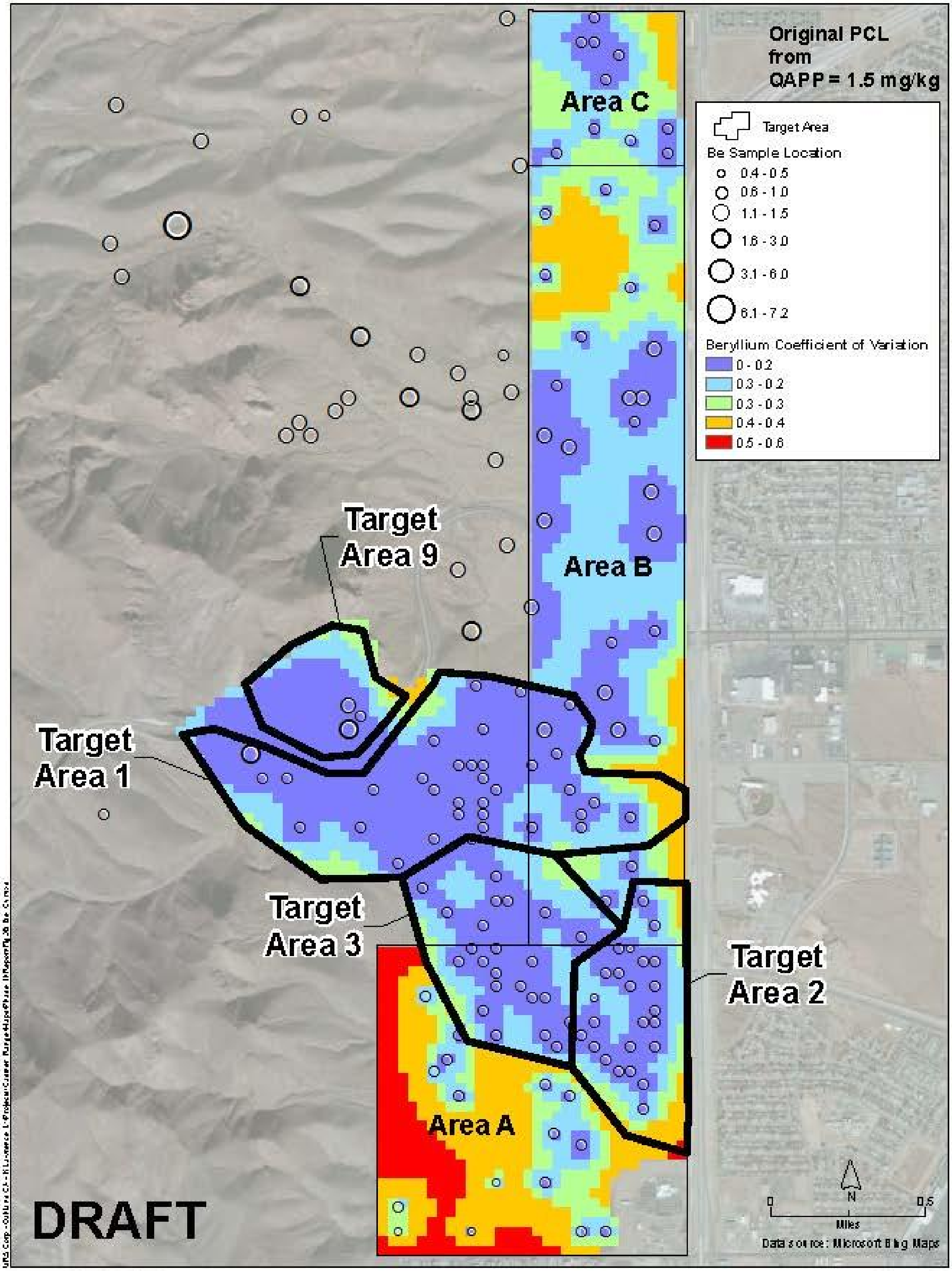
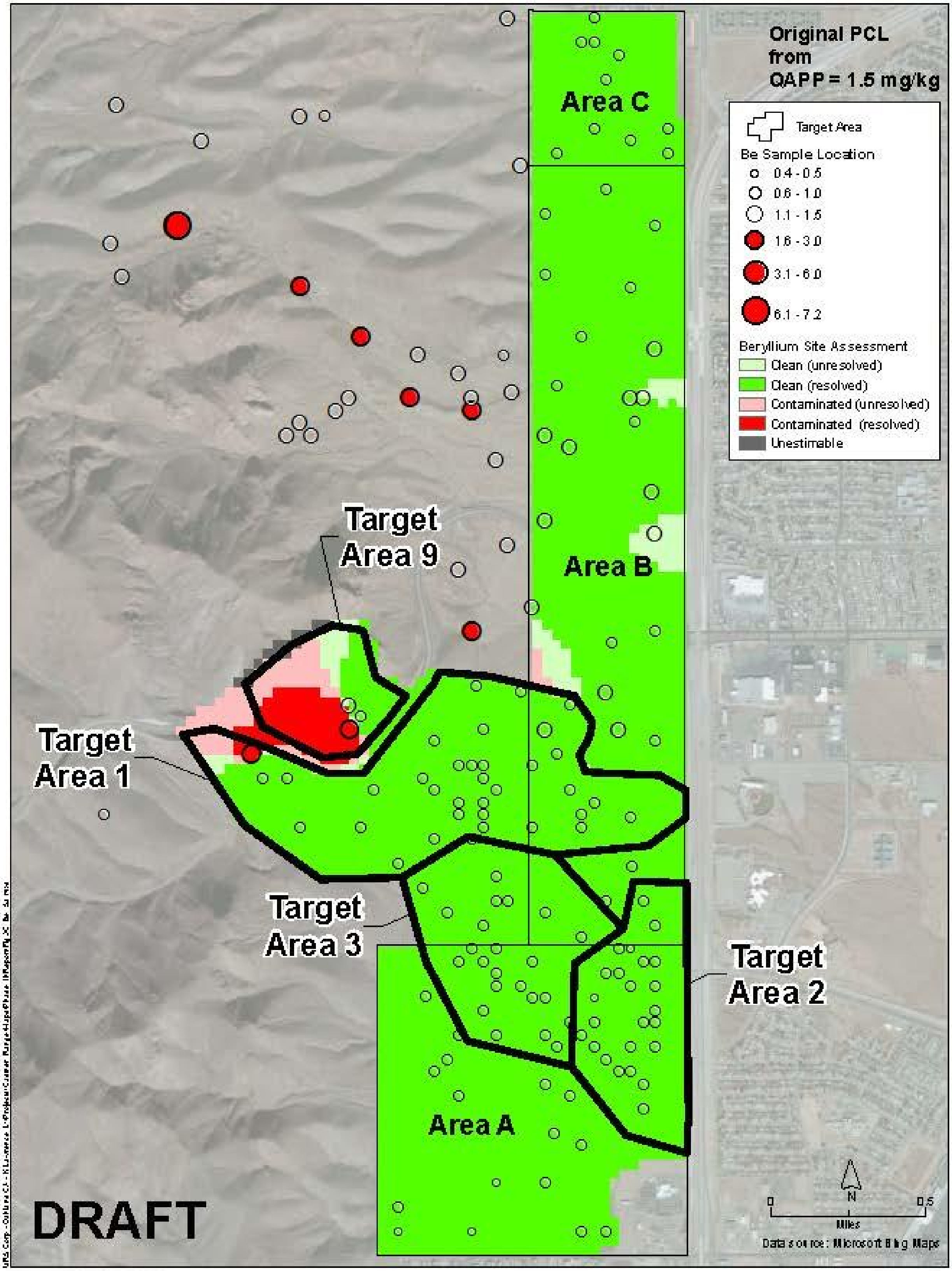


