Site-Wide Corrective Measures Implementation Plan for Soil Remediation
Fort McClellan
Anniston, Alabama

Prepared for:

McCLELLAN
DEVELOPMENT AUTHORITY

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Revision: 1

Corrective Measures Implementation Plan

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Fort McClellan Sitewide
Anniston, Alabama
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Date: September 18, 2017

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List of Acronyms and Abbreviations

ADEM	Alabama Department of Environmental Management
AEIRG	Alabama Environmental Investigation & Remediation Guidance
amsl	Above mean sea level
Army	U.S. Department of the Army
BBGR	Baby Bains Gap Road
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BMP	Best Management Practice
BRAC	Base Realignment and Closure
CA	Cleanup Agreement
CDTF	Chemical Defense Training Facility
CERCLA	Comprehensive Response, Compensation, and Liability Act
CFDP	Center for Domestic Preparedness
CFR	Code of Federal Regulations
CMER	Corrective Measures Effectiveness Report
CMIP	Corrective Measures Implementation Plan
CMIR	Corrective Measures Implementation Report
COC	Contaminant of Concern
DOJ	United States Department of Justice
ESCA	Environmental
°F	degrees Fahrenheit
ECP	Erosion Control Plan
EPA	U.S. Environmental Protection Agency
ESC	erosion and sediment control
ESCA	Environmental Services Cooperative Agreement
ESV	Ecological Screening Values
ft/ft	feet per foot
FOSET	Finding of Suitability for Early Transfer
FOST	Finding of Suitability for Transfer
FWS	U.S. Fish and Wildlife Service
GPS	Global Positioning System
IT	IT Corporation
LUCs	Land Use Controls
MDA	McClellan Development Authority
MEC	munitions and explosives of concern
MES	Matrix Environmental Services, LLC.
mg/kg	milligram per kilogram
mg/L	milligram per liter
msl	mean sea level
PCBs	poly chlorinated biphenyls
QA/QC	quality assurance/quality control
RBRG	Risk-Based Remediation Goal
RBTL	Risk-Based Target Level
RC	Remediation Contractor
RCRA	Resource Conservation and Recovery Act

RI	Remedial investigation
RSLs	Remedial Screening Levels
SAP/QA/QCP	Sampling and Analysis Plan and Quality Assurance/Quality Control Plan
sf	square foot
Shaw	Shaw Environmental Inc.
SSA	Site Specific CMIP Addendum
SWCC	Soil and Water Conservation Committee
SWPPP	Stormwater Pollution Prevention Plan
SVOCs	semivolatile organic carbons
T&D	transportation and disposal
TCLP	toxicity characteristic leaching procedure
UECA	Uniform Environmental Covenants Act
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UXO	unexploded ordnance
VOCs	volatile organic carbons
WMP	Waste Management Plan
XRF	x-ray fluorescence

1.0 PROJECT DESCRIPTION

1.1 Introduction

This Corrective Measures Implementation Plan (CMIP) was prepared by Matrix Environmental Services, LLC (MES) for the McClellan Development Authority (MDA) to describe the methods and procedures that will be used to address the remediation of metals-impacted soils from former small arms firing ranges and other potential areas of concern (collectively referred to as Ranges) located at the former Fort McClellan (Site) in Calhoun County, Alabama. This CMIP does not address any groundwater contamination that may exist on these Ranges, any groundwater contamination will be addressed under separate cover. The Ranges were part of the United States (US) Department of the Army (Army) normal operations at Fort McClellan and are located throughout the entire portion of the Fort McClellan Main Post in Anniston, Alabama (see **Figure 1**). Areas with confirmed metals-impacted soils that will require remediation include the Iron Mountain Road Ranges (IMRR) and Range 30 Impact Area. Additional areas may be identified at a later date as the site characterizations are completed and approved by Alabama Department of Environmental Management (ADEM).

1.2 General Information

Facility Name/Alias:	Fort McClellan
Facility Address:	Fort McClellan, Calhoun County, Alabama
Facility ID (If EPA ID has been issued):	AL4210020562
Facility Contact:	Robin Scott McClellan Development Authority 4975 Bains Gap Road Anniston, Alabama 36205 (256) 236-2011
Geographic Coordinates:	33° 42’ 17.82” N, 85° 46’ 07.31” W
Type of Facility:	Former Army Training Installation
Size of Facility:	42,286 acres
Facility Location Map	See **Figure 1**
Facility Site Map:	See **Figure 2**
Current Owner:	McClellan Development Authority
Years of Operation:	2010 to Present
Former Owner:	Anniston-Calhoun County Fort McClellan Development Joint Powers Authority
Years of Operation:	1999-2010
Former Owner:	United States Department of the Army
Years of Operation:	1917-1999 (See Section 2.1)

1.3 Environmental Setting

Climate – Fort McClellan has a temperate, humid climate with long summers and typically short winters. The average annual temperature is 63 degrees Fahrenheit (°F) with high temperatures of over 100°F and low temperatures below freezing. The average annual rainfall is approximately 53 inches per year (Shaw Environmental Inc. [Shaw], 2012).

Landscape (Physiography) – All of Fort McClellan lies within the Valley and Ridge Physiographic Province except for the easternmost portion of the Choccolocco Corridor, which lies in the Piedmont Physiographic Province. Lower elevations are about 700 feet above mean sea level (amsl) and the highest elevation is about 2,063 feet amsl on Choccolocco Mountain (Shaw, 2012).

Surrounding Land Use – The eastern and southern portions of the former Fort McClellan facility make up the Mountain Longleaf National Wildlife Refuge. The remainder of the ranges and surrounding area is controlled by the MDA for economic redevelopment. Fort McClellan is bordered by the City of Anniston to the south and west, and by unincorporated Calhoun County to the north and east. Land use to the west of the installation consists of a variety of commercial uses, the Anniston Middle School and Calhoun County Board of Education, and community facilities. To the south are low density single family residential and developing residential areas. Areas to the east and north within Calhoun County consist of rural land used for agricultural and open space with scattered residential development.

1.4 Facility/Site Accessibility

Access to the site will be coordinated with the MDA and MES. The sites are not accessible to the general public via automobiles. Access roads are gated. The sites can be accessed by foot.

1.5 Corrective Measures Objectives and Scope

The overall purpose and objective of this CMIP is to provide a consistent remediation plan to appropriately address metals soil contamination at former Ranges.

1.5.1 Summary of the Need for Corrective Action

As identified in the Cleanup Agreement (CA) between the ADEM and MDA (ADEM, 2012), the MDA is responsible for obtaining 'No Further Action" status at the Fort McClellan Ranges through the use of soil remediation activities and applicable land use controls.

1.5.2 Summary of major goals of corrective action

The major goal of the corrective action is to excavate; stabilize, as necessary; and dispose of metals-contaminated surficial soils, sub–surficial soils, and sediment from within these Ranges in order to allow beneficial reuse of the property. It is anticipated that the Ranges will be remediated to both human-health and ecological cleanup levels for metals in soils based on the future land use of the property. These cleanup levels will vary depending on the Ranges, but will include a combination of previously established human health risk based target levels (RBTLs), ecological risk-based goals (RBRGs), and land use controls (LUCs). Each of the Ranges (or grouping of Ranges) will have a site-specific CMIP Addendum

(SSA) that will identify the specific nature and extent of contamination existing at that Range(s) and the remediation objectives or goals for those sites.

1.5.3 List of Major Components of the Plan

There are five major components of the technical approach of this remedial project:

- A treatability study to identify a suitable stabilization formulation,
- Delineation of the horizontal and vertical extent of impacted soils,
- In-situ stabilization of soils that exceed the Resource Conservation and Recovery Act (RCRA) toxicity characteristic,
- Excavation of treated and untreated soils that exceed cleanup levels,
- Transportation and disposal,
- Site grading, backfill (where necessary), and vegetation restoration.

1.5.4 Summary of how the planned action will achieve goals

The soil remediation procedure described below will identify those areas of the target Range that contain soils with COCs that exceed the site specific cleanup levels. These site-specific cleanup levels are designed to protect human-health and ecological receptors that may come into contact with these soils. Once the areas with soil contamination have been delineated, a remediation contractor (RC) will perform the necessary steps to remove the soils from the Range and dispose of them at an ADEM approved landfill offsite. This process will remove the source of the contamination and mitigate the potential for receptor exposure. In some cases, the addition of LUCs may be necessary at the Ranges following the completion of remediation activities due to presence of constituents in soils above human health residential standards, a potential for munitions and explosives of concern (MEC), the use of groundwater may need to be restricted, or another as yet unidentified condition exists at the Ranges. LUCs will be implemented in accordance with Section IV.B.4. of the CA and ADEM Administrative Code R 335-5.

Pre- and post-excavation confirmation samples will be collected to verify that targeted areas meet cleanup levels. Further details of these activities are in subsequent sections of this CMIP.

2.0 SITE CHARACTERIZATION

2.1 Site (Facility) Description and Operational History

McClellan is located in the foothills of the Appalachian Mountains of northeastern Alabama, near the cities of Anniston and Weaver in Calhoun County. McClellan is approximately 60 miles northeast of Birmingham, 75 miles northwest of Auburn, and 95 miles west of Atlanta, Georgia.

The Main Post of McClellan consists of 18,946 acres and was purchased by the U.S. Government in March 1917 for construction of a National Guard Camp. On July 18, 1917 the U.S. War Department authorized the establishment of McClellan as an artillery range and a training camp and on July 20, 1917 construction of the camp began. By February 1919, 1,660 buildings had been constructed and a railway spur from the nearby Southern Railway Tracks was completed. The site was named Camp McClellan in honor of Major General George B. McClellan, a leader of the Union Army during the Civil War. Camp McClellan was used to train troops for World War I from 1917 until the armistice. It was then designated as a demobilization center. Between 1919 and 1929, Camp McClellan served as a training area for active army units and other civilian elements. Camp McClellan was re-designated as Fort McClellan in 1929 and continued to serve as a training area.

In 1940, the government acquired an additional 22,245 acres west of McClellan. This tract of land was named Pelham Range. In 1941, the Alabama Legislature leased approximately 4,488 acres to the U.S. Government to provide an access corridor from the Main Post to Talladega National Forest. This corridor provided access to additional woodlands for training.

The Army operated the Chemical Defense Training Facility (CDTF) at McClellan from 1951 until the school was deactivated in 1973. The CDTF was then reactivated in 1979 and was closed at the time of base closure in 1999 (Environmental Science & Engineering, Inc. [ESE], 1998). The CDTF offered advanced training in all phases of chemical, biological, and radiological warfare to personnel from all branches of the military.

In 1995, the U.S. Department of Defense announced that McClellan would close by October 1999. The Base Realignment and Closure (BRAC) commission recommended closure of the installation, except for minimum essential land and facilities for a Reserve Component Enclave and essential facilities needed to provide support for the chemical demilitarization operation at Anniston Army Depot. Subsequently, the U.S. Department of Justice (DOJ) requested a transfer of some facilities and training area to their authority for ongoing training exercises. McClellan transferred the CDTF and ancillary support facilities to the DOJ in 2000 to establish the Center for Domestic Preparedness (CFDP).

Property that was determined by the Army and ADEM to be suitable for transfer (i.e., “clean property”) was transferred to the JPA under a Finding of Suitability for Transfer (FOST). Subsequently, remaining contaminated property was transferred to the JPA under a Finding of Suitability for Early Transfer (FOSET). The basis for the continuing effort at these FOSET parcels is the execution of an Environmental

Services Cooperative Agreement (ESCA) and the CA that describe the responsibilities for completing the investigation and remediation of environmentally impacted sites at McClellan.

2.2 Regional Geology, Soils, and Hydrogeology

2.2.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including McClellan, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted with major structures and faults striking in a northeast-southwest direction. Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the stacking of large slabs of rock, referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group comprises the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984), but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran Formation is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish-gray siltstone and mudstone. Massive to laminated greenish-gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appears to dominate the unit and consists primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone which are locally interbedded with the coarse, clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of McClellan belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish-gray or pale yellowish-gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline, porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on Ft McClellan (Osborne and Szabo, 1984). The character of the Shady Dolomite in the McClellan vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of McClellan, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish-red-purple mudstone, shale, siltstone, and greenish-red and light gray sandstone, with locally occurring limestone and dolomite. The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of McClellan (Osborne et al., 1997). The Conasauga Formation is composed of dark gray, finely to coarsely crystalline medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weathers to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone consists of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped together as undifferentiated at McClellan and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at McClellan and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites and limestones and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish-gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomitic mudstone, and glauconitic limestone (Osborne, et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish-gray to grayish-red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile, brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on McClellan, to the Ordovician Athens Shale on the basis of fossil data.

The Pennsylvania Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty clay shale and mudstone with interbedded light to medium gray, very fine to fine grained, argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium to dark gray argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). In Calhoun County, the Parkwood Formation is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovazal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geologic feature in the vicinity of McClellan, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence comprising the Eden thrust sheet is exposed at McClellan through an eroded "window" or "fenster" in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The McClellan window is framed on the northwest by the Rome Formation, north by the Conasauga Formation, northeast, east, and southwest by the Shady Dolomite, and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the McClellan window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the McClellan window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the McClellan window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. The trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three-quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks. It is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the McClellan window, and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982; Osborne et al., 1988). The Coosa deformed belt is a narrow (approximately 5 to 20 miles wide) northeast-to-southwest-trending linear zone of complex structure (approximately 90 miles in length) consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

2.2.2 Regional Soil

The soil associations found at McClellan (U.S. Department of Agriculture [USDA], 1961), include:

- **Anniston-Allen, Decatur-Cumberland**. Alluvium, resulting from weathering of older residual soils developed from sandstone, shale and quartzite; deep, well-drained, level to moderately steep soil in valleys underlain by limestone and shale. Subsoil is dark red sandy clay loam. Cumberland and Decatur soils are dark reddish brown gravelly loam developed from weathered limestone.
- **Clarksville-Fullerton.** Well-drained to moderately well-drained stony or cherty soils developed in the residuum of cherty limestone. This association is limited to Pelham Range. The soils are generally dark brown to dark gray-brown silt loam.
- **Rarden-Montevallo-Lehew.** Moderately deep or shallow soils on ridgetops and steep slopes and in local alluvium in draws. Soils are developed from the residuum of shale and fine-grained, micaceous sandstone; reddish brown to dark gray-brown to yellow-brown silt loam, clay or silty clay.
- **Stony Rough Land**. Shallow, steep, and stony soils formed from the weathering of sandstone, limestone, and Talladega Slate. Infiltration is slow; the soils contain many boulders and fragments with clayey residuum. This association underlies a large portion of the Main Post at McClellan.