Figure 5-11. Estimated Beryllium Coefficient of Variation



Data source: Microsoft Bing Maps

Figure 5-12. Estimated Beryllium Site Assessment

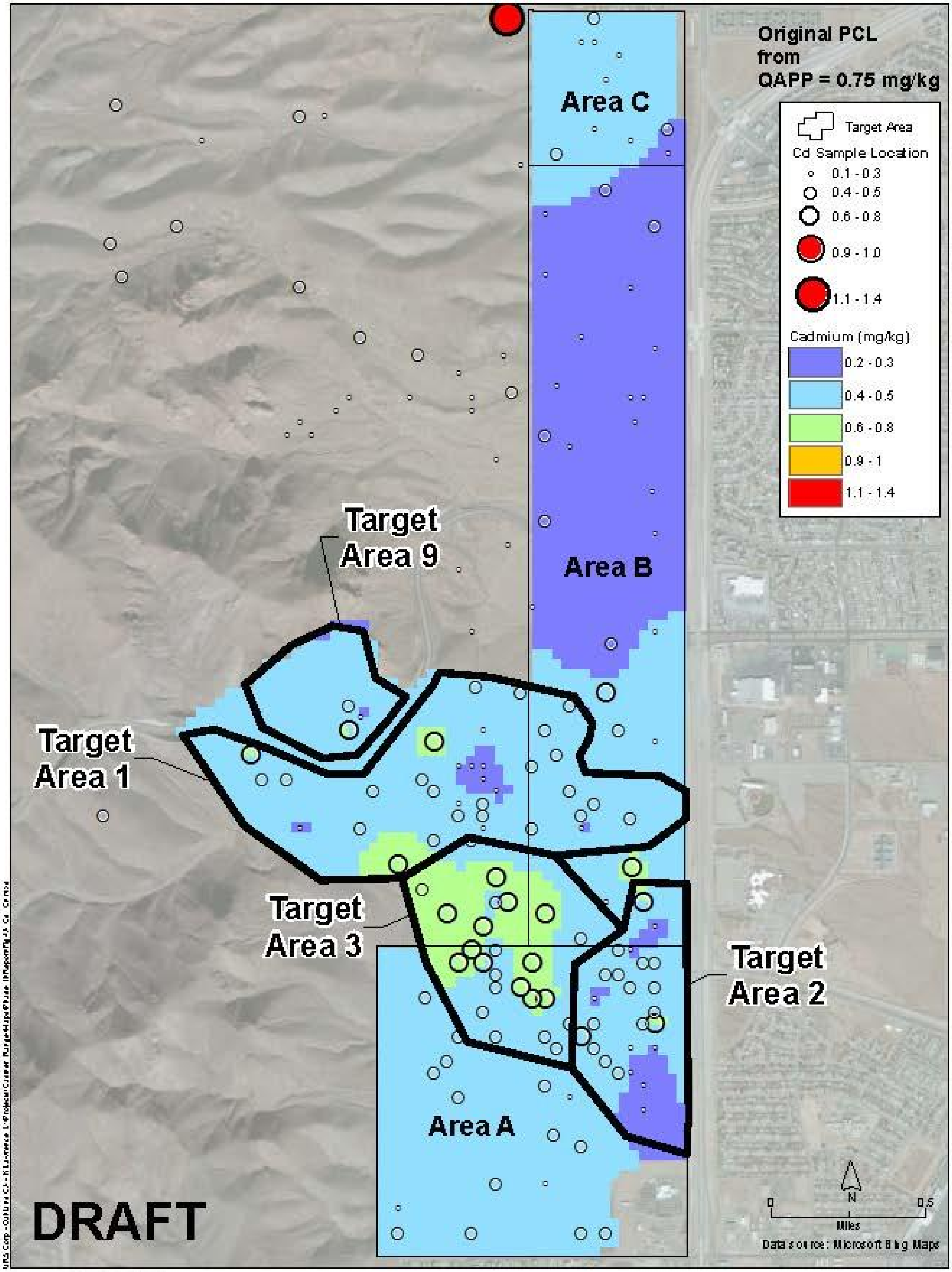


Figure 5-13. Estimated Cadmium Concentrations

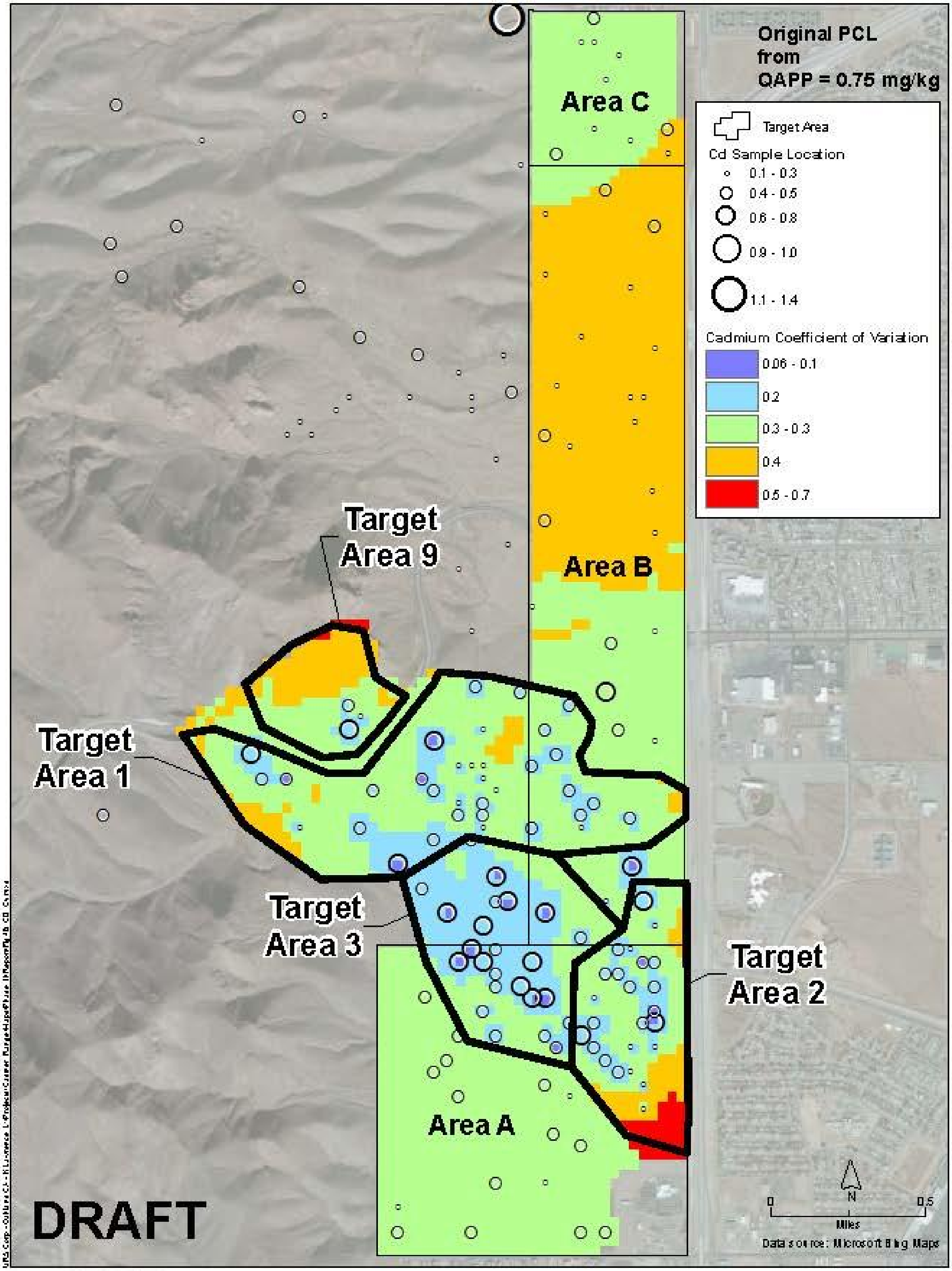


Figure 5-14. Estimated Cadmium Coefficient of Variation

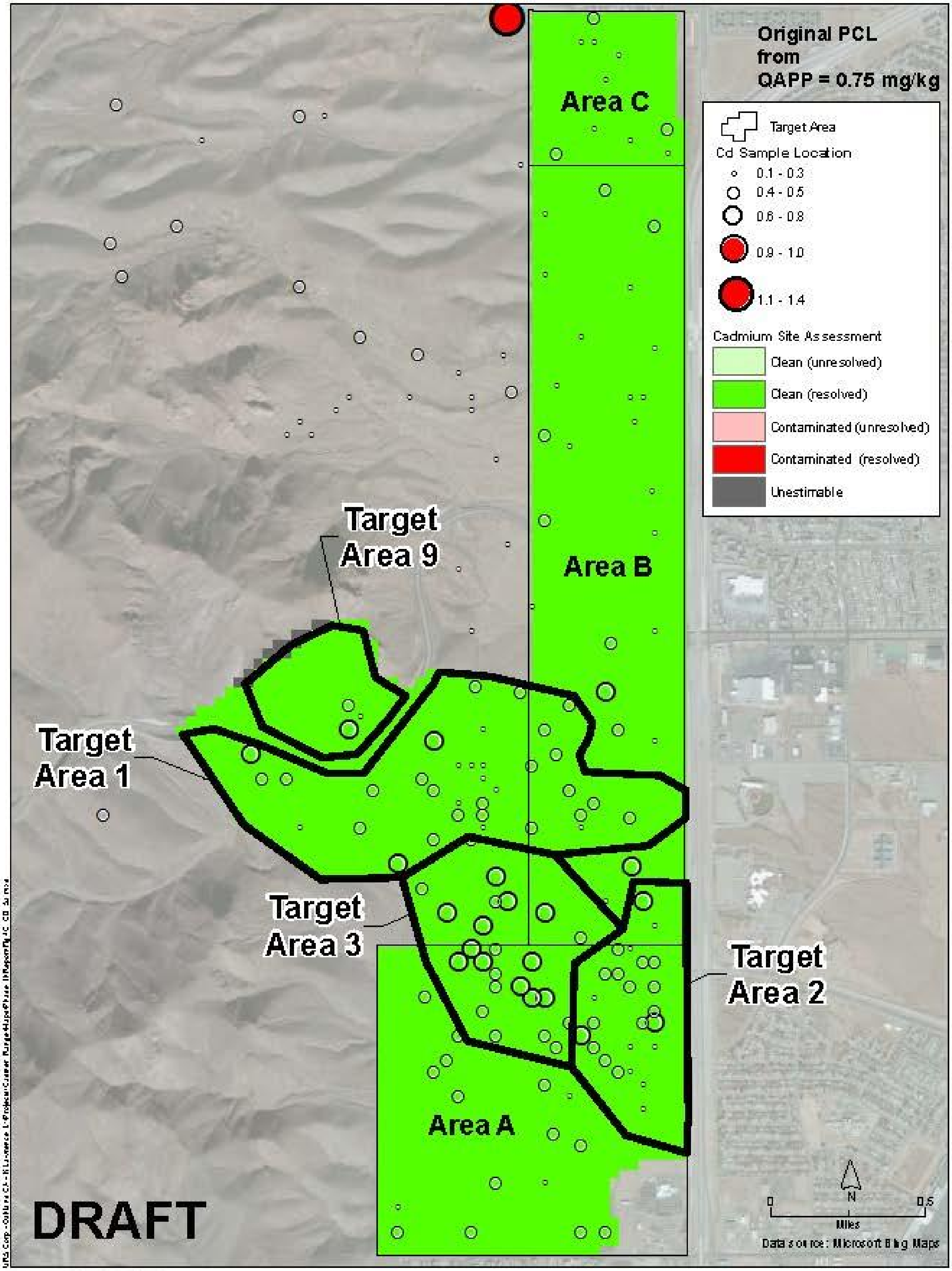


Figure 5-15. Estimated Cadmium Site Assessment

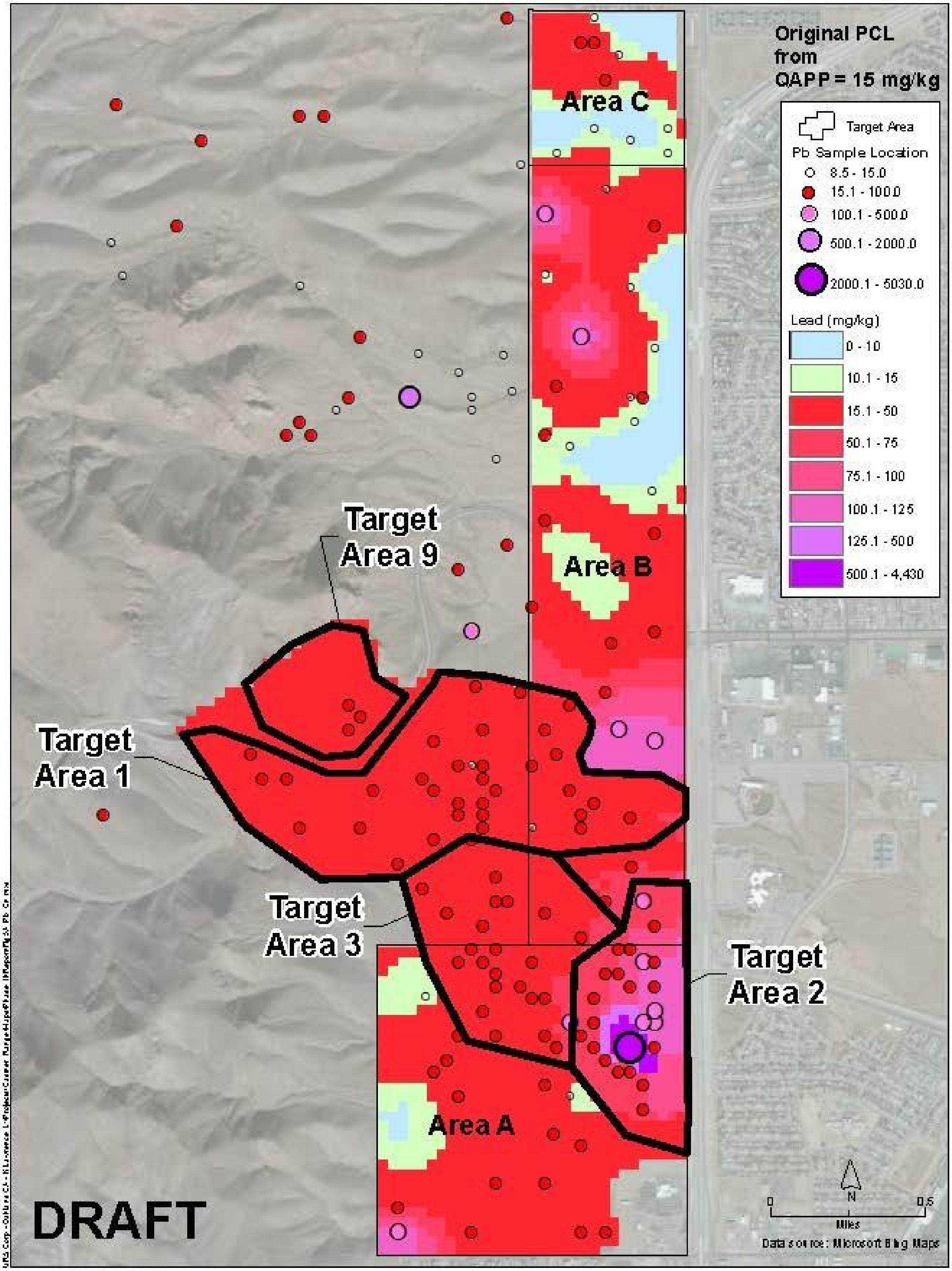


Figure 5-16. Estimated Lead Concentrations

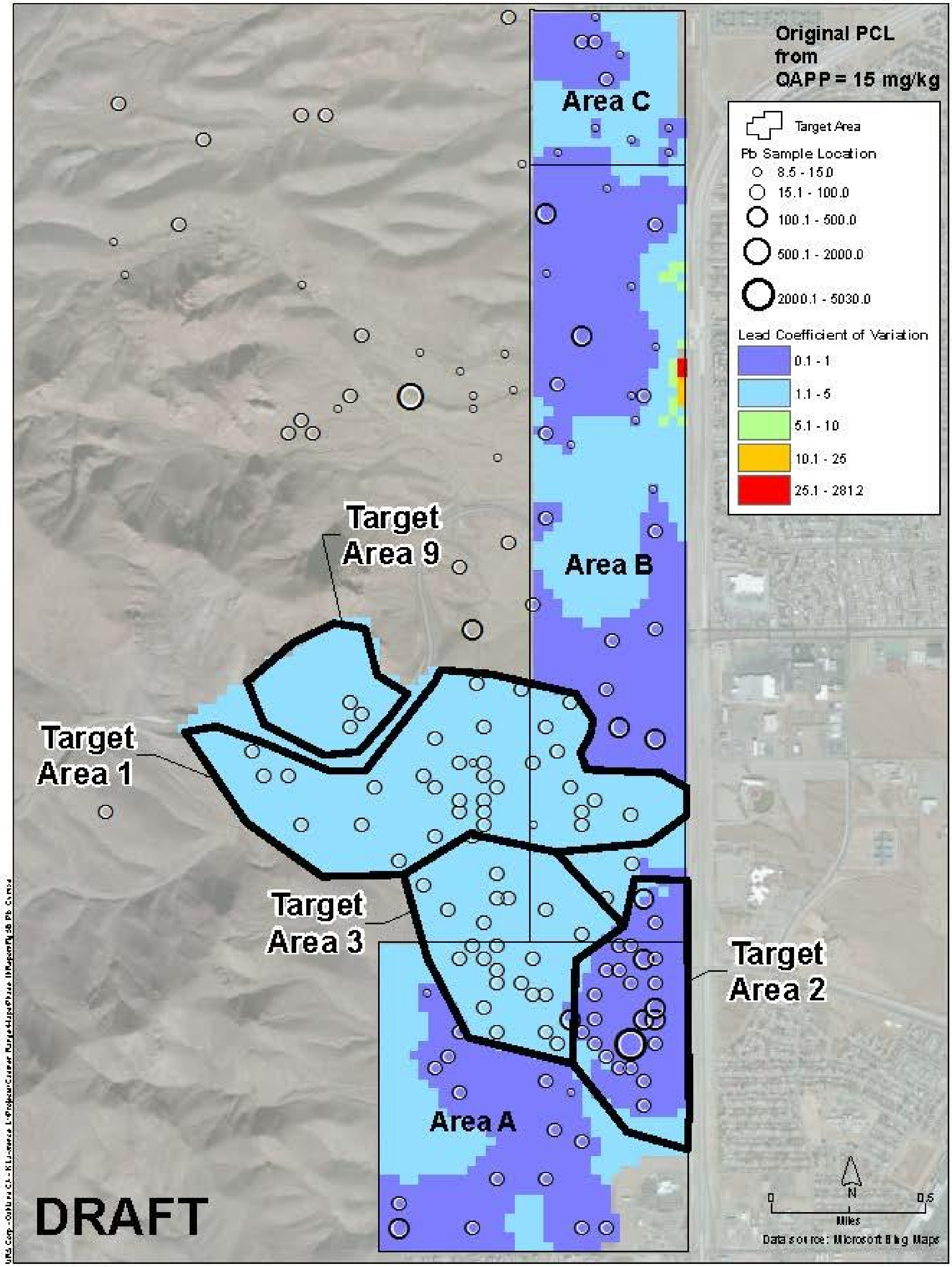


Figure 5-17. Estimated Lead Coefficient of Variation

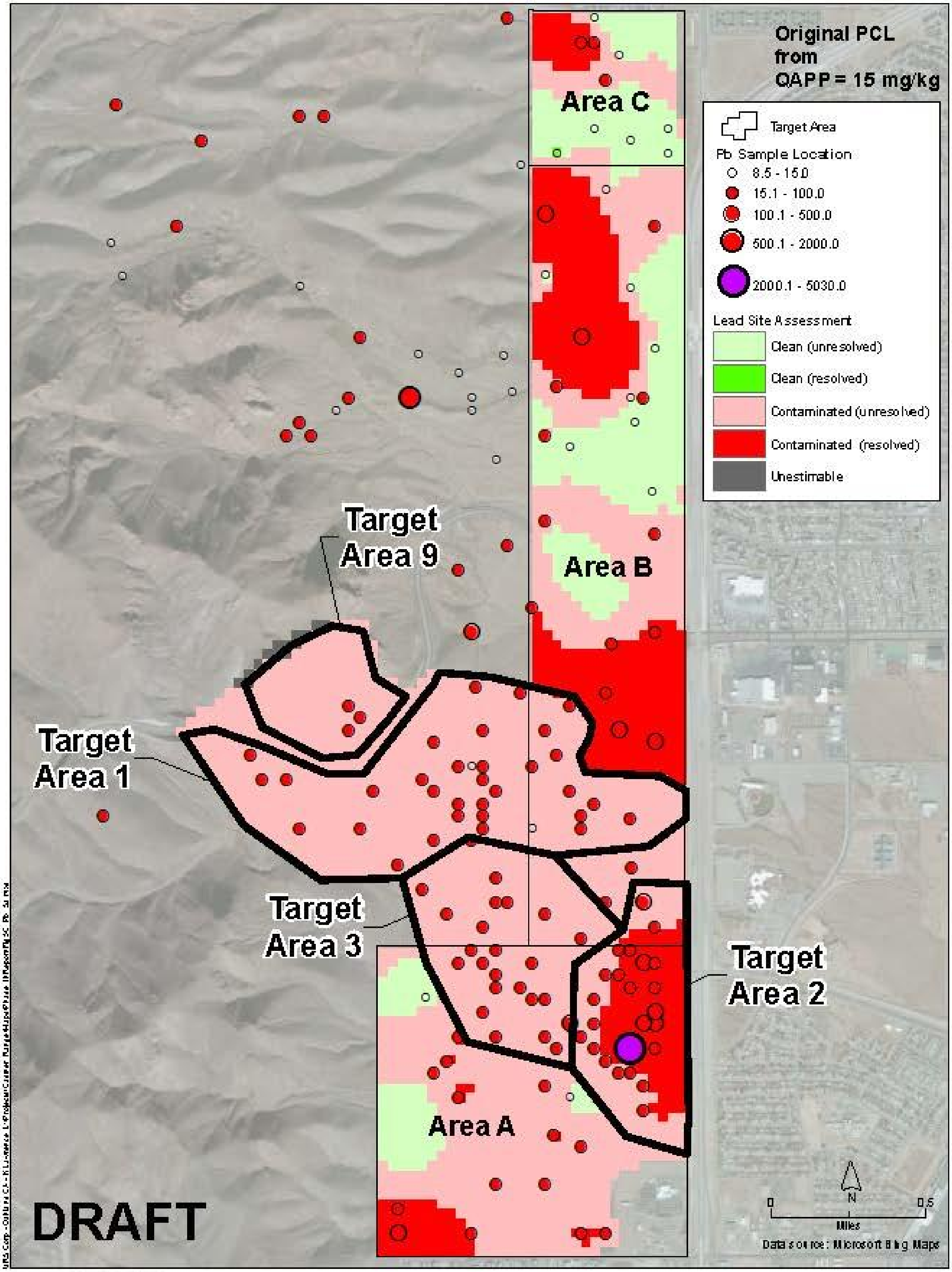


Figure 5-18. Estimated Lead Site Assessment

The supplemental sampling in Phase 2 was effective in closing the previously identified data gaps. There are no data gaps in the current analysis except for a handful of cells in the northeast edge of Target Area 9. Concentrations can be estimated with geostatistical means over all of the selected areas without having to collect any additional samples.

5.3 Beryllium Investigation