2.2.3 Regional Hydrogeology

The hydrogeology of Calhoun County has been investigated by the Geologic Survey of Alabama (Moser and DeJarnette, 1992), the U.S. Geological Survey (USGS) in cooperation with the General Services Administration (Warman and Causey, 1962), and ADEM (Planert and Pritchette, 1989). Groundwater in the vicinity of McClellan occurs in residuum derived from bedrock decomposition along fault zones within fractured bedrock and from the development of karst frameworks. Groundwater flow direction is generally toward major surface water features.

Precipitation and subsequent infiltration provide recharge to the groundwater flow system in the region. The main recharge areas for the aquifers in Calhoun County are located in the valleys. The ridges generally consist of sandstone, quartzite, and slate which are resistant to weathering, relatively unaffected by faulting, and therefore, relatively impermeable. The ridges have steep slopes and thin to no soil cover, which enhances runoff to the edges of the valleys (Planert and Pritchette 1989).

The thrust fault zones typical of the county form large storage reservoirs for groundwater. Points of discharge occur as springs, effluent streams, and lakes. Coldwater Spring is one of the largest springs in the State of Alabama, with a discharge of approximately 32 million gallons per day. This spring is the main source of water for the Anniston Water Department, and serves McClellan. The spring is located approximately 5 miles southwest of Anniston and discharges from the brecciated zone of the Jacksonville Fault (Warman and Causey, 1962).

Shallow groundwater at McClellan occurs principally in the residuum developed from Cambrian sedimentary and carbonate bedrock units of the Weisner Formation, Shady Dolomite and locally in lower Ordovician carbonates. The residuum may yield adequate groundwater for domestic and livestock needs but may go dry during prolonged dry weather. Groundwater within the residuum serves as a recharge reservoir for the underlying bedrock aquifers. Bedrock permeability is locally enhanced by fracture zones associated with thrust faults and by the development of solution (karst) features.

Two major aquifers were identified by Planert and Pritchette (1989): the Knox-Shady aquifer and the Tuscumbia-Fort Payne aquifer. The continuity of these aquifers has been disrupted by the complex geologic structure of the region, such that each major aquifer occurs repeatedly in different areas. The Knox-Shady aquifer group occurs over most of Calhoun County and is the main source of groundwater in the county. It consists of the Cambrian-and-Ordovician aged quartzite and carbonates. The Conasauga Formation is the most utilized unit of the Knox-Shady aquifer, with twice as many wells drilled as any other unit (Moser and DeJarnette, 1992).

Regional groundwater flow in the bedrock for the McClellan vicinity was described by the USGS (Scott, et al., 1987). Regional groundwater elevation ranged from 800 feet above mean sea level (msl) at McClellan to about 600 feet above msl to the west on Pelham Range, based on water depths in wells completed across multiple formations. Groundwater elevation contours suggest that regional groundwater flow is from the Main Post on McClellan northwest toward the city of Weaver. Scott et al., (1987) concluded that the groundwater surface broadly coincides with the surface topography and that the regional aquifers are hydraulically connected. Groundwater flow on a local scale may be more complex and affected by geologic structures such as the shallow thrust faults, rock fracture systems and karst development in soluble formations.

Shallow groundwater occurs in weathered residuum/transition zone derived from the bedrock and thin sediment deposits that are very similar to the decomposed rock. Generally, shallow groundwater flow closely mimics the local topography.

2.3 Groundwater Use

There is one potable water well located on the former Fort McClellan. This well is located at the Mountain Longleaf National Wildlife Refuge (N 33°42.531”, W 85°45.753”) for use at the Fish and Wildlife Service (FWS) office. The six-inch diameter well is screened from 150 to 175 feet below land surface, produces approximately 23 gallons per minute, and is located hydraulically upgradient of the Ranges associated with this Plan.

3.0 CONTAMINANT FATE AND TRANSPORT

3.1 Contaminants of Concern

Contaminants of concern (COCs) will be identified in the primary investigation report for the specific Range being addressed (Note that for the purposes of this document, contaminants of concern and chemicals of concern are considered synonymous). The primary COCs will consist of antimony, copper, lead, and zinc; since these metals are most commonly associated with small arms ranges. However, additional COCs requiring remediation may be identified in the SSA.

3.2 Affected Media

The purpose of this CMIP is to present a standard approach to the remediation of contaminated soils (surface, subsurface, and sediment) at Fort McClellan, and while traces of other constituents may have been detected in groundwater at Ranges, the focus of this plan is strictly on the soils. Contaminated media at the ranges consists of surficial and sub-surficial contaminated soil as well as some contaminated sediment.

3.3 Extent and Distribution of Contaminated Media

Metals in soils is expected to be the predominant contamination at the Ranges, based on the use of the Ranges for small arms training. The constituents of concern are anticipated to be small arms related; specifically lead, antimony, copper, and zinc. However, as stated previously, other constituents may be present.

The procedures described below have been proven to be effective to address metals that may be of concern at the Ranges. Should other COCs be identified that cannot be effectively remediated with the procedures described below, then those Ranges will undergo further evaluation to determine the most appropriate remediation process.

3.4 Determination of COCs

The investigation documents will identify the COCs for each Range that were determined to be of risk to human health or the environment. The SSA will present the COCs from the investigation and will include a current evaluation of those constituents to determine if they remain applicable. It should be expected that the COCs identified at the time of the investigation could change with the discovery of better analytical methods/procedures, changing Site conditions (i.e. erosion or sedimentation, etc.), changes to the future land use, changes to the screening levels available at the time of the investigation, the additional information about these sites that was not available at the time of the investigation, etc. All of these factors will be considered in the SSA.

3.5 Exposure Pathways and Risk Assessment

The Range investigation document include an exposure model that was developed for both the current and the future land use. These models identify the receptor scenarios associated with the land use. As discussed above, the result of these assessments will be reviewed to determine both the COCs and the target remedial goals for the Range and included in the SSA.

4.0 CORRECTIVE ACTION

4.1 Design Objectives

The objective of the corrective measures is to address COCs in soils at Fort McClellan to mitigate potential ecological and human-health risks.

4.1.1 Proposed Remedy Overview

The proposed remedy consists of the following components:

Treatability Study – A treatability study may be performed to determine the proportion of soil stabilization amendments needed to chemically immobilize metals contamination and reduce the RCRA toxicity characteristic leaching procedure (TCLP) concentrations of the RCRA 8 metals to levels appropriate for non-hazardous offsite disposal while producing a pH of no more than 12. Treatability studies will be performed when Ranges have different soil types, different or additional COCs, or when historical operations might require a different stabilization agent than those used previously at Fort McClellan.

Delineation – Soils at the Range will be initially assessed in a 10,000 square foot (sf) grid pattern that encompasses the Range COC concentration contours identified in the Range investigation document. This pattern will generally be created using 100 ft x 100 ft square grids, however there may instances where the grid sizes will be adjusted to accommodate Site topography and other Range features. Regardless of the individual cell geometry, the cells that make up the initial delineation/characterization will not have an area greater than 10,000 sf. A five-point composite sample (as described in the Sampling and Analysis Plan and Quality Assurance/Quality Control Plan (SAP/QA/QCP) in **Appendix A**) will be collected from 0 - 0.5 feet (ft) below ground surface (bgs) of the cell and analyzed for the SSA identified COCs. These composite samples may be analyzed onsite with an x-ray fluorescence (XRF) or sent to an offsite laboratory for total metals analysis (only those metals identified as COCs in the SSA). Any use of an XRF onsite for characterization and/or confirmation analyses will be performed in accordance with the procedures and criteria outlined in Section 4.4 of the SAP/QA/QCP in **Appendix A**. The delineation samples may be split and have additional analyses performed at the prerogative of the RC for the purposes of planning/managing the remediation activities. This initial delineation will be used to determine the horizontal extent of contaminated soil at the Ranges; vertical delineation will be performed using confirmation sampling after excavation.

Post excavation composite samples in one ft MEC clearance areas will be collected from 0-0.25 ft bgs (MES, 2014). The samples will be collected according to the procedures outlined in the SAP/QA/QCP in Appendix A, with on the depth of the aliquots varying from the depths stated above.

Excavation – Contaminated soils, as identified in the SSA, will be excavated from the cells identified during the initial delineation for transportation and disposal (T&D) at an offsite landfill.

Following the removal of these soils from the cell, a 5 point composite confirmation sample will be collected from the bottom of the excavation, at an interval of 0-0.5 ft bgs. This sample will determine whether additional soil stabilization and/or excavation is required (horizontal extent). The lateral extent of the excavation will be confirmed with the collection of sidewall grab samples. These samples will be analyzed for Site COCs using either x-ray fluorescence (XRF) screening (supplemented with laboratory analyzed split samples) or analysis at an off-site laboratory.

Stabilization – Stabilization/treatment of contaminated soils will be required for those soils that do not meet the requirements for Subtitle D landfill disposal. These soils will be amended based on the treatability study formulation for the Range and will be conducted in-situ prior to removal.

Disposal – Disposal of the non-hazardous soil will be at an ADEM-approved Subtitle D disposal facility in accordance with state and federal regulations. Samples results for disposal characterization will be submitted to ADEM for approval prior to any T&D.

Additional details on the technical approach, the specifics of the design and implementation, the schedule of remedial activities, and performance monitoring to evaluate remedy effectives are provided in the subsequent sections below.

4.1.2 Remediation Goals

The target remedial goals have been designed to ensure the protection of human health and the environment. The remedial goals will vary for each site; depending on the future land use (residential, commercial/industrial, wildlife refuge, etc.), the COCs, the MEC status of the Site, etc. The remedial goals for the Ranges will be based on both human health and ecological risk assessments, with the specific constituent goals being the most restrictive exposure scenario. This results in the most conservative remedial design for the given future land use. As stated previously, it is anticipated that the predominant COCs will be small arms constituents, though the actual COCs will be identified in the SSA for the Range.

4.1.3 Projected time frame for remedy and implementation reporting

The time frame for remediating each site depends on the current redevelopment needs of the MDA, site size, current accessibility, COCs, and environmental factors. It is anticipated that each remediation project will take less than one year to complete and more than one project may run concurrently. Corrective Measures Implementation Reports (CMIRs) will be submitted following the completion of the remediation and will provide a detailed description of the work completed, as well as the necessity for additional actions or environmental covenants.

4.2 Design Criteria

Design criteria are used to ensure that the design meets the objective of the corrective action. Specifically for these corrective actions, the design criteria ensure that metal contaminated soils above site-specific cleanup levels are removed from the Ranges and that the soil is effectively treated for disposal as a non-hazardous waste. In addition, the design criteria guide performance monitoring objectives. As such, the following criteria were developed to support this design:

- The design mitigates soil exceeding the site-specific cleanup levels based on horizontal extent;
- The design mitigates soil exceeding the site-specific cleanup levels based on vertical extent; and
- The design treatment process is capable of treating soil that could exceed the RCRA toxicity characteristic for RCRA 8 metals to below the toxicity characteristic maximum concentration as measured by TCLP analysis

The focus of the design of the technical approach is on meeting the design criteria and the overall project objectives. Specifically, the design addresses the ultimate goal of the corrective action and removal of soils exceeding cleanup levels and includes the following components:

- Treatability Study;
- Delineation;
- Soil Excavation;
- Soil Stabilization;
- Waste disposal.

4.2.1 Treatability Study

A treatability study may be performed to evaluate formulations capable of meeting stabilization requirements. Note that the treatability study focus will be on any Site metals that have RCRA disposal requirements. Specifically, the treatability study will consist of the following components:

Sample Collection and Characterization – A composite sample will be collected and homogenized from one gallon aliquots, the number of aliquots varying based on the characteristics of the Range(s) being remediated. The number of aliquots required for each Range will be provided in the SSA. Sample locations will be identified in areas that have the highest concentrations and will be located using a Global Positioning System (GPS) unit. After the composite samples are collected and individually homogenized, these composite samples will be further combined and homogenized to produce the composite sample for stabilization treatability testing and waste characterization analysis.

Formulation Development – Once the results from the characterization are known, portions of the composite sample will be mixed with different soil amendment products until homogenized and allowed to cure overnight. The ratio of additive to soil will be varied to obtain a comprehensive understanding of the effectiveness of varying dosages on the sample leachability. To evaluate the performance of the various amendment/soil samples at reducing constituent leachability to below landfill requirements, a TCLP analysis will be performed. Based on the leachability results from the formulation development testing, formulations can be selected for leach testing. The treated material for selected formulations will be submitted for full TCLP testing for confirmation.

The treatability study will recommend a formulation that successfully stabilizes the contaminated soils. The selection of the specific stabilization reagent will be based on several factors, which will include availability of materials, costs, ease of use, ability to obtain ADEM approval, etc. At the time of this plan development, Enviroblend products have been one of the reagent products accepted by ADEM for use at multiple sites at McClellan and at other locations in Alabama. The RC may suggest additional stabilization reagents, however they must include Enviroblend products in the treatability study and shall be responsible for obtaining ADEM approval for use at any Range project. Specific details of the treatability study including tested formulations and manufacturer's literature will be provided in the treatability study report contained in the SSA.