In the Phase 1 sampling, beryllium was detected in concentrations higher than the TRRP PCL of 1.5 mg/kg in seven sampling units. Samples from eight additional sampling units were collected upgradient, downgradient, and in a nearby drainage in an attempt to define the source and the potential transport. The Phase 2 data were collected using the arroyo sampling method, where the sampling area encompasses about 1 acre, but the shape follows the path and the width of the specific arroyo.

Figure 5-19 shows the Phase 1 and Phase 2 beryllium data. Although there are exceedences near Transmountain Road, the area of interest is the east-west drainage to the north. It was hypothesized that there might be an anthropogenic beryllium source (either mining-related or range-related) to the west and that surface water storm flow might be a transport mechanism via the arroyos. A visual evaluation of Figure 5-19 initially appears to support a west-to-east concentration trend, but if the high value at AR008 is disregarded, the other values do not indicate a clear trend. A Mann-Kendall test for trend was completed on the data set, including AR008 and concluded that there was insufficient evidence to indicate a trend at the level of significance specified, 0.05 (Appendix G).

At this time, no trend is supported by the data and no conclusions can be drawn about a possible source or any potential transport.

5.4 Fate and Transport Investigation

The analyses of Phase 1 data showed a correlation between target areas and elevated metal contamination, indicating that they may be potential sources of range-related MC contamination. Six arroyos related to Target Areas 1 and 3 were selected for additional sampling in Phase 2. It was hypothesized that storm events might scour surficial deposits of contamination from target areas into nearby drainages. Elevated MC levels in the arroyos, therefore, might be indicative of transport from the areas of elevated MC levels in source areas.

Figure 5-20 shows Target Area 1 and the arroyos potentially associated with it. In Tables 5-5, 5-6, and 5-7, the metals results from arroyo samples and the closest upstream sampling units are presented. Results exceeding the site-specific background are highlighted.

Figure 5-20 shows Target Area 3 and the arroyos potentially associated with it. In Tables 5-8, 5-9, and 5-10, the metals results from arroyo samples and the closest upstream sampling units are presented. Results exceeding the site-specific background are highlighted.