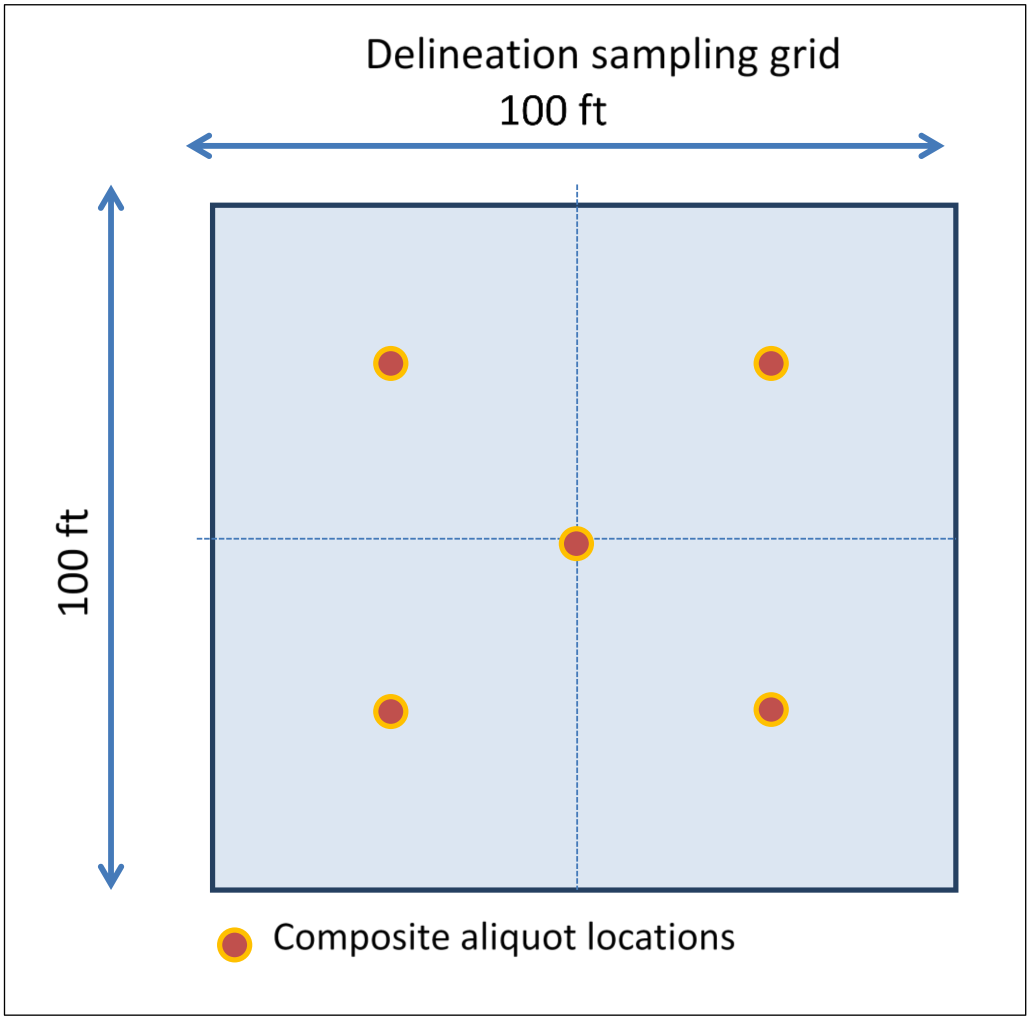
4.2.2 Delineation

The technical approach for delineation focuses on identifying the horizontal and vertical extent of contamination and determining treatment requirements, if any, for disposal of the contaminated soil. To address this, the areas within the contaminated soil contours identified in the site investigation will be divided up based on a square grid pattern with 10,000 sf cells. While the basic pattern is anticipated to be a square grid (with 100 ft x 100 ft cells), it may be necessary to vary the geometry of the cells to better relate to site conditions. Should it become necessary to deviate from the square grids, care will be taken to ensure that each cell being characterized will not exceed 10,000 sf. In the case of outlying locations that are not contiguous with the majority of the Range contamination contours, the delineation geometry and size may vary greatly from the remainder of the Range cells, but these locations will not exceed the basic 10,000 sf guideline.

Initially, horizontal delineation will be performed by collecting a five point composite sample from each 10,000 sf grid. The composite sample aliquots will be collected in a geometric pattern (see image below) that complements the grid geometry and ensures that the sample is representative of the soils in that location. The composite samples will be collected from 0-0.5 ft bgs, taking care to remove any vegetation or other debris. Each cell in the grid will have a unique identification number consisting of a combination of letters and number, as well as the range or parcel identification. The composite samples will be analyzed onsite using x-ray fluorescence device or sent to an offsite laboratory for analysis. All samples will be collected, handled, and analyzed in accordance with the procedures in the SAP/QA/QCP.

Aliquots will be collected from the center of each cell and from the approximate center of each cell quadrant. The aliquots will be collected in equal proportions and a single composite sample prepared for analysis. To allow for further delineation, aliquot samples will be split and a portion will be retained until sample results are received. Based on the sample results, a determination will be made as to whether to analyze the retained split samples as individual samples. The sample configuration of each cell is shown below.

To assess the vertical extent of soils requiring remediation, post excavation samples will be collected at 0-0.5 ft bgs. After stabilization treatment and/or excavation activities have been conducted in a cell, composite soil samples will be collected from the base of the excavation, with aliquot locations at or near the pre-excavation aliquot locations. Based on the results of this sampling, it will be determined whether the cell has reached its vertical extent of excavation or if additional excavation is required. If it is established that additional soil needs to be removed, subsequent treatment and removal will be performed in 0.5-foot lifts until post-excavation confirmation samples indicate that the vertical extent has been reached.



To address the vertical extent criteria in the 1-foot MEC Clearance Areas, all excavation efforts will be limited to the upper 0.5 ft. After stabilization treatment and/or excavation activities have been conducted in these cells, post excavation composite soil samples will be collected from the base of the excavation. Regardless of the results, the cell will be backfilled to the original grade.

Additional details of sampling, sampling protocols, sample identification, sampling methods, and analytical methods are provided in the SAP/QA/QCP, including a detailed flow chart of sampling procedures.

Additional samples will be collected approximately every 50 - 75 linear foot intervals around the perimeter of the excavation to determine whether the lateral excavation extent needs to be adjusted. If these samples exceed Site cleanup levels, the cell will be extended in the direction of the sample and the process repeated until excavation sidewalls are below cleanup levels. Soils associated with these step outs will be stockpiled in the cell awaiting characterization results and disposal. It should be noted that if the grid sizes are adjusted in the field, the sidewall sampling interval may also be adjusted to better coincide with the grid geometry.

4.2.3 Soil Excavation

Following delineation in each 10,000 sf cell, one foot of soil in cells with Site contaminants above site-specific cleanup levels will be excavated and stockpiled within their respective grid and characterized for RCRA 8 metals and TCLP. Since the excavation and the subsequent stockpiling occur within the cell footprint, cross contamination with another cell or the area surrounding the cell is not expected. Efforts will be made to ensure that the stockpiles are staged a minimum of 2 feet from the cell walls and the stockpiles will remain covered to prevent any runoff. Following the removal of the material stockpiled in the cell, post-excavation confirmation samples will be collected to determine if additional soil needs to be addressed. Subsequent excavation and stabilization, if required, will be performed in 0.5–foot lifts until the post-excavation sample results are below site cleanup levels. The 1-foot MEC Clearance Areas will not be excavated to a depth greater than 0.5-foot bgs due to the possible presence of unexploded ordnance (UXO).

4.2.4 Soil Stabilization

Stabilization based on the treatability study formulation will be conducted on stockpiles of soil within their respective grids if they exceed disposal criteria so that the soils can be removed and disposed of as a non-hazardous waste.

The stabilization treatment will involve:

- Spreading the appropriate quantity of soil amendment in accordance to the selected formulation into the soil piles to be treated;
- Mixing the applied reagent into the soil with an excavator bucket or similar implement until the treated soil is visibly homogenous through the vertical and horizontal extent of the stockpile;
- Applying water as needed to achieve an optimal moisture content, using a water truck and misting spray nozzle, taking care to add water gently and evenly in a manner that avoids saturation, runoff, and/or pooling so as to prevent contamination transport;
- Samples will be collected of the treated materials and sent offsite for TCLP, RCRA 8 metals, and pH;
- If confirmation samples indicate that additional stabilization is necessary, subsequent stabilization will be performed in stockpiles of the next 0.5-foot lifts, as needed.

Stabilization will be confirmed by recording the volume of stabilization agents added to each cell, visual inspection notes, and photographic documentation. Following stabilization treatment, a composite sample will be obtained from the treated cell and analyzed at an off-site laboratory to confirm that the treated soil meets non-hazardous disposal criteria. Sample results of stabilized soils will be forwarded to ADEM for approval to dispose of the stockpiled material. No waste material will be sent for disposal without prior approval by ADEM.

4.2.5 Waste Disposal

Upon receipt of ADEM approval to dispose of soils that do not require treatment or have received adequate stabilization, the RC will facilitate the loading and transport of non-hazardous materials from their respective cells to the ADEM-approved subtitle D landfill. To confirm that the design criteria for waste disposal are met, waste characterization samples will be collect in accordance to the SAP/QA/QCP**.** Additional details of waste management are provided in the Waste Management Plan (WMP), located in Appendix B**.**

4.3 Regulatory Requirements

The primary regulatory driver for this corrective action is the CA between ADEM and the MDA (ADEM, 2012). The primary regulatory requirements are the state and federal rules and regulations pertaining to RCRA and corrective measures and ADEM guidance manuals, specifically:

- ADEM Division 14 (Land Division - Hazardous Waste Program) Rules (ADEM Administrative Code r. 335-14);
- Alabama Law under Title 22 of the Code of Alabama including the Alabama Hazardous Wastes;
- Alabama Environmental Investigation & Remediation Guidance (AEIRG);
- Alabama Hazardous Waste Management and Minimization Act, Code of Alabama, 1975, as amended, §§ 22-30-1 to 22-30-24;
- Code of Federal Regulations (CFR) Title 40 (40 CFR Parts 260, 261, & 268); and
- Alabama State Soil and Water Conservation Committee (SWCC) guidance including the *Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas (SWCC, 2009)*

The RC will obtain the necessary city, county, and state permits including filing a Notice of Intent (if required) and other permit requirements under Alabama Construction General Permit (General Permit Number ALR100000) as part of National Pollutant Discharge Elimination System requirements.

5.0 CORRECTIVE ACTION WORKPLAN

This section will provide more detailed information on the actual soil remediation process, including general types of equipment to be used, standard Site setup tasks, etc. The SSA will include a more detailed description of planned Site activities, including specifics for equipment, Site preparation tasks, erosion and sediment controls (if necessary), etc. The RC will have the responsibility for the implementation of these tasks. MES as the MDA's representative, will be responsible for the overall project management, including RC oversight, coordination and management of T&D, ensuring regulatory compliance, and administrative functions.

5.1 Mobilization/Demobilization

Prior to mobilization, the condition of roads that will be used to transport materials and excavated soil will be evaluated. All necessary pre-mobilization survey work will also be performed to determine the initial lay-out of the contaminated excavation areas. A temporary office facility for conducting site meetings and to provide an office space may be mobilized to the site.

The RC will mobilize all necessary equipment to support the corrective action. The heavy equipment initially mobilized may include excavator(s), wheel loader(s), dozer(s), water truck(s) for dust suppression and stabilization support, a tiller(s), skid steer(s), and dump truck(s). Additional and/or alternative equipment may be used based on availability and to address various needs as the project progresses. Other equipment that may also be mobilized including a wood chipper to chip cleared trees, the XRF for field screening, sampling equipment, decontamination equipment, and the necessary health and safety equipment. During mobilization, any necessary materials will also be delivered to the site including any needed road base, fuel, soil amendments, and other materials to support demarcation, sampling, decontamination, stabilization, and excavation. Personnel will be mobilized at this time including equipment operators, technicians, a site supervisor, and skilled laborers. Additional information on project personnel is provided in Section 6.1.

Upon completion of the site activities, the RC will walk the site with an MDA/MES representative to survey the site and complete a project close out punch list. Once the punch list is substantially completed, the RC will demobilize from the site. Demobilization will consist of removal of all equipment and materials, restoration of disturbed areas, removal of trailer(s), and removal of all signs, erosion control materials, and if used, temporary fencing/exclusion zone demarcation.

5.2 Unexploded Ordnance Support, Site Preparation, and Road Construction

5.2.1 Unexploded Ordnance

Although the Ranges have been cleared of MEC, the RC personnel will be observant and work under the assumption that MEC could be encountered anywhere on site and that any MEC present could be UXO. The RC personnel will take extreme care when conducting land clearing, excavation, demolition or other construction related activities that may disturb land surface. In the event that potential MEC is identified, work within the area will stop and MES will be contacted for assistance by the RC's

Construction Manager. The Construction Manager will attempt to reallocate work crews to minimize downtime and standby time while MES specialists evaluate the suspected MEC.

5.2.2 Utility Location/Marking

The RC will hold discussions with MDA/MES personnel, review site drawings, obtain historical survey data and contact the Alabama One Call underground utility locating service to identify any buried utilities and begin clearly marking any recognizable or underground utilities within the various work areas in preparation for future excavation and site activities. The RC personnel may use spotters and hand-held detectors throughout excavation activities as necessary to provide an additional level of utility location.

5.2.3 Site Preparation

Initial site preparation activities will include establishing a laydown yard, decontamination areas, and other work areas. It is anticipated that additional areas will be established as the project progresses to improve efficiency and to prevent the dispersal of contaminants.

Equipment Staging/Support Zone - A laydown yard may be established near the entrance to the Range for heavy equipment and supplies. This area will also be used for logistical support activities.

Decontamination Areas - Once the RC personnel have mobilized to the site, a decontamination station will be located in the contamination reduction zone at the entrance/exit of the Range. Individual decontamination areas may be established at other locations, as necessary. The decontamination stations will be constructed in a manner to facilitate egress of the trucks off the Site without causing congestion of incoming traffic. The decontamination pad will likely be constructed of ALDOT #4 and/or #57 stone (or similar). The pad will measure approximately 40-feet by 12-feet by 6-inches deep to ensure that no contamination leaves the site. The pad may also use a Ply-X 150 HDPE liner or suitable material as a barrier between the vehicle and the ground. If used, the liner or suitable material will be covered by 6-inches of coarse aggregate for the dump trucks to travel over and will be sloped to a collection sump. The decontamination pads will be large enough to handle all Site equipment and constructed in accordance with Alabama erosion and sediment control (ESC) guidance. The RC will employ dry decontamination procedures as the primary form of decontamination as a source of water is not readily available. Personnel decontamination areas will be established at each area within the contamination reduction zones. The RC may also choose to establish individual equipment decontamination stations at remote excavation areas as needed or appropriate. The layout and construction of these stations will be evaluated by the Construction Manager based on existing site conditions.

If necessary, wet procedures will include spraying off the trucks and/or equipment with a pressure washer located in the decontamination pad. Trucks will use tarp covers to eliminate the loss of non-hazardous treated and untreated soils and dust while traveling over the roads. If water is needed or spent during decontamination operations, it will be collected and applied to soil awaiting treatment or transport or applied to uncompleted parts of the excavation as dust control.

Soil Stockpile Areas - All impacted soils, both treated and untreated, will only be stockpiled within their respective cells. When clean materials (i.e. – backfill soil, aggregates) are delivered to the site, they will be placed in the immediate vicinity of their final placement area. The RC will maintain all stockpiles and other work areas in a manner that minimizes dust at all times. The areas will be managed in accordance with the Stormwater Pollution Prevention Plan (SWPPP) and the Erosion Control Plan (ECP). Additional details of waste management are in the WMP.

Erosion and Water Control Measures - Erosion and run-on/runoff control measures will be installed, managed, and maintained throughout project performance. Further details of activities associated with stormwater pollution prevention and erosion control activities will also be conducted as described in the SWPPP and ECP prepared and kept at the site during work activities.

5.2.4 Road Improvements

Roadway improvements may include grading and stabilization using ALDOT #4 stone or #57 stone and trimming trees presenting obstructions. Further details of road improvements and other transportation requirements will be provided in a Transportation Plan prepared for the Range.

5.3 Location Demarcation and Surveying of Contaminated Areas

A licensed Alabama surveyor will establish control points; surface elevation shots for stormwater drainage grading and pre-excavation surface elevations, if necessary; marking-out the contaminated excavation areas; intermediate and post-construction surveys of the excavation areas; and measuring the elevations and thickness of soil removed to compare soil excavation volume with actual disposal quantities from disposal weight tickets (using a treated soil density factor for the volume to weight conversion). The licensed Alabama surveyor will also perform pre-excavation and post-backfill topographic surveys for all MEC areas, as needed. Layout areas for potential silt fence installation and/or other erosion and sedimentation control measures will be established as described in the ECP and SWPPP. The RC may also use GPS data collection systems to mark-out confirmation sample locations and other site features requiring accurate location, as appropriate. All GPS units will have sub-meter accuracy. Final location of pre- and post-excavation confirmation samples will either be performed by the Alabama licensed land surveyor or by RC personnel using the GPS unit.

5.4 Preconstruction, Demolition, and Clearing

Once the preliminary excavation limits are established, clearing and demolition (where necessary) activities will commence. This will consist primarily of removal of vegetation from excavation areas and the demolition of Range features. Efforts will be made to minimize areas of soil and vegetation disturbance.

5.4.1 Removal of Vegetation

The RC will conduct various forms of clearing and grubbing and tree trimming activities during the course of these projects, as needed. Some of these activities will take place within Exclusion Zones while other work will be conducted in laydown areas, the Support Zone, and along roadways. Trees and smaller vegetation will be removed from the delineated excavation areas as needed to facilitate soil assessment and excavation activities. The root mass and soil will be collected and sized as practical for disposal in accordance to the WMP. Trees and brush cleared outside the contaminated excavation areas (i.e.

laydown areas, tree trimming for roadway construction) may be chipped and used for erosion and sediment control.

5.4.2 Demolition of Range Features

Some of the Ranges may have structures that will need to be removed during the remediation work. Prior to any demolition, samples of the building materials will be analyzed by TCLP metals analysis for the eight RCRA metals to determine final disposition. The demolition of these structures will likely be accomplished using an excavator fitted with a thumb and/or an excavator with a hoe ram attachment. Waste materials will be collected for disposal, recycling, or preferably reuse, and managed as appropriate in accordance to the WMP. During demolition, commingling of debris with the surrounding soil will be minimized. Sampling frequency and methodologies are provided in the SAP/QA/QCP. Any demolished material that is transported off-site for disposal will require laboratory analytical collected at a frequency of 1 sample for each 500 cubic yards transported offsite.It is anticipated the analytical results will confirm the debris is non-hazardous and it will be transported to, and disposed at, the McClellan Industrial Waste Landfill in accordance with Solid Waste Disposal Facility Permit No. 08-02. Additional size reduction may be necessary to meet the facility's waste acceptance criteria. The material may also be evaluated for recycling or reuse as discussed above. Re-use could include the use of concrete as rip-rap for site restoration (i.e., armoring, check dams, etc.).

5.4.3 Site Control

Due to the remote location and access limitations of the Range exclusion zones, it is not anticipated that unauthorized personnel will enter exclusion zones. However, as a precautionary measure, the RC will mark the exclusion areas and post signs as necessary. In areas where additional controls are needed, the RC may use construction fencing materials and barricade tape to delineate the site exclusion zones, contamination reduction zone, and site support zones. Road gates will be locked at night and during the day when the RC personnel are not present on site.

5.4.4 Surface Water and Erosion Controls

Stormwater pollution prevention and erosion control activities will also be conducted as described in the SWPPP and ECP.

5.5 Contaminated Soil Excavation Plan

Once the site is laid out according to Section 4.2.2 of this plan, excavation of the identified grids will begin. The material will be excavated to a depth of 1 foot bgs and stockpiled within the cell footprint. The stockpile will then be sampled for RCRA 8 metals and TCLP to obtain waste disposal acceptance data. After analytical results for the cell have indicated that the stabilized soil meets TCLP requirements or it has been established that TCLP results indicate that stabilization is not necessary, the RC will submit the data to MES to forward to ADEM for approval to begin loading and disposal.

The initial limits of excavation will be based upon the Site contaminant concentration contours identified in the Site investigation reports. These initial excavation limits be confirmed with pre-excavation composite sampling, analyzed by an XRF or with offsite laboratory analysis. Based on the preliminary characterization data, the RC will estimate the volume of material requiring excavation and disposal. Post-excavation confirmation soil samples will be collected from the excavation areas to confirm that the remaining soils meet the Site remedial goals. The post-excavation confirmation samples will be collected at the base of the excavation, one sample for each 2,500 square feet of excavated area, to verify that the cleanup standard has been achieved. Additionally, sidewall samples will be collected every 75 feet along the perimeter of the excavation. If sidewall sample(s) exceed the Site cleanup levels, excavation will occur in 1-foot horizontal increments in the direction of the impacted area extending the cell size. The sidewall materials will then be stockpiled within the cell and sampled for RCRA 8 metals and TCLP, stabilized if necessary until Subtitle D landfill disposal requirements are met. The confirmation soil sampling process will be repeated until the cell has achieved Site cleanup standards.

Excavation will be performed to minimize future impacts to the site, prevent the additional dispersal of contaminants, and to establish that the remediation has achieved Site cleanup levels. Specifically for each range, the primary criterion for the order of excavation will be the topographic elevation, starting with areas of higher elevation and then moving out to areas of lower elevation. The secondary criterion will be contaminant concentration; starting with the areas with the highest contamination concentrations and then moving out to areas of lower contamination concentrations within each range. This will prevent the migration of contaminants to areas that have already been excavated and will allow greater control of soil erosion and stormwater run-off. A spotter will be used to determine excavation depth and watch for MEC. In addition, excavation activities will be performed in accordance with the SWPPP and ECP that will be prepared and kept on site during excavation activities.

5.6 Soil Stabilization

Soil stabilization activities will consist of in-situ stabilization, where necessary, of contaminated soils at the Ranges using the formulation determined in the treatability study. In accordance with the SAP/QA/QCP, each stockpile will have ten aliquots collected from it; these aliquots will be composited into one sample, and the pre-treatment composite sample sent to an off-site laboratory for TCLP RCRA 8 metals. Stockpiles with TCLP RCRA 8 metals concentrations greater than the respective metal's regulatory limit (i.e., 5.0 mg/L for lead) will require chemical amendment prior to non-hazardous disposal. For each of these stockpiles, the amendment and soil will be mixed until visibly homogeneous with an excavator bucket or similar implement. Once the stabilized material has set up, a treatment verification sample will be obtained from the stockpile as described above and analyzed by TCLP for RCRA 8 metals to verify the effectiveness of the treatment. If the treated material meet disposal criteria, the material may be disposed of at a non-hazardous landfill. All information associated with the stabilized stockpile will be presented to ADEM for waste approval. No material shall be sent for offsite disposal without ADEM approval. Upon receipt of ADEM approval for disposal, the stabilized soil will be loaded out for T&D as a non-hazardous special waste at an ADEM-approved Subtitle D Landfill in accordance to the WMP and State and Federal regulations. Soil cells with a TCLP leachate concentration result greater than the applicable toxicity characteristic will be retreated and retested until the stabilized soil meets toxicity characteristic standards.

5.7 Sampling and Analysis

The combined SAP/QA/QCP Plan provides the specific sampling protocol and analytical methods for:

- Pre-excavation composite sampling,
- Post-excavation composite sampling,
- Waste Characterization Samples,
- Treatment Verification Samples,
- Quality Assurance/Quality Control (QA/QC) Samples, and
- XRF Soil Screening Samples.

In addition, this plan includes the project's Data Quality Objectives and QA/QC requirements and should be referred to for specifics.

5.8 Transportation and Disposal of Waste

Untreated and treated soils that meet non-hazardous disposal criteria will be loaded and transported off-site to an ADEM-approved Subtitle D Landfill (Cedar Hill or alternate) for disposal as a non-hazardous waste. Any soil that cannot be rendered non-hazardous using the stabilization process in Section 4.5, which is unlikely, will be disposed as hazardous waste at a permitted Subtitle C facility. Additional details of waste management are provided in the WMP.

5.9 Site Restoration

Once the excavation is complete and attainment of the cleanup standards verified through confirmation sampling, the RC personnel will begin site restoration.

5.9.1 Grading

Grading will be performed to promote positive drainage for the site, prevent any unnatural erosion of the soils/features of the site, and return the site as close to its natural state as possible. Fine grading will be accomplished with on-site equipment by breaking up any large soil clods and removing non-organic materials larger than one inch in diameter and ensuring drainage for each disturbed area. The majority of excavated areas are anticipated to be graded to match the contours of the surrounding landscape to facilitate natural surface water flow, without being backfilled.

When backfill is used, a composite sample will be collected from the borrow source and analyzed once per 500 tons for volatile organic carbons (VOCs), semivolatile VOCs (SVOCs), poly chlorinated biphenyls (PCBs), herbicides, pesticides, and metals. All backfill must be at or below EPA Region IX Remedial Screening Levels (RSLs) for residential soil for every constituent except metals. Metals results shall be compared to site-specific background screening values (SAIC, 1998).

Compaction of backfilled areas will generally be performed utilizing the heavy equipment onsite. No special testing or compaction specifications are required, however it may be necessary in some areas to perform additional compaction to prevent erosion. These areas will be identified in the SSA for the Range.

5.9.2 Seeding

After fine grading operations are complete, site personnel will seed excavation and other disturbed areas with a warm season grass/weed mixture (Tall Fescue/Serecia). Visual inspections will be conducted monthly or after significant rainfall events by MES until the vegetation is firmly established. Additional revegetation details are incorporated into the SWPPP and ECP.

6.0 IMPLEMENTATION AND SCHEDULE

6.1 Project Management

The plan for managing this project has been developed to ensure effective and efficient communication by presenting each employee with a clear list of roles and responsibilities and a management approach to ensure that the project is completed in a timely manner and the project objectives are thoroughly addressed.

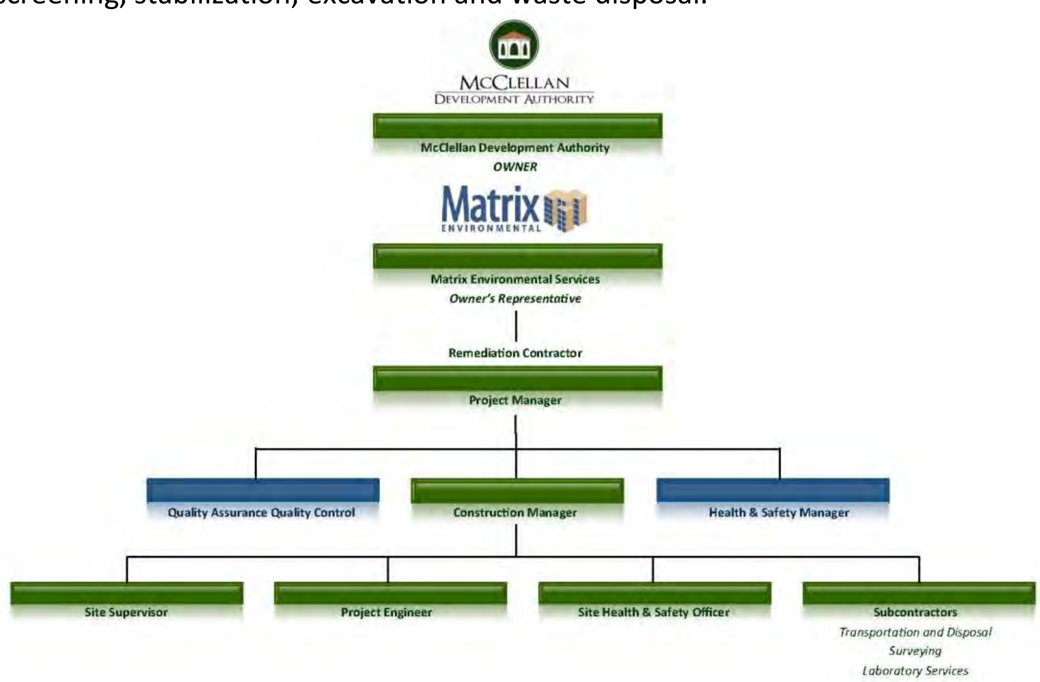
All oversight, RC, and subcontractor field personnel assigned for work onsite shall have, at a minimum, successfully completed a 40-hour health and safety training program and annual 8-hour refresher course in compliance with OSHA 29 CFR 1910.120.

6.1.1 Program Management and Oversight

Matrix Environmental Services, LLC, as the MDA representative, is responsible to ensure that the project is performed safely and responsibly, while meeting all of the plan objectives. MES personnel will provide technical and administrative oversight of the remediation activities, coordination for T&D of materials with the disposal facility, facilitate regulatory interaction, and manage project reporting.

6.1.2 Remediation Contractor

The RC project manager will oversee all aspects of this project with the support of the construction manager, the project engineer, the quality assurance officer, health and safety manager, and the senior technical advisor. Site personnel will include trained and qualified equipment operators, laborers, a health and safety officer, a stabilization technician, and other qualified personnel to support sampling, XRF screening, stabilization, excavation and waste disposal.