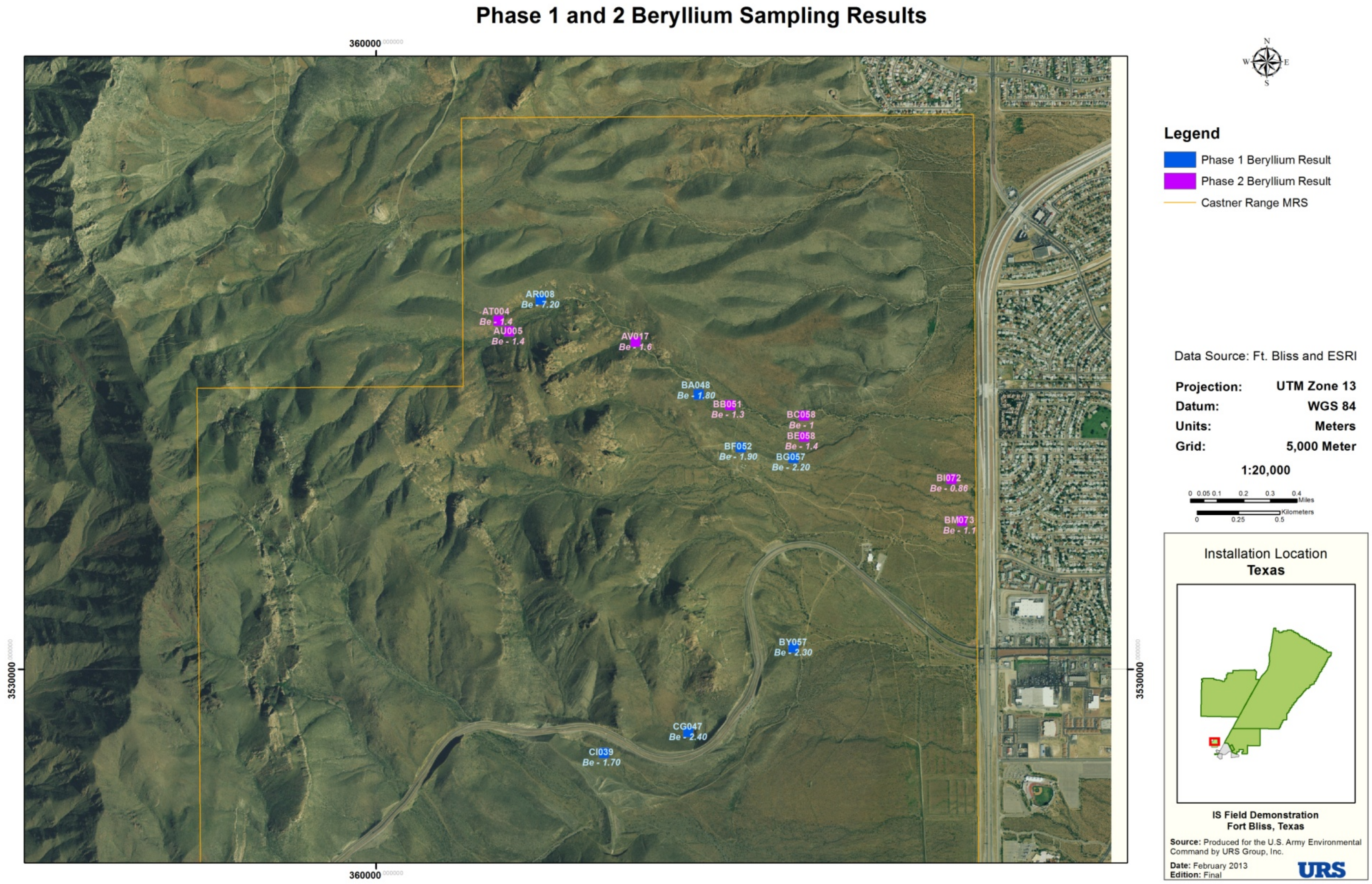


Figure 5-19. Phase 1 and Phase 2 Beryllium Sampling Results

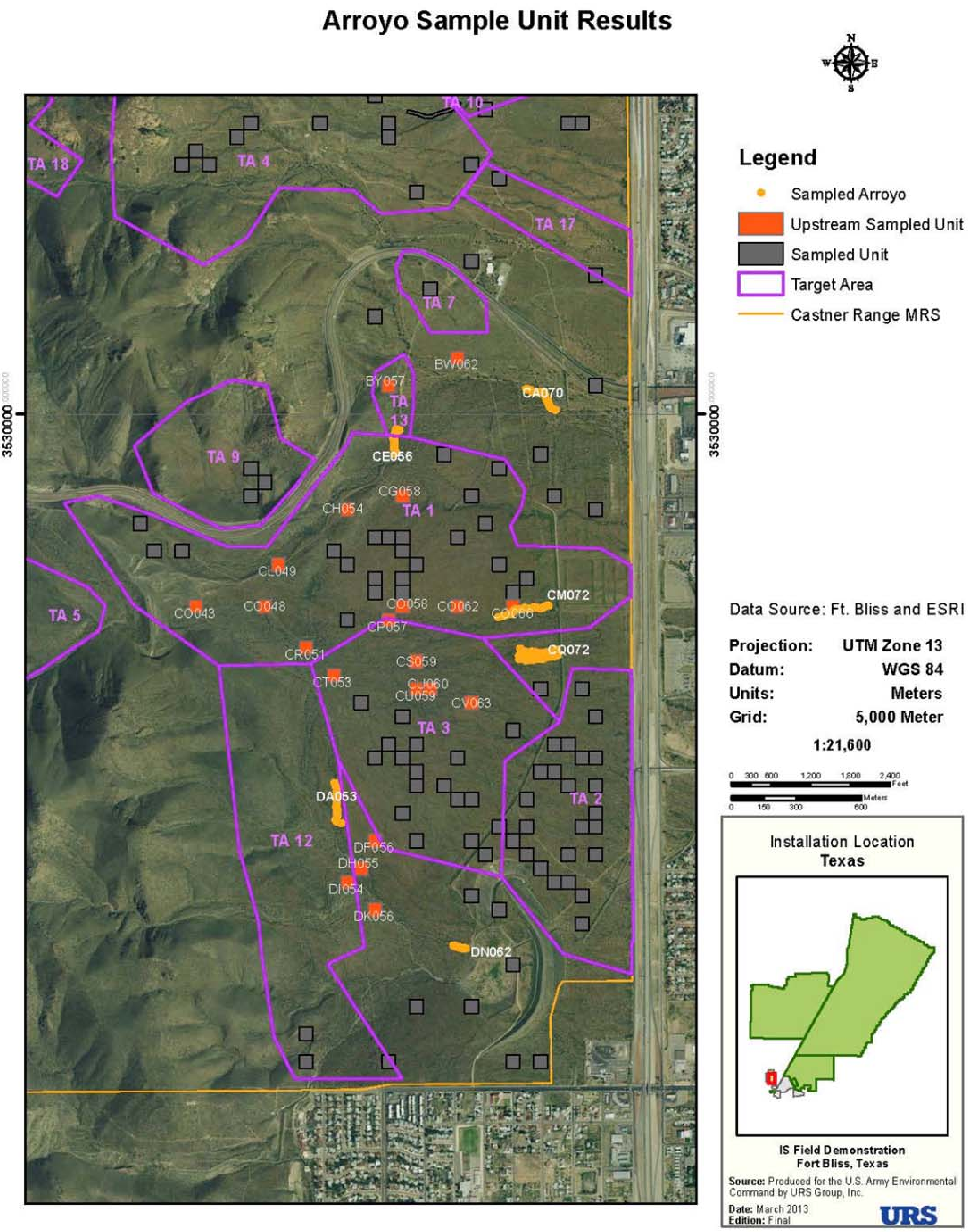


Figure 5-20. Arroyos Near Target Area 1 and Target Area 3 and Upstream Sampling Units

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Table 5-5. Arroyo Sample CE056 and Upstream Sample Data (mg/kg)

Analyte	Site Specific Background (UPL)	Possible Upstream Samples			Arroyo
		CH054 N	**CG058 N**	**CL049 N**	**CE056 A**
		13-Sep-12	**9-Feb-11**	**9-Feb-11**	**13-Sep-12**
Aluminum	8,630	**8640 X8**	**7520 X8**	**8380 X8**	**3070**
Antimony	0.354	**0.47 JL**	<0.0950 R	<0.0950 R	**0.16**
Arsenic	5.68	<0.0880 UJL	**5.90 JL**	**5.60 JL**	**1.8**
Barium	74.3	**61.8**	**63.8**	**77**	**55.7**
Beryllium	0.619	**0.69 JL**	**1.00 JL**	**0.930 JL**	**0.82**
Cadmium	0.401	**0.64 JL**	**0.300 JL**	**0.340 JL**	**0.40**
Chromium (total)	11.9	**9.4 JL**	**9.1**	**8.5**	**3.9**
Cobalt	4.9	**3.2 JL**	**4.40 JL**	**4.30 JL**	**2.6**
Copper	19.9	**23.6 JL**	**17.2**	**18.6**	**9.9**
Lead	20.83	**31.8**	**23.1 JL**	**20.9 JL**	**17.1**
Manganese	231	**242 X8**	**233 X8**	**215 X8**	**281**
Mercury	0.0235	**0.038 J**	**0.0260 J**	**0.0310 J**	**0.012**
Molybdenum	0.41	**0.38 JL**	**0.540 JL**	**0.610 JL**	**0.5**
Nickel	8.1	**6.4 JL**	**7.90 JL**	**8.10 JL**	**4.5**
Selenium	0.393	**0.59 JL**	<0.244 UJL	<0.244 UJL	**0.47**
Silver	0.036	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 U
Thallium	0.206	<0.206 UJL	<0.206 UJL	**0.250 JL**	<0.206 U
Vanadium	26.7	**20.8 JL**	**17.1**	**17.7**	**11.2**
Zinc	40.4	**46.8 JL**	**54.6**	**49.3**	**54.1**

Bold Value = analyte detected

Shaded Green Exceeds site-specific background UPL

J = Estimated

JH = Estimated, potentially biased high

JL = Estimated, potentially biased low

R = Rejected

U = Not detected at the stated detection limit

X7 = TCEQ does not offer accreditation for this analyte

X8 = Laboratory is not accredited for this analyte by this method, although accreditation is offered

Sample types: N – normal, A – average of triplicate samples

Table 5-6. Arroyo Sample CA070 and Upstream Sample Data (mg/kg)