6.2 Contingency Plan

The following events have been identified along with migration actions:

Table 1 – Contingency Plan

Event	Mitigation
1) Suspected MEC is encountered during field activities	Work stops in area and a MEC specialist evaluates the suspected item.
2) Cell sampling results indicate that contaminants are below cleanup levels within the preliminary excavation extents	Consult with MDA/MES and ADEM to determine whether removal is necessary.
3) Stabilization for a cell produces stabilized soil that exceeds RCRA toxicity characteristic criteria	Repeat stabilization. If repeated stabilization is not effective then evaluate formulation/mixing methods used in the field. Disposal at a Subtitle C landfill as a last resort.
4) Anomalous conditions detected during excavation such as evidence other types of contaminants, unusual geologic conditions, etc.	Evaluate anomalies and revise excavation, sampling or stabilization approach as needed.
5) Inclement weather	Evaluate whether the field activities will be affected and if necessary accommodate conditions.
6) Soil characteristics or site grade affect mixing during stabilization	Evaluate alternative mixing methods and/or equipment. Any changes to these procedures that represent a substantive change in Site operations will require ADEM concurrence.
7) Slope stability issues are encountered that affect excavation or stabilization.	Alternative equipment and/or formulations will be evaluated and discussed with MDA/MES and ADEM.
8) Remedy fails to achieve cleanup goals	Failure analysis will be performed to identify components of the design that are failing to meet project objectives. Once identified, alternative approaches will be evaluated and recommended to MDA/MES and ADEM.
9) Unforeseen problems are encountered that cause remedial activities to stop	The cause of the problems will be analyzed in the field to determine whether they can be mitigated and an alternative approach will be implemented after consulting with MDA/MES and ADEM. If an alternative approach cannot be recommended, an alternative remedy may need to be evaluated, criteria for this are presented below.

Specific criteria that will be used to determine whether an alternative remedy will be implemented include:

- A determination that process modifications to general approach of in-situ stabilization and excavation cannot feasibly meet cleanup goals.
- The horizontal extent of contamination is significantly larger than what was identified in the investigation.
- The depth of the soil contamination is not conducive to stabilization and/or excavation.
- The soil is not conducive to stabilization due to unknown chemical or physical characteristics.

6.3 Performance Monitoring and Plan Effectiveness

The project objectives and design criteria will be used to evaluate project performance and effectiveness as shown below:

Table 2 - Performance Monitoring

Performance Criteria	Monitoring Method	Effectiveness Criteria
1) The corrective action mitigates risks posed by soil exceeding the cleanup levels based on horizontal extent.	Confirmation samples at the edges of the excavation, i.e. sidewall samples every 50-75 ft.	Sample results indicate that Site contaminants meet cleanup levels.
2) The corrective action mitigates risks posed by soil exceeding the cleanup levels based on vertical extent	Confirmation samples from the bottom of the excavation for each remediation cell.	Sample results indicate that Site contaminants meet cleanup levels.
3) Excavated soil is stabilized and does not exceed RCRA regulated levels for the toxicity characteristic	Waste Confirmation samples from the stabilized soil.	Sample results indicate that stabilized soil has TCLP concentrations below landfill requirements.

6.4 Corrective Measures Completion Criteria

The remediation is completed when all subject areas have been delineated and any Site soils that exceed the site-specific cleanup levels have been safely removed and disposed of at an ADEM approved landfill.

6.5 Land Use Controls

Land Use Controls (LUCs) may be necessary upon completion of corrective measures implementation. LUCs will be required if the remediation does not achieve both residential and ecological remedial goals, if the Range includes areas where MEC clearances were not performed to depth, or some additional condition associated with the Range would prevent unrestricted use. The LUCs will be included in an environmental covenant pursuant to the Alabama Uniform Environmental Covenants Act (UECA), Code of Alabama 1975, §§ 35-19-1 to 35-19-14 for the Site and will be submitted under separate cover. A draft environmental covenant with the anticipated LUCs for the Site will be included in the SSA.

6.6 Anticipated Submittals

6.6.1 Site Specific Addendum

SSAs to this CMIP will be submitted to ADEM for each Range that will require soils remediation. The SSA will be appended to this CMIP and include Range-specific information including COCs identified in the site investigations for the Range, specific treatability information based on Site sampling, figures containing Site features, any specific adjustments to the CMIP that results from actual Site conditions, etc. The SSAs will be will be submitted to ADEM for review and approval prior to commencement of field activities.

6.6.2 Waste Profile and Waste Approvals

MES will coordinate with the selected disposal facility to submit waste profile information to ADEM at the beginning of each soil remediation project. MES, as the Generator's authorized agent, will complete an ADEM *Waste Profile Form 300* for each project, describing the types of waste anticipated from the project. The designated disposal facility will submit the completed Form 300 to ADEM with the application fee to obtain the waste profile number. Once the project commences, MES will submit batches of analytical results to ADEM for disposal approval. Once that approval has been obtained, MES will coordinate T&D with the disposal facility and the RC. All contaminated soils will be transported to the disposal facility under a non-hazardous special waste manifest.

6.6.3 Corrective Measures Effectiveness Report

The CA states that Corrective Measures Effectiveness Reports (CMERs) be submitted to ADEM annually to summarize the activities that have occurred at the Site in the previous year, as well as reporting the effectiveness of the remediation system. The soil remediation described in this plan will not have any short or long term monitoring required to ensure compliance. Additionally, the implementation of the remediation technology described above is not expected to last as long as a year at any location. Therefore, the submittal of a CMER for a soil remediation project is not anticipated. Should the corrective measure implementation exceed one year from the approval date of the SSA, a CMER will be submitted in accordance with the CA.

6.6.4 Corrective Measures Implementation Report

At the completion of the field work for the Range corrective measures implementation, MES will submit a CMIR to ADEM. The format and content of the report will be in accordance with the CA and current ADEM guidance.

6.7 Schedule

The schedule for corrective measures implementation will be included in the SSA. The schedule should include the approval date of the SSA as "day zero" and include both a description of the major tasks of the project and the estimated number of days to complete each task.

7.0 CONCLUSIONS AND RECOMMENDATIONS

This CMIP presents the MDA's approach for addressing metal-contaminated soil at all remaining Ranges at Fort McClellan. This plan was written to provide a basic description of the work for soils remediation, and as such does not contain site-specific information about the Ranges remaining to be remediated. Each of the remaining Ranges at Fort McClellan that will require soil remediation will have a SSA, appended to this plan, which describes the particulars of that Range. At the completion of the field work, a CMIR will be submitted to ADEM, describing the work performed, the status of the Range, any recommended LUCs that may be required, and a summary of the achievement of the project goals and project effectiveness.

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FIGURES

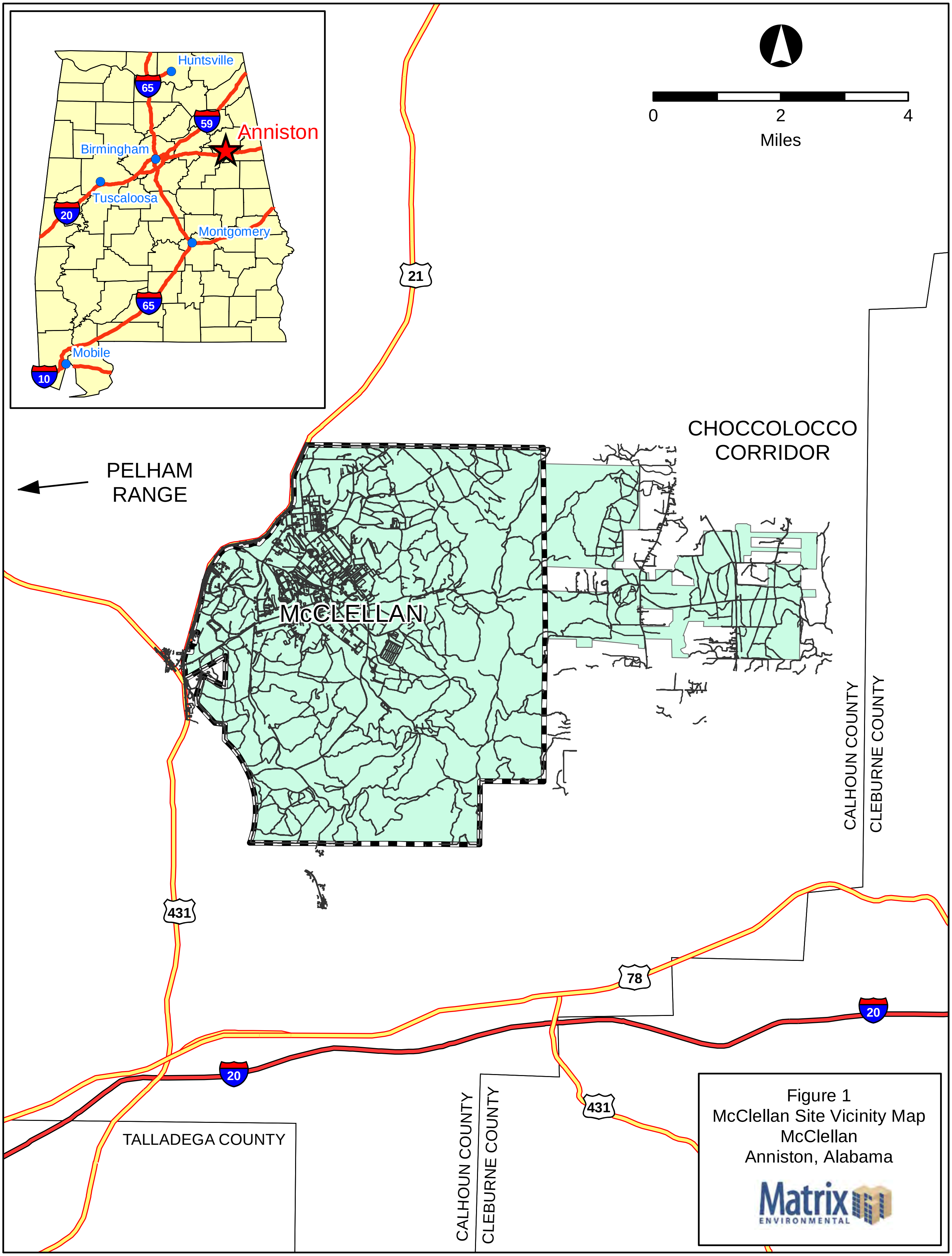

Figure 1
McClellan Site Vicinity Map
McClellan
Anniston, Alabama

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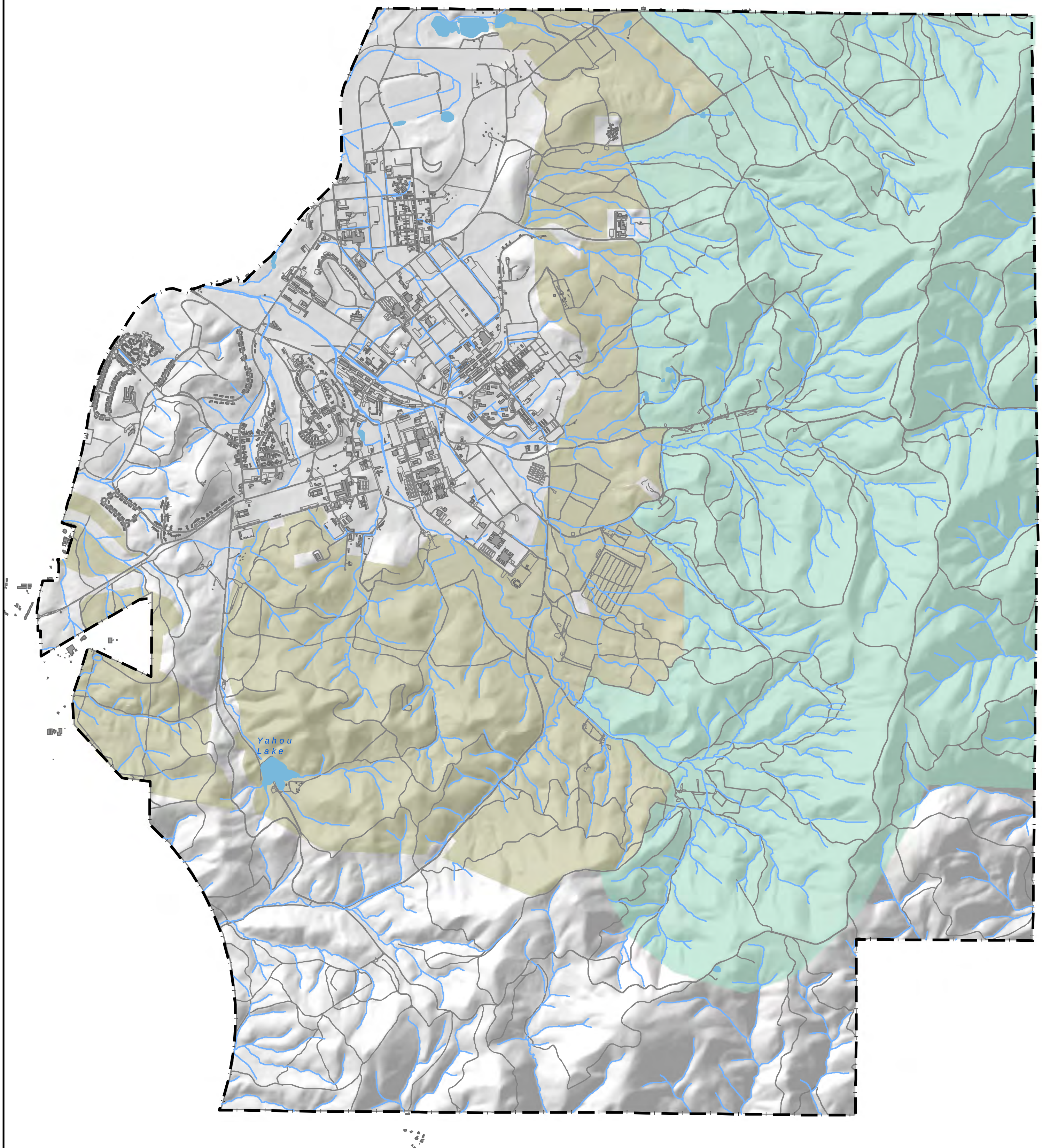
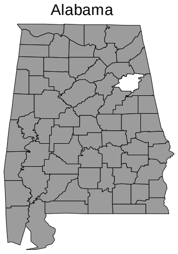


Legend

- McClellan Boundary
- Charlie
- CERFA - MRS Boundary
- Buildings
- Lake
- Streams
- Road

0 2,000 4,000 Feet

Alabama



Calhoun County

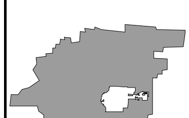


Figure 2
Site Map

McClellan
Anniston, Alabama

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APPENDIX A

SAMPLING AND ANALYSIS
And
QUALITY ASSURANCE/QUALITY CONTROL PLAN

APPENDIX A

SAMPLING AND ANALYSIS
And
QUALITY ASSURANCE/QUALITY CONTROL PLAN

Soil Remediation
Fort McClellan
Anniston, Alabama

Prepared for:

McCLELLAN DEVELOPMENT AUTHORITY

Prepared by:

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April 2017
(revised September 2017)

Revision: 1

SAMPLING AND ANALYSIS
And
QUALITY ASSURANCE/QUALITY CONTROL PLAN

Soil Remediation
Fort McClellan Sitewide
Anniston, Alabama
Revision 1

Prepared and Approved by:

Alexander Smith, PE (AL#28773)
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Date: 9/18/17

ALABAMA LICENSED No. 28773 PROFESSIONAL ENGINEER ALEXANDER M SMITH JR.

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APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

%R	Percent Recovery
ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
AEIRG	Alabama Environmental Investigation and Remediation Guidance
Bgs	below ground surface
BS	Blank Spike
BSD	Blank Spike Duplicate
CD	Construction and Demolition debris
CMIP	Corrective Measures Implementation Plan
CMIR	Corrective Measures Implementation Report
COC	Chain of Custody
DPT	direct push technology
EPA	U.S. Environmental Protection Agency
FT	foot/feet
GPS	Global Positioning System
IDW	investigation-derived waste
IDW/RDW	Investigation and Remediation Derived Waste
IN	inch/inches
ISC	Initial Site Characterization
LCD	liquid crystal display
LQM	laboratory's QAM and Management
MDLs	method detection limits
MES	Matrix Environmental Services
MS/MSD	Matrix Spike/Matrix Spike Duplicates
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
PDA	personal digital assistant
PECs	Post-excavation composite samples
PPE	personal protective equipment
PQLs	practical quantification limits
PREXCSS	pre-excavation confirmation soil sample
POSTXCSS	post-excavation confirmation soil sample
QC	Quality Control
QCD	Quality Control Duplicate Sample

QCS	Quality Control Split Sample
QA/QC	Quality Assurance/Quality Control
QA/QCP	Quality Assurance/Quality Control Plan
QAM	Quality Assurance Manual
RC	remediation contractor
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SAP/QA/QCP	Sampling and Analysis Plan and Quality Assurance/Quality Control Plan collectively
SCSs	stockpile characterization samples
SRMs	Standard reference materials
SSA	Site Specific Addendum
SWs	Sidewall samples
TAT	turnaround time
TCLP	toxicity characteristic leaching procedure
TVs	treatment verification samples
XRF	X-Ray Fluorescence

1.0 INTRODUCTION & SCOPE

This Sampling and Analysis Plan (SAP) and Quality Assurance/Quality Control Plan (QA/QCP) (collectively SAP/QA/QCP) documents the methods for sampling and analysis and quality assurance/quality control procedures to be implemented during corrective measures implementation of the Former Fort McClellan firing ranges (Ranges). Adherence to the procedures described in this document will ensure quality throughout the execution of the CMI.

This SAP/QA/QCP contains all applicable elements of the proposed remedial actions pursuant the Alabama Environmental Investigation and Remediation Guidance (AEIRG) document (September, 2005) and the Alabama Department of Environmental Management's (ADEM's) Corrective Measures Implementation Plan (CMIP) checklist Version 1 (June, 2012). This SAP/QA/QCP is intended to provide all personnel with the requirements necessary to successfully, efficiently, and accurately collect the samples and field information required for corrective measure activities. The Quality Assurance/Quality Control (QA/QC) sections in this document list QA/QC procedures to be implemented in conjunction with the SAP to ensure data quality across the project. The items described in this SAP/QA/QCP include the following:

- Preparatory activities and site management & control;
- Documentation and record keeping of field activities;
- Standardized sample identification;
- Sampling method procedures (i.e., soil sampling);
- XRF soil screening procedures;
- Sample custody, handling, and shipping;
- Preparation and frequency of QA/QC samples;
- Equipment/tool/supply decontamination;
- Characterization and disposal of investigation-derived waste (IDW).

Data Quality Objectives were developed for this scope using the procedure presented in *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA/600/R-00/007) and other United States Environmental Protection Agency (EPA) guidance. The Data Quality Objectives are presented in **Appendix A.1**.

2.0 PREPARATORY ACTIVITIES

The following preparatory activities will be completed prior to mobilization to ensure that the analytical sampling and screening will be performed safely and in compliance with the applicable sections of the AEIRG and EPA guidance documents and procedures. A three-ring binder, including all applicable AEIRG and EPA guidance documents and procedures for site work conducted as part of this corrective measure, will be retained and available for review in the remediation contractor's (RC) office trailer. The AEIRG will take primacy for the performance of all site work.

1. The RC will notify the selected analytical laboratory of the impending sampling event, allowing sufficient time for each laboratory to prepare the appropriate number and type of sample containers.
2. The RC will also notify Matrix Environmental Services (MES) of the specific sampling schedule in order to allow them the opportunity to observe sampling procedures and collect split samples, if desired.
3. All equipment and supplies to be utilized during the sampling activities will be assembled and inspected.
4. All calibration, cleaning, and maintenance required to ensure that the equipment is in proper working order will be completed prior to mobilization.
5. All forms, applicable guidance documents, field logbooks, and operations manuals to be used by the RC technical personnel during the sampling event will be assembled. All guidance documents and operations manuals will be reviewed by technical personnel prior to mobilization.
6. The RC will hold a sampling kick-off meeting. During this meeting; sampling protocols, QA/QC requirements, health and safety requirements, and any other pertinent details will be reviewed with the sampling personnel.

A copy of a general RC organizational structure is included in the CMIP.

3.0 PROJECT FILE MANAGEMENT / DOCUMENTS AND RECORDS

Management and field personnel will create, maintain, store, and dispose of appropriate documents and records for the project, including training records, internal audits, field measurements, and sampling events. Records must be created to adequately document activities throughout performance of the project.

A unique identifier (project number) will be assigned and utilized for all documents utilized throughout performance of this project. All project files for the project will either be stored in fire-proof file cabinets onsite or in duplicate offsite storage (electronically). All records are maintained for a duration of 10 years, or longer as required by law in the case of employee medical records. MES will be the primary responsible party for maintenance, management, and storage of project files, records, and documents.

Specific forms (chain of custody (COC), field sampling, and calibration logs, etc.) will be utilized to document all information pertaining to the CMI. Forms anticipated to be used are included in **Appendix A.2** of this plan. Document and records requirements will be maintained per the AEIRG document and/or applicable EPA guidance documents and procedures. Some of the documentation requirements include:

- That the field crew signs or initials all records/notes with a waterproof pen.
- That the use of field sampling and documentation supplies and equipment be tracked with an in-house system.
- That sample containers are prepared by the laboratory and shipped with a packing list documenting its contents.
- That the preservatives used by the laboratory are traceable by preparation date, vendor, and lot number.
- That the sample containers are pre-cleaned at the laboratory.
- That all equipment is maintained and calibrated in accordance with manufacturers' instructions and records retained onsite.

Field notes shall include:

- Names of personnel, subcontractors, and others onsite.
- Date and chronological summary of field activities.
- Ambient conditions.
- Sample location descriptions, sample identification.
- Lithology.
- Field measurement data.
- Sample order.
- Field decontamination procedures.
- Field calibration records.
- Types of quality control samples collected.
- Sampler signatures.

- Results of QC checks.
- Documentation of all problems encountered in the field with corrective action resolution.

Field logs (COCs, calibration, sample collection, etc.) will be kept in a three-ring binder that will be stored in the RC's office. Field notes will be recorded in bound field books. Field logs/field books shall include weather observations at the site during field activities. All relevant observations or digressions from standard QA/QC procedures, deemed notable by any field team member, shall also be recorded in the field logbook. The approved SAP/QA/QCP will be located onsite during field activities. Field data worksheets will be used to record all field measurements and any uncertainties encountered while performing field measurements. Each page of the field logs and field data worksheets will be dated and signed by the person making the entries. The originals in the bound three-ring binders will be retained in the physical project file.

Prior to collection of each sample, surface debris (i.e., rocks, vegetation) will be removed from the immediate sample area. Samples will be collected, placed in laboratory-provided coolers, and secured for shipment/transport. COC information will accompany the samples, which are collected at the site. Upon receipt of the samples and COC information, the laboratory representative:

- Checks sample container integrity and documentation.
- Verifies the sample preservatives.
- Logs receipt of the samples.

COC forms shall accompany all samples from origin through disposal. All sample containers shall be labeled with the sample identification, preservative, sampler name, analyses required, and date/time of collection. The sample identification shall be linked to the labels, COC, and field notes.

The COC form shall include the following information:

- Project name and address.
- Dates and times of sample collection.
- Name of sampler.
- Sample identification.
- Number of samples.
- Analyses required.
- Preservation method.
- Turn-around time (days) for sample results.
- Comments.

The laboratory will send an e-mail confirmation upon receipt of samples to the RC Project Manager or QA/QC Officer. The RC Project Manager or QC Officer will review the COC and laboratory information for consistency with the internal work order that documented the sampling work, and analyses to be conducted during that field event.

The laboratory shall provide both electronic and paper copies of the analytical results, which will then be reviewed by the RC Project Manager and/or RC QA/QC Officer. The electronic copy shall be placed in the project file maintained on the server, which is routinely backed-up to ensure data integrity. The paper version of the results will be maintained in the physical project file, which will be archived upon completion of the project.

General information that may be requested from the laboratory, dependent upon requested analyses, includes:

- Analytical results.
- Method blank results.
- Surrogate recoveries and acceptance limits.
- Matrix spike/matrix spike duplicate results, and acceptance limits.
- Spike/Duplicate results and acceptance limits.
- Laboratory control sample results and acceptance limits.
- Serial dilution results.
- Interference check samples.
- Project narrative containing observations and explanation of any data qualifiers.
- Signature by laboratory quality assurance officer.

The laboratory analytical report will be submitted to the RC Project Manager. When necessary, a narrative will be provided with the laboratory report that describes:

- The dates of sample receipt, preparation, and analysis.
- The condition of the samples upon receipt.
- Sample preparation and analysis.
- Any problems encountered during sampling, handling, storage, preparation, analysis, and their solution.
- Any variance from the standard operating procedures.
- A discussion of the quality of the reported analytical data.

The Project Manager will submit the laboratory analytical report to the MES Project Manager after the data has been validated by the RC QA/QC Manager. Detailed information concerning analytical quality assurance and quality control is included in **Section 7.0** of this document.

Project records and documents will be handled in general accordance with the AEIRG document and/or applicable EPA procedures. The laboratory will manage the original raw data for this project in both hard copy and electronic format. The Laboratory Director will retain information on where the records are stored, who will be responsible for records management, and how long specific types of records or documents will be maintained.

Project documents, records, and logs will be disposed of upon completion of the retention time as applicable by discarding, destroying, or long term storage.

4.0 SAMPLING PROCEDURES

Environmental and health related sampling will be conducted at the site. Health related sampling procedures, if necessary, are provided in the remediation contractor's health and safety plan, and will not be included in this document. Environmental sampling procedures are described in the following paragraphs.

To minimize the need for equipment decontamination, samples will be collected with dedicated, disposable sampling equipment whenever possible. Field decontamination procedures will follow Appendix E of the Alabama Environmental Investigation and Remediation Guidance, included in this document as **Appendix A.3**. All waste characterization, confirmation, and QA/QC sample analyses will be conducted by a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory. The Sampling, Treatment, and Excavation procedures to be used for various situations are summarized in flow chart form in **Appendix A.4**.

4.1 Site Characterization and Post-Excavation Confirmation Soil Sampling

Site characterization and post-excavation confirmation soil sampling will be conducted to determine if the soils in the designated cell exceed the Range cleanup standards presented in the Site Specific Addendum (SSA) to the CMIP or to ensure the soils that remain following an excavation meet the cleanup standard for the Range.

4.1.1 Site Characterization Sampling

Initial Site Characterization (ISC) samples will be collected to determine whether the soils within a gridded cell exceed the Range cleanup standards and will require removal. These ISCs are composite samples consisting of five (5) aliquots (grab samples) spaced evenly throughout the cell, generally 100 feet (ft) x 100 ft(collection points will be spaced as described in **Section 4.2.2** of the CMIP or determined by technical personnel based on actual field conditions). It is expected that cell configuration may vary due to field conditions from that described in the CMIP. Each aliquot of the composite sample will be collected from 0-0.5 ft below ground surface (bgs), making sure that surface debris (i.e., rocks, vegetation) is removed from the immediate sample area. A portion of each of the five aliquots will be placed in a pre-cleaned stainless steel bowl and thoroughly mixed to ensure homogenization of the sample. The remainder of each aliquot will be labeled and retained for future laboratory analyses, if needed. The homogenized composite sample will then be placed directly into a laboratory-provided sample container and sealed in a re-sealable plastic bag.

The aliquots may be collected by advancing a stainless-steel hand auger to six inches bgs and collecting the soils in a clean stainless steel or glass bowl or some other dedicated container. The use of a mini-excavator, direct push technology device (DPT), or similar equipment may also be used depending on Site conditions. These options would be utilized due to rocky soils and/or heavy vegetation across the site. For these sampling methods, clean dedicated sampling tools and/or clean stainless-steel tools will be used to collect the aliquot. Each center point aliquot sample location will be marked and labeled with a wooden stake and identified using nomenclature guidelines provided in **Section 5.0** of this document. Outlying aliquot sample locations will be marked with pin flags. The center point aliquot sample location will be surveyed in using either a Global Positioning System (GPS) unit with sub-meter accuracy or an Alabama registered Professional Land Surveyor.