		Possible Upstream Samples			Arroyo
	Site Specific Background	BW062 A	BY057 N	CE056 A	CA070 N
Analyte	**(UPL)**	**3-Feb-11**	**8-Feb-11**	**13-Sep-12**	**14-Sep-12**
Aluminum	8,630	**3870**	**7250 X8J**	**3070**	**5340 X8**
Antimony	0.354	<0.0950 R	**0.130 JL**	**0.16**	**0.26 JL**
Arsenic	5.68	**2.93**	**5.10 JL**	**1.8**	**4.1 JL**
Barium	74.3	**45.3**	**74.2 JH**	**55.7**	**59.2**
Beryllium	0.619	**1.27**	**2.30 JL**	**0.82**	**1.0 JL**
Cadmium	0.401	**0.22**	**0.300 JL**	**0.40**	**0.33 JL**
Chromium (total)	11.9	**5.1**	**7.40 JL**	**3.9**	**5.8 JL**
Cobalt	4.9	**1.83**	**3.80 JL**	**2.6**	**2.4 JL**
Copper	19.9	**7.63**	**17.0 JH**	**9.9**	**8.6 JL**
Lead	20.83	**23.7**	**129 JL**	**17.1**	**23.6 JL**
Manganese	231	**163**	**242 X8**	**281**	**260 X8**
Mercury	0.0235	**0.0113**	**0.0280 J**	**0.012**	<0.010 U
Molybdenum	0.41	**0.587**	**0.510 JL**	**0.5**	**0.58**
Nickel	8.1	**3.97**	**6.70 JL**	**4.5**	**4.5 JL**
Selenium	0.393	**0.315**	<0.244 UJL	**0.47**	<0.244 UJL
Silver	0.036	<0.0360 UJL	<0.0360 UJL	<0.0360 U	<0.0360 UJL
Thallium	0.206	<0.206 UJL	**0.460 JL**	<0.206 U	<0.206 UJL
Vanadium	26.7	**6.7**	**14.9 JL**	**11.2**	**17.3 JL**
Zinc	40.4	**57.6**	**68.7 JL**	**54.1**	**59.0 JL**

Bold Value = analyte detected

Shaded Green Exceeds site-specific background UPL

J = Estimated
JH = Estimated, potentially biased high
JL = Estimated, potentially biased low
R = Rejected
U = Not detected at the stated detection limit
X7 = TCEQ does not offer accreditation for this analyte
X8 = Laboratory is not accredited for this analyte by this method, although accreditation is offered

Sample types: N – normal, A – average of triplicate samples

Table 5-7. Arroyo Sample CM072 and Upstream Sample Data (mg/kg)

	Site Specific Background (UPL)	Possible Upstream Samples				Arroyo
		CO062 A	CO066 N	CO058 N	CP057 N	CM072 N
Analyte		13-Sep-12	9-Feb-11	8-Feb-11	8-Feb-11	14-Sep-12
Aluminum	8,630	**7397**	**5670 X8JH**	**6250 X8J**	**6550 X8J**	**7320 X8**
Antimony	0.354	**0.31**	<0.0950 R	<0.0950 R	<0.0950 R	**0.65 JL**
Arsenic	5.68	**0.15**	**4.10 JL**	**5.10 JL**	**4.70 JL**	**3.5 JL**
Barium	74.3	**48.7**	**42.8 JH**	**54.4 JH**	**64.3 JH**	**52.7**
Beryllium	0.619	**0.64**	**0.600 JL**	**0.760 JL**	**0.920 JL**	**0.66 JL**
Cadmium	0.401	**0.43**	**0.250 JL**	**0.290 JL**	**0.420 JL**	**0.40 JL**
Chromium (tot)	11.9	**8.5**	**6.70 J**	**8.30 JL**	**7.90 JL**	**7.8 JL**
Cobalt	4.9	**3.0**	**3.40 JL**	**4.00 JL**	**5.10 JL**	**3.2 JL**
Copper	19.9	**12.6**	**12.7 J**	**14.3 JH**	**18.3 JH**	**14.8 JL**
Lead	20.83	**14.6**	**19.5 JL**	**19.7 JL**	**24.1 JL**	**33.2 JL**
Manganese	231	**189**	**148 X8JH**	**179 X8**	**223 X8**	**198 X8**
Mercury	0.0235	**0.0240**	**0.0230 J**	**0.0250 J**	**0.0230 J**	**0.019 U**
Molybdenum	0.41	**0.23**	**0.300 JL**	**0.290 JL**	**0.380 JL**	**0.21 JL**
Nickel	8.1	**5.9**	**5.80 JL**	**7.20 JL**	**9.30 JL**	**6.4 JL**
Selenium	0.393	**0.45**	<0.244 UJL	<0.244 UJL	<0.244 UJL	<0.244 UJL
Silver	0.036	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Thallium	0.206	<0.206 UJL	<0.206 UJL	**0.230 JL**	**0.380 JL**	<0.206 UJL
Vanadium	26.7	**17.3**	**13.0 J**	**15.4 JL**	**16.0 JL**	**20.3 JL**
Zinc	40.4	**29.4**	**32.4**	**37.2 JL**	**53.8 JL**	**36.8 JL**

Bold Value = analyte detected

Shaded Green Exceeds site-specific background UPL

J = Estimated
JH = Estimated, potentially biased high
JL = Estimated, potentially biased low
R = Rejected
U = Not detected at the stated detection limit
X7 = TCEQ does not offer accreditation for this analyte
X8 = Laboratory is not accredited for this analyte by this method, although accreditation is offered

Sample types: N – normal, A – average of triplicate samples

Table 5-8. Arroyo Sample CQ072 and Upstream Sample Data (mg/kg)

Analyte	Site Specific Background (UPL)	Possible Upstream Samples				Arroyo
		CV063 N	**CU060 N**	**CU059 N**	**CS059 N**	**CQ072 N**
		13-Sep-12	**8-Feb-11**	**10-Feb-11**	**13-Sep-12**	**13-Sep-12**
Aluminum	8,630	**7140 X8**	**6550 X8**	**4250 X8J**	**7150 X8**	**7180 X8**
Antimony	0.354	**0.70 JL**	**0.110 JL**	**0.210 U**	**0.43 JL**	**0.48 JL**
Arsenic	5.68	<0.0880 UJL	<0.0880 UJL	**0.310 U**	<0.0880 UJL	<0.0880 UJL
Barium	74.3	**58.2**	**70.6 JL**	**44.1 J**	**55.9**	**56.9**
Beryllium	0.619	**0.68 JL**	**0.92**	**0.650 JL**	**0.65 JL**	**0.64 JL**
Cadmium	0.401	**0.64 JL**	**0.58**	**0.430 JL**	**0.58 JL**	**0.59 JL**
Chromium (total)	11.9	**7.6 JL**	**8.40 JL**	**5.10 JL**	**7.4**	**7.2 JL**
Cobalt	4.9	**3.3 JL**	**5.40 JL**	**3.50 JL**	**3.5 JL**	**3.3 JL**
Copper	19.9	**16.7 JL**	**23.1 JL**	**15.7 J**	**16.1 JL**	**15.9 JL**
Lead	20.83	**38.1**	**48.2 J**	**43.2 JH**	**35.5**	**33.6**
Manganese	231	**243 X8**	**253 X8J**	**162 X8J**	**236 X8**	**236 X8**
Mercury	0.0235	**0.028 J**	**0.0220 J**	**0.0220 J**	**0.022 J**	**0.021 J**
Molybdenum	0.41	**0.28 JL**	**0.420 JL**	**0.300 JL**	**0.26 JL**	**0.25 JL**
Nickel	8.1	**6.6 JL**	**9.60 JL**	**6.00 JL**	**6.9 JL**	**6.7 JL**
Selenium	0.393	**0.56 JL**	<0.244 UJL	<0.244 UJL	**0.58 JL**	**0.55 JL**
Silver	0.036	<0.0360 UJL	<0.0360 U	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Thallium	0.206	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL	<0.206 UJL
Vanadium	26.7	**18.3 JL**	**17.9 JL**	**9.30 JL**	**18.4 JL**	**17.4 JL**
Zinc	40.4	**41.8 JL**	**63.2 JL**	**45.5 JL**	**41.7 JL**	**39.9 JL**

Bold Value = analyte detected

Shaded Green Exceeds site-specific background UPL

J = Estimated
JH = Estimated, potentially biased high
JL = Estimated, potentially biased low
R = Rejected
U = Not detected at the stated detection limit
X7 = TCEQ does not offer accreditation for this analyte
X8 = Laboratory is not accredited for this analyte by this method, although accreditation is offered

Sample types: N – normal, A – average of triplicate samples

Table 5-9. Arroyo Sample DA053 and Upstream Sample Data (mg/kg)

Analyte	**Site Specific Background (UPL)**	**Possible Upstream Samples**				**Arroyo**
		CO048 N	**CO043 N**	**CT053 N**	**CR051 N**	**DA053 N**
		13-Sep-12	**8-Feb-11**	**10-Feb-11**	**9-Feb-11**	**14-Sep-12**
Aluminum	8,630	**8380 X8**	**5620 X8J**	**5250 X8J**	**6320 X8JH**	**3580 X8**
Antimony	0.354	**0.43 JL**	<0.0950 R	**0.120 U**	<0.0950 R	**0.23 JL**
Arsenic	5.68	<0.0880 UJL	**4.60 JL**	<0.0880 UJL	**4.30 JL**	**1.3 JL**
Barium	74.3	**48.4**	**59.2 JH**	**50.1 J**	**67.5 J**	**42.2**
Beryllium	0.619	**0.67 JL**	**0.880 JL**	**0.720 JL**	**0.890 JL**	**0.55 JL**
Cadmium	0.401	**0.47 JL**	**0.270 JL**	**0.500 JL**	**0.690 JL**	**0.39 JL**
Chromium (total)	11.9	**8.9 JL**	**7.90 JL**	**6.20 JL**	**8.00 JL**	**4.2 JL**
Cobalt	4.9	**2.9 JL**	**4.50 JL**	**3.60 JL**	**5.30 JL**	**2.7 JL**
Copper	19.9	**13.4 JL**	**14.0 JH**	**19.9 J**	**165 JL**	**11.6 JL**
Lead	20.83	**16.5**	**16.8 JL**	**40.0 JH**	**37.8 JL**	**13.4**
Manganese	231	**187 X8**	**194 X8**	**179 X8J**	**245 X8JH**	**174 X8**
Mercury	0.0235	**0.025 J**	**0.0210 J**	**0.0210 J**	**0.0270 J**	**0.023 U**
Molybdenum	0.41	**0.25 JL**	**0.350 JL**	**0.350 JL**	**0.440 JL**	**0.23 JL**
Nickel	8.1	**6.1 JL**	**8.70 JL**	**7.40 JL**	**10.3 JL**	**4.9 JL**
Selenium	0.393	**0.51 JL**	<0.244 UJL	<0.244 UJL	<0.244 UJL	**0.32 JL**
Silver	0.036	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Thallium	0.206	<0.206 UJL	**0.400 JL**	<0.206 UJL	**0.360 JL**	<0.206 UJL
Vanadium	26.7	**19.9 JL**	**14.9 JL**	**11.1 JL**	**16.7 JL**	**11.4 JL**
Zinc	40.4	**31.8 JL**	**48.9 JL**	**53.2 JL**	**75.1 JL**	**27.8 JL**