4.1.2 Post-Excavation Sampling

Post excavation sampling will consist of two types of samples, a composite soil sample collected from the bottom of the excavation and a sidewall grab sample. Post-excavation composite samples (PECs) will be collected as described above for ISCs, however the samples will be collected approximately every 2,500 square feet of excavation bottom (one quarter of each cell) with the collection points spaced as described in **Section 4.2.2** of the CMIP or determined by technical personnel based on actual field conditions. The location of each of the composite sample's five aliquots will be selected to provide adequate characterization of soil within each 2,500 square foot area and will be based upon previous ICS results to guide excavation activities. Aliquots will be handled and managed as described above. Each aliquot of the composite sample will be collected from 0-0.5 ft bgs (where ground surface is now 1 foot or more below original grade) following excavation activities.

Sidewall samples (SWs) will be collected approximately every 50-75 feet along the sidewalls of the excavation, depending on the excavated cells geometry. SWs are grab samples and will be collected and managed in a manner similar to the aliquot sampling described above. The RC will ensure that at least one SW sample will be collected from each wall of the excavation.

All PEC or SW shall be submitted to a fixed-base laboratory for analysis of those constituents identified in the SSA with the standard laboratory turnaround time (TAT). The RC may request quicker TATs as necessary to support Site efforts.

4.2 Waste Characterization Sampling

It is anticipated that two different waste characterization samples may be collected during CMI; stockpile characterization samples and demolition debris samples. Stockpile characterization samples will be collected on a stockpile of soil from a remediation grid (cell) to determine if the soils will require chemical amendment and stabilization prior to disposal. There are two main types of soil characterization samples, initial stockpile characterization samples and treatment verification samples. The stockpile characterization samples (SCSs) are the initial sample collected on a newly generated stockpile to determine whether stabilization will be required prior to disposal. The treatment verification samples (TVs) will be collected from soil stockpiles that have been previously stabilized to determine if the treatment process was successful and the soils can be sent for disposal. Generally, the stockpile created from a remediation cell (100 foot x 100 foot) will generate an approximate volume of 370 cubic yards (518 tons) with a 1 foot (ft) excavation. In areas that have a MEC clearance that prevents the cell excavation to depth, the stockpile volumes will differ from this estimate but will not exceed this volume. The specific waste characterization sample collection methodology is summarized below.

A 10-aliquot composite, waste characterization sample will be collected from each stockpile. The location of each of the composite sample's 10 aliquots will be selected to provide adequate characterization of soil within the stockpile, and will include aliquots from both the surface of the stockpile and at least three aliquots from the center of the stockpile. The aliquots collected from the center of the stockpile may be collected while the stockpile is being generated or by a clean, stainless-steel hand auger advanced into the middle of the stockpile. Each aliquot of the composite sample will be collected using cleaned or new sampling tools. A portion of each of the ten aliquots will be placed in a pre-cleaned stainless steel bowl and thoroughly mixed to ensure homogenization of the sample. The remainder of each aliquot may be labeled and retained for future laboratory analyses, if necessary. The homogenized composite sample will then be placed directly into the laboratory-provided sample containers, sealed in a re-sealable plastic bag, and packed for shipment. All waste characterization will be analyzed by toxicity characteristic leaching procedure TCLP for RCRA eight metals (SW-846 Method 1311).

In addition to the waste soils characterization samples, some of the Ranges may have permanent structures (including range butts, fox holes, target mounds, etc.) that will need to be removed. Some of these items may require sampling prior to disposal. Construction and Demolition debris (CD) samples will be collected as necessary to characterize these items for disposal. These samples could include demolished concrete, electrical wiring, piping, wood waste, and other items.

All sample shipments will be conducted under COC documentation protocols. Analytical results from characterization samples will be utilized to support the waste profile with the ADEM-approved Subtitle D Landfill. The waste characterization samples will be submitted to ADEM for approval prior to disposal. No soil will be transported offsite without prior approval from ADEM. Following approval from ADEM, stockpiles with their respective toxicity characteristic limit below the TCLP RCRA eight metals concentrations will be directly loaded from the cell and transported off-site for disposal as a non-hazardous waste at an ADEM-approved Subtitle D Landfill.

All waste characterization and soil sampling activities will be conducted in accordance with the AEIRG document and/or applicable EPA procedures. QA/QC samples will be collected in accordance with **Section 4.3**. If additional analyses are required by the disposal facility, the field crew will be provided with a written notification of the additional analyses and the data will be reported in the Corrective Measures Implementation Report CMIR.

4.3 Quality Assurance/Quality Control Samples

QA/QC samples will be collected in accordance with the AEIRG document and/or applicable EPA procedures. QA/QC samples will be collected to ensure that quality analytical data is being generated at each range. Remediation contractor personnel will collect QA/QC samples to evaluate XRF soil screening and pre-treatment, treatment verification, pre-excavation and post-excavation confirmation soil samples. The following QA/QC samples will be collected. Sample type, sample identification, collection frequency, associated sample media, and analytical methods are included in **Table 1**.

Duplicate Samples – Duplicate samples will be collected as a measure of variability within the area represented by a sample (i.e., grid). These samples will be collected at the same time, using the same procedures, equipment, containers, and analytical methodology as the original samples.

Split Samples – Split samples will be collected to assess sampling handling variability. These samples will be collected at the same time, using the same procedures, equipment, containers, and analytical methodology as the original samples with the exception that twice the sample volume needed for the original sample will be collected. The sample volume will be apportioned, after mixing, into two sets of containers.

Equipment Rinsate Blanks – Equipment rinsate blanks will be collected to ensure proper field decontamination of field sampling equipment. After the field sampling equipment has be decontaminated, and prior to use, it will be rinsed with organic-free, deionized water. The rinse water will be collected and submitted for analyses of the all contaminants of concern for which the original samples with that piece of equipment are being analyzed.

Matrix Spike/Matrix Spike Duplicates (MS/MSD) - MS/MSD samples will be run to measure bias due to sample handling and or analytical procedures and to assess laboratory performance. The original sample will have sufficient sample volume for a MS/MSD, thus, additional sampling containers will not be required.

Table 1 – QA/QC Sample Guidelines

Sample Type	Sample ID	Frequency	Sample Media	Analytical Method
Duplicate Sample	QCD	1 every 20 (5%)	Soil	EPA 6010B* TCLP RCRA 8
Duplicate Sample	QCD-XRF	1 every 10 (10%)	Soil	EPA Method 6200
Split Sample	QCS	1 every 20 (5%)	Soil	EPA 6010B* TCLP RCRA 8

Equipment Rinsate	QCE	1 every 20 (5%)	Water	EPA 6010B*
MS/MSD	MS/MSD	1 every 20 (5%)	Soil	EPA 6010B*

Notes:
EPA 6010B* for antimony and lead.
QCS-XRF will designate a split sample to verify XRF screening data results.

QA/QC samples may be analyzed on the quick turn-around basis; 24-hour EPA Method 6010B and 72-hour TCLP RCRA eight metals if Site conditions warrant. Quality control evaluation and corrective action are discussed in **Section 7.0**.

4.4 XRF Soil Screening

The RC may use an X-Ray Fluorescence (XRF) instrument to perform soil screening analysis prior to, during, and following excavation activities. Information concerning the general scope and application, general principals of operation, operational procedures, sample preparation, analyses, and safety are summarized below. If an XRF is to be used during the remediation process, the operating manual for the actual XRF unit will be included in the SSA.

4.4.1 Scope and Application

The following text describes the typical sampling and operating procedures required to use an XRF instrument for the screening level analysis of metals in soils and sediments. These procedures are included in the EPA SW-846 Method 6200 (2007), EPA Science and Ecosystem Support Division Operating Procedure SESDPROC-107-R2 (2011), and the Alabama Department of Public Health (ADPH) Office of Radiation Control (Chapter 420-3-26). Any XRF instrument that the RC uses for soil screening will utilize state-of-the art x-ray tube technology instead of radioactive sources to generate the radiation needed to cause metals fluorescence.

XRF results that are within 5% of site remedial goal (i.e., if the lead remedial goal is 400 mg/kg, the range of sample results would be 380 - 420 mg/kg), those samples will be confirmed with an offsite laboratory totals analysis to confirm if the sample exceeds the cleanup goals for the Range(s). If an XRF result indicates that the concentration in the soil is less than the 5% of the remedial goal, the soil is considered to be below cleanup levels and thus no excavation is required. If an XRF result indicates that lead is above 5% of the remedial goal, the soil is considered to be above cleanup levels and will be scheduled for excavation & characterization for disposal. The acceptance criteria for XRF results versus laboratory analytical results will be 35% relative percent difference.

Operational procedures summarized in this section are applicable to in situ (direct analysis) and ex situ (analysis of samples) detection and quantification of the XRF target metal (lead) in soil matrices. The procedures described below represent the general operation of an XRF unit, some of the basic procedures may differ depending on the XRF models being used. Data from XRF analysis is considered to be "screening level" only and is useful for initial screening and contaminant delineation. "Screening level" data generated by the XRF will not be used for waste disposal purposes. Matrix effects, lack of sample preparation, and interferences may affect comparability with fixed-base laboratory methods for metals analysis.

The XRF instrument will be operated in accordance with the manufacturer's directions and instructions. A copy of the Operations Manual will be retained in the RC's onsite administrative trailer. Operation of the XRF instrument will be restricted to personnel trained and knowledgeable in the operation of an XRF instrument or under the supervision of personnel who are trained and knowledgeable in the operation of an XRF instrument.

4.4.2 Sample Preparation Procedures

Sample preparation is dependent on the mode of analysis. For samples analyzed in the field, rock and vegetative matter will be removed as the sample is homogenized. If any metal debris (such as bullets or bullet fragments) is present in the sample, they will be identified by the analyst and removed by hand. The amount and type of metal debris observed will be recorded on the sample analysis form or sample collection log.

Direct "In Situ" Analysis

To protect the XRF analysis window from damage, the homogenized material is placed in a plastic re-sealable bag for analysis. The bags used should be non-textured plastic, storage or freezer bags, either one quart or one pint size. Once the material is in the bag, the analyst will compress and smooth the material inside the bag's interior surface using his gloved hands forcing the material to the bottom of the bag working the material into a consistent sample interface for analysis. If the bag has any printing on the front side, the analyst will turn the bag over and analyze the sample through the reverse (unprinted) side.

Onsite Sample Preparation for "Ex Situ" Analysis

For samples analyzed in a laboratory environment: (a) rock, vegetative matter, and metal debris will be removed as the sample is homogenized; (b) an aliquot of sample will be placed in a disposable, oven-safe container and dried; (c) after cooling, the sample will be crushed with a ceramic pestle, if necessary, and passed through a ASTM No. 10 (2-mm) wire mesh sieve and onto a piece of wax paper. After sieving, samples may be transferred to a bag for analysis.

4.4.3 Sampling Analysis

Sample analysis begins by exposing the sample to primary radiation from the source. The XRF generally has two options for sample presentation to the instrument; direct analysis or an integrated test stand.

Direct Analysis.

If direct analysis is performed, the analyst will ensure the instrument window is in direct, stable contact with the sample bag or cup so that the instrument window and the sample surface are properly aligned. The analyst will initiate the analysis by depressing (and releasing) the XRF trigger mechanism as he holds the instrument down against the sample bag. The instrument will perform an initial “safety check” and then open the shutter allowing the analysis to begin. The analyst must hold the instrument upright and maintain a steady contact with the sample while the instrument is in the "on" position. The XRF has a flashing red strobe light mounted on the top of the instrument and a small liquid crystal display (LCD) display on the rear of the instrument. While taking a direct reading, the light will flash and the LCD display will show a counter of the total seconds elapsed. The analyst must not move the instrument during direct analysis until the sequence is complete and the shutter closes automatically. Remediation contractor technical personnel will mainly conduct direct analysis of the sample.

Significantly moving the instrument or sample during direct analysis would invalidate the run and potentially expose the user to x-rays.

Test Stand Analysis.

Using the integrated test stand, the instrument is mounted in a cradle and the instrument window fits into a slot beneath the test platform so the XRF window faces “up.” The personal digital assistant (PDA) is removed from the XRF in this configuration and is remotely attached to the instrument via data cable. The analyst places the bagged soil on the test platform directly over the XRF window of the unit, the test stand’s protective cover is closed over the analysis area, and the analysis is started using the PDA. The test stand includes a red light mounted on top of the stand that will flash when analysis is underway. When analyzing the sample, the test stand cover must remain closed to reduce radiation risk to the analyst. Once the analysis run is complete, the PDA display changes and the red light returns to steady.

4.4.4 Standards and Blanks

Standard reference materials (SRMs) are prepared soil samples containing certified concentrations of metals in soil. SRMs are purchased from the National Institute of Standards and Technology (NIST) or a commercial supplier. They are used for accuracy and performance checks of XRF analyses. Three standards containing the analytes of interest at low, medium, and high levels are recommended to verify the instrument performance. Historical concentrations at the site and the concentrations of project-specific clean up levels of the analytes of interest will be considered in the selection of SRMs.

A blank sample of "clean" quartz or silica dioxide sand that is free of any of the analytes of interest at the detection limits is required. Usually this material will be supplied by the instrument manufacturer.

All calibrations for the XRF analyzer will be performed in accordance with the instrument manufacturer's instructions and documented on the XRF Calibration Form located in **Appendix A.2** of this plan.

4.4.5 Operational Procedures

Operational procedures for the XRF instrument that will be used by Remediation contractor for soil screening activities will be included in the unit's Operations Manual. As previously mentioned, a copy of the Operations Manual for the XRF unit selected by Remediation contractor will be retained in the administrative trailer. The Operations Manual will be onsite prior to the commencement of any soil screening activities. General Calibration and XRF Screening Summary Forms are included in **Appendix A.2** of this document.

4.4.6 General Safety Precautions

Proper safety precautions will be observed when conducting field XRF measurements. Safety precautions will be included in RC's SSHSP and the unit's Operations Manual. When conducting XRF screening activities, care must be taken to minimize exposure to potential health hazards through the use of protective clothing, eye wear and gloves. The operator should always be aware of the instrument's radioactive source and the direction of its beam of X-rays. The operator should never point the open source at anyone.