Bold Value = analyte detected

Shaded Green Exceeds site-specific background UPL

J = Estimated

JH = Estimated, potentially biased high

JL = Estimated, potentially biased low

R = Rejected

U = Not detected at the stated detection limit

X7 = TCEQ does not offer accreditation for this analyte

X8 = Laboratory is not accredited for this analyte by this method, although accreditation is offered

Sample types: N – normal, A – average of triplicate samples

Table 5-10. Arroyo Sample DN062 and Upstream Sample Data (mg/kg)

Analyte	Site Specific Background (UPL)	Possible Upstream Samples				Arroyo
		DI054 N	**DK056 N**	**DH055 N**	**DF056 N**	**DN062 N**
		10-Feb-11	**10-Feb-11**	**10-Feb-11**	**15-Feb-11**	**14-Sep-12**
Aluminum	8,630	**4360 X8J**	**5400 X8J**	**4510 X8JH**	**5820 X8J**	**7600 X8**
Antimony	0.354	**0.290 U**	**0.150 U**	<0.0950 R	<0.0950 R	**0.27 JL**
Arsenic	5.68	**1.20 JL**	**1.10 JL**	**4.30 JL**	**1.80 JL**	**3.8 JL**
Barium	74.3	**44.1 J**	**51.0 J**	**49.3 J**	**46.4 J**	**57.5**
Beryllium	0.619	**0.540 JL**	**0.630 JL**	**0.720 JL**	**0.670 JL**	**0.67 JL**
Cadmium	0.401	**0.320 JL**	**0.460 U**	**0.390 JL**	**0.340 JL**	**0.46 JL**
Chromium (total)	11.9	**5.50 JL**	**8.00 JL**	**5.60 JL**	**7.20 JL**	**10.5**
Cobalt	4.9	**3.70 JL**	**5.00 JL**	**3.70 JL**	**3.50 JL**	**3.5 JL**
Copper	19.9	**10.9 J**	**16.0 J**	**14.6 JL**	**15.6 J**	**15.7 JL**
Lead	20.83	**19.0 JH**	**25.9 JH**	**23.0 JL**	**25.7 JL**	**24.5 JL**
Manganese	231	**157 X8J**	**195 X8J**	**191 X8JH**	**156 X8J**	**214 X8**
Mercury	0.0235	**0.0170 J**	**0.0200 J**	**0.0200 J**	**0.0260 J**	**0.016 U**
Molybdenum	0.41	**0.290 JL**	**0.340 JL**	**0.360 JL**	**0.270 JL**	**0.21 JL**
Nickel	8.1	**7.40 JL**	**9.80 JL**	**6.80 JL**	**5.70 JL**	**7.1 JL**
Selenium	0.393	<0.244 UJL	**0.350 U**	<0.244 UJL	**0.520 JL**	<0.244 UJL
Silver	0.036	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL	<0.0360 UJL
Thallium	0.206	<0.206 UJL	<0.206 UJL	**0.280 JL**	<0.206 UJL	<0.206 UJL
Vanadium	26.7	**10.5 JL**	**13.8 JL**	**11.9 JL**	**13.2 JL**	**23.1 JL**
Zinc	40.4	**61.9 JL**	**73.7 JL**	**48.9 JL**	**36.4 JL**	**52.1 JL**

Bold Value = analyte detected

Shaded Green Exceeds site-specific background UPL

J = Estimated

JH = Estimated, potentially biased high

JL = Estimated, potentially biased low

R = Rejected

U = Not detected at the stated detection limit

X7 = TCEQ does not offer accreditation for this analyte

X8 = Laboratory is not accredited for this analyte by this method, although accreditation is offered

Sample types: N – normal, A – average of triplicate samples

In Tables 5-5 through 5-10, only analytes exceeding the site-specific background were examined for correlation between the arroyos and the upstream sampling units. One possible data pattern that could indicate transport would be multiple analytes clearly exceeding background values in the source area, and the majority of the same analytes in the arroyos also exceeding the background values. It is difficult to conclude that this pattern exists at these locations, however, because the values only exceed the background level slightly. In all six cases, only six occurrences of contaminants exceed the background level by a factor of two or more. The rest of the data show very small differences between source and arroyo. Furthermore, only two of the six arroyos had a ratio of exceedences in the source area to exceedences in the arroyo of greater than 50%. Physical and chemical phenomena may also complicate the analysis of transport, including the propensity for one metal to bond more tightly to a given soil type than others, rendering it more or less mobile than other contaminants.

In short, the data collected in Phase 2 do not show strong evidence of contaminant transport, as would be indicated by a correlation between arroyo and upstream data. Not finding a correlation in these data does not mean there is not one. It is possible that transport is occurring but the specific selection of sampling locations did not discover it. It is also possible that transport is not occurring, but these limited data do not support either conclusion.

In an RI/FS, this question could arise if there were exceedences of a PCL or another action level at a specific location. In that case the investigation would be able to target specific analytes in specific drainages, and could collect additional samples to conclusively answer the question, which would have a bearing on the area requiring remedial action.

5.5 Nature and Extent of Contamination—Incremental Sampling Data

Both Phase 1 and Phase 2 sampling data confirmed that the nature of potential contamination on the Closed Castner Firing Range is predominantly metals. Explosives and propellants were discovered only sporadically and were associated with specific and known range activities, such as OB/OD operations.

Figures 5-4 through 5-18 show that geostatistical kriging methods are useful and appropriate tools when using randomly distributed data points to delineate the extent of contamination over a large area of interest. In this study, emphasis was placed on specifically defined areas, including potential sources areas—Target Areas 1, 2, 3, and 9—and potential land use-defined areas—Areas A, B, and C. Geostatistical methods require sample data that provide representative spatial coverage over the entire area.

5.6 Evaluation of CRREL Guidance

One of the key objectives of the project was to implement the CRREL-developed incremental sampling guidance (CRREL 2011) and evaluate its suitability for application in a full-scale Army MMRP production environment. In general, the guidance was clearly stated, easily implemented, and applicable to the Closed Castner Firing Range. Throughout the project, however, it was discovered that some elements of the guidance could benefit from modification. The guidance document was rigorously reviewed, and implementation at the Closed Castner Firing Range is documented in Appendix H. Phrases from the guidance that began with imperative or recommending language (i.e., “recommended,” “should,” “must,” “need,” etc.) were abstracted into the table in the appendix, and implementation in this project was documented. Possible modifications to the document were also recorded. Those recommendations include:

- The implementation of an incremental sampling program may be novel to many regulators. In particular, the selection of action levels or PCLs will vary from location to location. For example, in CRREL 2011, Section 6.3 describes EPA recommendations to base exposure point concentrations on a 95% UCL. This would be a point of negotiation between the project team and the regulator, and may or may not be optimum use of the data. Because of the nature of the data produced by incremental sampling, it may be best suited for specific approaches in screening and risk assessment; it is recommended that the Army develop recommendations for best practices under specified conditions that Project Managers can recommend and clearly describe in negotiations with regulators and stakeholders inexperienced with incremental sampling practice.
- This project collected an unusually high number of incremental samples in pursuit of project objectives, in part because of the large area involved. Because it is unlikely that a typical RI would collect as many samples, it is recommended that additional guidance be developed for

the application of ISM for a variety of investigation scenarios. Scenarios might include more types of training ranges, ranges where the contaminated area is well known, ranges where large tracts are believed to be uncontaminated, scenarios spanning the variety of potential land uses and public access, and ranges with sensitive or protected ecological receptors.

- EPA Method 8330B, Section A.4.0 recommends cleaning the sampling tool between replicate samples within the same sampling unit. The Army guidance states otherwise; it is recommended that Army guidance be modified to be consistent with Method 8330B.
- Several of the sampling grid establishment recommendations in the Army guidance relied on manual methods suited to small areas or a minimum number of samples. Because of the large numbers of samples and the large areas covered by the range, pre-loading of sampling unit and increment locations into handheld GPS units proved highly efficient and successful at the Closed Castner Firing Range. It is recommended that Army guidance be modified to encourage field navigation by GPS.
- Arroyos (ephemeral drainage channels) sampling was implemented during the Phase 2 sampling to enable investigation of contamination transport. It is recommended that the arroyo sampling approach be added to Army guidance to provide a proven option for future projects with similar needs.
- Because projects will specify sample processing by Method 8330B, it is recommended that the Army guidance replace the detailed laboratory processing description with a reference to the Method 8330B.

6. CONCLUSIONS AND RECOMMENDATIONS

The objectives of the ISM Field Demonstration on the Closed Castner Firing Range MRS were to assist USAEC and USACE to:

- Implement the Army's draft incremental sampling protocol and recommend modifications to improve effectiveness;
- Determine the nature and extent of MC;
- Gain regulatory feedback on the sampling approach and results;
- Test the effect of sampling unit size on MC concentrations; and
- Test the correlation between MEC density and MC concentrations.

6.1 Army Draft Guidance

This project demonstrated the full-scale field implementation of ISM in accordance with the Army's draft guidance. It was a particular goal of the project to collect data in a manner that would allow their use in a future RI. With few exceptions, the guidance was successfully implemented at the Closed Castner Firing Range, and appears suitable for use and ready for adaptation to a formal guidance document. Suggested areas for improvement include:

- **Conclusion**: For a production project of over 4,004 acres, it was found to be efficient to preselect sampling unit locations and primary, duplicate, and triplicate increment locations, and preload them into handheld GPS units assigned to field teams. In planning discussions with CRREL personnel, it was determined that these preselections would not compromise the intent of randomness. Field navigation by GPS was successfully used at the Closed Castner Firing Range.

  Recommendation: It is recommended that the Army guidance be modified to support use of GPS navigation.

- **Conclusion**: This project collected an unusually high number of incremental samples in pursuit of project objectives, in part because of the large area involved.

  Recommendation: Because it is unlikely that a typical investigation would involve collection of as many samples, it is recommended that additional guidance be developed for the application of ISM for a variety of investigation scenarios. Scenarios might include more types of training ranges, ranges where the contaminated area is well known, ranges where large tracts are believed to be uncontaminated, scenarios spanning the variety of potential land uses and public access, and ranges with sensitive or protected ecological receptors.

- **Conclusion**: Arroyo sampling was used to investigate contaminant transport questions, which will likely be raised at many other investigation sites.

  Recommendation: It is recommended that the practices developed and applied on this project, or similar methods, be refined, validated, and included in the Army guidance as a sampling option.

6.2 Nature and Extent of MC

Both Phase 1 and Phase 2 sampling data confirmed that the nature of potential MC contamination on the Closed Castner Firing Range is predominantly metals. Explosives and propellants were discovered only sporadically and were associated with specific and known range activities, such as OB/OD operations.

Recommendation: No specific recommendations pertain to the nature of the MC contamination.

Section 5.2 presented the results from careful geostatistical kriging, and demonstrated that geostatistical kriging methods are useful and appropriate tools when using randomly distributed data points to delineate the extent of contamination over a large area of interest. In this study, emphasis was placed on specifically defined areas, including potential source areas—Target Areas 1, 2, 3, and 9—and areas adjacent to current development—Areas A, B, and C. Geostatistical methods require sample data that provide representative spatial coverage over the entire area. The site assessment maps provide useful criteria to decide whether a particular unit area may need remediation relative to a specified PCL, if there is uncertainty about this decision, and whether additional sampling in the unit area may be necessary to resolve this uncertainty.

Analysis of contamination relative to soil type did not show significant effect on contaminant concentrations. Analysis of contamination by target areas and nontarget areas showed statistically significant differences ascribed to past range uses.

Recommendation: There are aspects of extent that were not fully delineated by this study. It is recommended that additional investigation complete the delineation to support remedial and land management decisions. These aspects include:

- Defining and delineating the groundwater pathway;
- Defining and sampling the surface water/storm water/sediment transport pathway;
- Completing the investigation of anomalous beryllium contamination by identifying the source and delineating the transport pathway; and
- Sampling specific drainage/arroyo pathways to understand the mobility of contaminants from actionable source areas.

Site-specific background UPLs were calculated based on 15 incremental samples collected from nearby property unaffected by military activities.

Recommendation: It is recommended that the use of site-specific background data in determining PCLs and assessing the extent of actionable contamination be fully determined in conjunction with TCEQ regulators and the objectives of an RI.

6.3 Regulatory Feedback on Approach and Results

Plans and comparison values were prepared in accordance with Texas regulations. URS assigned a specialist with expertise in Texas regulations and the TRRP to consult in the planning and to review results and reports in light of Texas-specific regulations. Two meetings were held with TCEQ: one at the beginning of the project to review the approach, and one following the Phase 2 sampling to discuss preliminary results. Key issues discussed in these meetings included:

- In general, while TCEQ regulations (e.g., TRRP) do not specifically address the use of ISM, the State of Texas understands the benefits of using the method on DoD sites. Each TCEQ project manager will be required to address and approve the application of ISM for use on their specific site, but the method could be justified as a type of representative sample.
- The selection of a screening standard/PCL is an issue appropriately addressed at the RI planning stage. At that time, all pathways and receptors will be considered in the context of known site characteristics. It was agreed that using the conservative levels in the QAPP (URS 2011) was appropriate for this demonstration project. Regulatory interpretation of the ISM results on a sampling unit basis is still undetermined, and will be addressed in the RI phase when selecting the screening level.
- TCEQ is familiar with the use of geostatistical methods to interpolate and display sampling results, and is not opposed to using the methods with the data collected at the Closed Castner Firing Range.
- Calculation of site-specific background levels from incremental sampling data is acceptable to TCEQ, but the rationale and detailed calculations should be presented for a full review, prior to acceptance.
- Metals results—especially lead—could be biased high if the sieve screen in the laboratory is too coarse, allowing larger lead particles into the grinding process, even though the lead in large particles is not as bioavailable as in smaller particles. Currently the sieve used in Method 8330B is a #10 sieve (particles less than 2mm); TCEQ recommended study/consideration of a #60 sieve (particles less than 0.25mm).
- Surface water is ephemeral at the Closed Castner Firing Range, but is a potential transport mechanism. Although surface water studies and sampling were beyond the scope of this demonstration project, future investigations may need to more directly address this issue.

In addition to meetings with TCEQ regulators, the project team met in TPP meetings with stakeholders to discuss the planning, execution, and intermediate and final results. Stakeholders are a key part of the public involvement aspect of the regulatory process. Stakeholders in Texas included public officials, private citizens, activists, and representatives of special interest groups, academics, and neighbors and users of former Closed Castner Firing Range property (see Section 4.4 and Appendix A)

Recommendation: No specific recommendations pertain to regulatory issues.

6.4 Effect of Sampling Unit Size

One of the original study objectives was to evaluate the effect of sampling unit size on analytical results, and early planning included 10-acre sampling units. The main reason for originally considering larger sampling units was to enable a more coarse screening coverage of a greater fraction of the surface area of the large range. Following planning discussions with CRREL and TCEQ stakeholders, however, it was determined that all sampling units would be limited to 1 acre, and that the team would forego evaluation of this study objective in favor of a consistent sampling unit size within the envelope of previous research. Much of CRREL’s earlier research had involved areas much smaller than 10 acres, and in many cases smaller than 1 acre. Stakeholders were concerned that there was insufficient scientific support for a 10-acre sampling unit, and little experience at assessing the accuracy and interpreting the results at that scale. Because the future land use of the Closed Castner Firing Range is unknown, and because the final number of sampled acres was 163, or about 2.3%, it was concluded that 1-acre sampling units provided the best balance between established experience and areal coverage. The stakeholders concurred with this decision.

Recommendation: No specific recommendations pertain to increased sampling unit sizes.

6.5 Correlation Between MEC/MD Density and MC

Potential target areas in the study area were designated based on the observed density of metallic anomalies and the fraction of these anomalies related to MD (URS 2012). In the statistical analysis, areas were grouped into confirmed target areas and all other areas, which combined suspected target areas and nontargets areas. Statistical analysis indicated that concentrations for cadmium, copper, lead, and nickel were statistically higher in the target area than the combined group of suspected-plus-nontarget areas. Chromium (total) concentrations were moderately higher in the target areas. These metals appear to be correlated to MD in target areas.

Beryllium concentrations were significantly lower in the target areas; arsenic concentrations were moderately lower in the target areas. Zinc concentrations were statistically no different between the two groups and may not be related to MD.

It was concluded that there is a statistically significant correlation between MEC density and MC concentrations. Because of the correlation between MEC density and MC concentrations, the DGM results, together with the intrusive investigation results demonstrating the presence of MEC/MD, may be used to guide the number and placement of MC sampling units.

Recommendation: It is recommended that the Army guidance include directions about designing and applying efficient sampling programs on the basis of geophysical and intrusive investigation results.

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