Proper training for the safe operation of the instrument and radiation training will be completed by the analyst prior to XRF soil screening activities. Protective shielding will not be removed by the analyst or any personnel other than the manufacturer. The analyst will be aware of the local state and national regulations that pertain to the use of radiation-producing equipment and radioactive materials with which compliance is required. There will be a person appointed within the RC's organization that is solely responsible for properly instructing all personnel, maintaining inspection records, and monitoring x-ray equipment at regular intervals.

X-ray tubes do not require radioactive material licenses or leak tests, but do require registration with the Alabama Department of Public Health, Office of Radiation Control. The RC will obtain approval and register the XRF unit a minimum of three business days prior to site activities. In addition, fail-safe x-ray warning lights will be illuminated whenever an x-ray tube is energized. Provisions listed above concerning radiation safety regulations, shielding, training, and responsible personnel apply to x-ray tubes just as to radioactive sources. In addition, a log of the times and operating conditions will be kept whenever an x-ray tube is energized. An additional hazard present with x-ray tubes is the danger of electric shock from the high voltage supply; however, if the tube is properly positioned within the instrument, this is only a negligible risk. Any instrument is capable of delivering an electric shock from the basic circuitry when the system is inappropriately opened. The unit will be properly and securely stored in remediation contractor's onsite administrative trailer when the unit is not in use.

5.0 SAMPLE IDENTIFICATION

Each sample will have a three-part identification code to accurately and uniquely identify the sample. All samples (except QC) will have a location code, sample type, and location number.

5.1 Sample Location Identification

Each sample identification will be assigned a specific sampling identification code so it is apparent at which Range and Parcel a sample was collected, the type of sample collected (i.e., initial site characterization), the location of the sample (i.e., sample grid or soil stockpile) and the depth below original ground surface of the sample (in foot/feet (FT) or inches (IN), if applicable. The use of symbols for identifying sample depths in FT or IN is not allowed, i.e. (‘) or (“). An example of the soil sample location identification coding that will be used is summarized below.

Location		Sample Type		Location Number		Depth (bgs)	
Range 23, Parcel 079-Q	R23P079	XRF screening	XRF	Grid	A1	0-6 inches	6IN
Range 23 Parcel 079-Q	R23P227	Initial Site Characterization	ISC	Grid	C7	1 ft	1FT
Range 25E Parcel 223-Q	R25EP223	Stockpile Characterization	SCS	Grid-Stockpile	B10	–	–
Range 23 Parcel 079-Q	R23P079	Treatment Verification	TV	Grid-Stockpile	F3	–	–
Range 18, Parcel 074-Q	R18P074	Post Excavation Confirmation Sample	PEC	Sub-Grid (A-D)	G12A	1 ft	1FT
Range 25E Parcel 223-Q	R25EP223	Construction & Demolition	CD	–	–	–	–

Note:
PREXCSS = Pre-excavation confirmation soil sample
POSTXCSS = Post-excavation confirmation soil sample
The QA/QC coding presented in Section 4.3 above may be added to the sample identification for quality control samples.

5.2 Sample Identification Examples

- R23P079-XRFA1-6IN – Represents an XRF screening sample collected in Parcel 079-Q of Range 23 from grid A1 at 0-6 inches) below land surface.
- R23P079-ISCB2-1FT – Represents an initial site characterization soil sample collected in Parcel P079-Q of Range 23 from grid B2 at 1 ft. below land surface.
- R25EP223-SCSB10 - Represents an initial stockpile characterization sample collected in Parcel P223-Q of Range 25E from the stockpile in grid B10.

- R23P079-TVF3-QCD01 - Represents a duplicate quality control sample of the treatment verification sample collected from the stabilized stockpile of Parcel 079-Q of Range 23.
- R25EP223-CD01 - Represents a construction and demolition debris sample from Parcel P223-Q of Range 25E.

6.0 SAMPLE HANDLING, PACKAGING, SHIPPING, AND CUSTODY

All sampling, sample handling, packaging, and shipping activities will conform to the AEIRG document and/or applicable EPA procedures. All records and documentation will be retained in Remediation contractor's onsite administrative trailer.

6.1 Sample Handling

Completed labels will be affixed to all sample containers prior to or during sampling collection. After each container is filled, a custody seal will be placed across the lid. The sample will then be placed within a re-sealable plastic bag, sealed, wrapped in protection wrap (bubble wrap), and placed within a shipping cooler. All pertinent information concerning the sample will be noted in the field logbook and on the COC record prior to moving to the next sample location.

6.2 Sample Packaging, Shipping, and Custody

All samples will be packaged and shipped to the laboratory via overnight courier. Each sample cooler will contain a COC record detailing all samples enclosed within the sample cooler. The COC form will address all samples in that cooler, but not address samples in any other cooler. A filled sample cooler will be sealed with custody seals and strapped with clear shipping tape to ensure the cooler remains closed and undisturbed. Samples will be shipped to the laboratory daily, if needed. It should be noted that samples being submitted for total metals or TCLP analyses do not require that a temperature of 4 degrees Celsius be maintained. Thus, samples submitted for laboratory analyses will not be iced.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

7.1 Field Quality Control Requirements

Soil QA/QC samples will be collected and analyzed as discussed in **Section 4.3**. Field data will be reviewed for integrity by checking all logbook field entries and sampling forms for errors and consistency. A field data usability review that includes an assessment of field procedures, completeness, comparability, representativeness, precision, and bias (accuracy) of the data will be performed for each sample group sent for analysis. The process for reconciling the data includes the evaluation of the following questions:

(1) Were samples collected using the appropriate collection procedures?
(2) Were samples handled in accordance with the AEIRGs, EPA procedures, and this SAP/QA/QCP?
(3) Were the samples collected from the pre-determined or specific sampling locations?
(4) Were the samples properly preserved?
(5) Were field sampling problems documented in field logs?
(6) Were the SAP/QA/QCP specified analytical methods used?
(7) Were problems identified during laboratory analysis?
(8) Was the laboratory able to meet the MDLs, PQLs, and QA/QC requirements specified in the SAP/QA/QCP and provided in the analytical methods?
(9) What were the results of data validation (do any of the data points require rejection)? (10) If data is problematic, is re-sampling or reanalysis required (if data is rejected -how does the result affect the ability to make site decisions)?

7.2 Field Equipment Quality Control Requirements

All field equipment will be visually inspected and calibrated at the beginning of each sampling day, after every four hours of use or as specified by the manufacturer's instructions, and at the end of the workday. Field calibration logs are maintained for equipment that requires onsite calibration (i.e., XRF unit and air monitoring equipment). Field equipment calibration log books are maintained for each piece of equipment and project field logs are maintained for each sampling event and given to the Project Manager upon completion of the sampling event to maintain in the project file for reference. The remediation contractor Project Manager or QA/QC officer may request spot checks of equipment calibration at any time. Calibration records can be traced to equipment logs by referencing project specific field notes.

7.2.1 XRF Calibration

XRF instrument calibration will follow the calibration procedures outlined in the manufacturer's operator's manual and the forms included in **Appendix A.2**. The XRF instrument will undergo a system check during start up or when the instrument is reset. An energy calibration using the stainless steel coupon (if using the test stand) or clip (direct analysis) will be conducted after a successful system check. Calibration verification will be performed using SRMs to check the accuracy of the instrument and to assess the stability and analysis of analytes of interest. Check samples will be analyzed at the beginning of each day. Additional checks will be analyzed during the day and at the end of the day. The count time of the calibration check should approximate the analysis time of the field samples (i.e., 90 seconds of elapsed time is the default). A blank sample of quartz or silica dioxide sand will be analyzed at the beginning of each day. No analytes of interest should be detected above the typical detection limits.

All field data sheets and quality control data will be maintained for reference and inspection and included in the CMIR.

7.3 Laboratory Quality Control Requirements

The remediation contractor QA/QC Manager will monitor the project to ensure quality assurance policies are met. Quality control checks will be performed on field data by reviewing the COC forms and results from the lab for each sampling event. All sample results will be reviewed and correlated to field measurements and observations. The analytical data will be evaluated using, at minimum, the following laboratory control checks:

- Laboratory control standard
- Laboratory Control Standard duplicates
- Matrix spikes
- Matrix spike duplicates
- Method reagent blanks

In addition to these control checks, a comparison of the sample duplicate(s) and the corresponding sample result(s) will be made to evaluate the reproducibility of the sample results based on the laboratory analysis and sample collection and transportation procedures. For this comparison, if the duplicate or sample result is less than 5 times the reporting limit, then the comparison is made by the absolute difference between the results (S-D). For soil samples, if the difference is less than twice the magnitude of the (higher) reporting limit, precision is considered "acceptable". If these differences are within 2X the "acceptable" limits, they are considered "slightly high"; anything beyond that would be considered "high". If both sample and duplicate results are greater than five times (5X) the reporting limit (the higher of the two RLs, if they're not the same), then precision is assessed by the %RPD (difference in results divided by the average of the two results X 100). <35% RPD = "good/acceptable", >35% but < 50% = variability is "slightly high", >50% = "high".

Based on data qualifiers provided by the laboratory, and on the sample/sample duplicate comparison described above; data usability will be categorized as fully quantified, qualified, or unusable. Unusable data will not be utilized. Raw data will be included in the CMIR.

If quality issues are identified, an evaluation of laboratory analysis procedures will be performed. This evaluation will include a review of holding times, blanks, control samples, duplicate analysis, detection limits, holding times, laboratory controls, and overall assessment of data will be conducted. The review also will verify that the predefined number of samples were analyzed and will confirm that the predefined analytical methods and detection limits were used. The QA/QC Manager will review the quality control samples, hold times, calibration, and surrogate recovery, as well as the precision, accuracy, and completeness for the sampled analytes of concern calculated below to determine whether the data will be accepted or rejected. In the event results are rejected, the Quality Assurance Officer and Project Manager will meet to discuss the reasons for the rejection of data and what steps should be initiated including additional site sampling if deemed necessary.

Precision, accuracy and completeness calculations are as follows, respectively:

1. RPD =200*I (BS %R -BSD Result) / (BS %R + BSD Result) 1
2. BS Recovery = 100*(BS Result)/ [Spike Added]
3. BSD Recovery = 100*(BSD Result)/ [Spike Added]

RPD: Relative Percent Difference   %R: Percent Recovery
BS: Blank Spike   BSD: Blank Spike Duplicate

Laboratory data validation will be accomplished through a series of checks and reviews intended to assure that the reported results are of a verifiable, reproducible, and acceptable quality. The validation process will include the determination that:

- Quality control blanks meet criteria
- Quality control data (spikes, duplicates) are acceptable
- Surrogate spike recoveries are acceptable Field audits that indicate that QA/QC procedures are followed

The detection limit requirements for each analyte will be below the applicable regulatory criteria for each analyte of interest. The RC Project Manager or QA/QC Manager will review the laboratory QC samples and control limits identified in the selected laboratory's Quality Assurance Manual (QAM). The quality of the data generated using the laboratory QAM will provide analytical data of a sufficient quality for this project.

Laboratory related QA/QC requirements and data validation are included in the following sections. Constituents of concern, analytical/extraction methods, sample container, preservation, and holding time requirements are summarized the AEIRG document, Appendix G, Table 1 and in applicable EPA procedural documents.

7.4 Laboratory Equipment Quality Control Requirements

The laboratory's QAM addresses the testing, inspection, and maintenance for their analytical instruments. The Laboratory Director will review and verify the laboratory data generated under their corrective action system for accuracy according to the laboratory's QAM and Management (LQM) Program. Any problems identified during this process will be reported to the remediation contractor Project Manager and QA/QC Manager in the analytical data report. The QA/QC Manager validates laboratory data upon receipt of the analytical results.

7.5 Analytical Sensitivity

The laboratory's QAM addresses analytical method sensitivity. The Laboratory Director will review and verify the laboratory data generated under their corrective action system for accuracy according to the laboratory's QAM/Laboratory Quality Management (LQM) Program. Any problems identified during this process will be reported to the Remediation contractor Project Manager and QA/QC Manager in the analytical data report.

7.6 Quality Control Evaluation and Corrective Action

The remediation contractor QA/QC Manager or other senior level staff (i.e., Construction Manager, Project Manager, and/or Technical Director) will conduct field audits during the course of field activities to ensure conformance with this SAP/QA/QCP. Due to the limited duration of these projects, it is anticipated that only one audit of sampling field activities will be scheduled. However, there will be continual review, verification, and validation of all reported analytical data and field forms, log book entries, and other project documentation being generated onsite. The QA/QC Manager may conduct an onsite field audit at the times samples are being collected for both field and laboratory analysis. The QA/QC Manager will have the authority to halt the onsite work if he/she believes the findings from the audit justify such action. In the event discrepancies are identified during an audit, the QA/QC Manager will discuss findings with the RC Project Manager and Construction Manager. The Construction Manager, in consultation with the RC Project Manager, will be responsible for corrective actions related to field activities. Audit findings will be included in the CMIR along with descriptions as warranted. Audit forms are included in **Appendix A.2**.

A corrective action will be initiated to any identified nonconformance in an effort to define a problem, identify the root cause, and determine how to prevent the problem from recurring. The corrective action process is summarized below:

- Upon identification or notification for the need for a corrective action, the QA/QC Manager and Project Manager will attempt to identify the root cause of the problem;

- Once the root cause is identified, the QA/QC Manager and Project Manager will determine how to prevent the problem from recurring;
- Affected personnel will be notified of the solution to the problem either verbally or in writing;
- Management will be responsible for ensuring that the affected personnel are properly implementing any changes (i.e., sampling procedure modification); and
- The QA/QC Manager and Project Manager will review the new process or procedure to ensure its effectiveness.

7.7 Data Validation

A Stage 2A data validation shall be performed in accordance to Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, OSWER No. 9200.1-85, EPA 540-R-08-005, January 13, 2009.

8.0 INVESTIGATION DERIVED WASTE MANAGEMENT

Investigation and Remediation Derived Waste (IDW/RDW) will be generated during this corrective action, including used personal protective equipment (PPE) and disposable sampling equipment. All IDW/RDW will be managed in accordance with the AEIRG document and/or applicable EPA procedures. It is expected that all IDW/RDW which will be generated during this corrective action will be non-hazardous. If any IDW/RDW is subsequently identified as hazardous or suspected hazardous, it will be containerized and disposed in accordance with federal, state, and local regulations.

All non-hazardous PPE and disposable sampling equipment will be bagged and properly disposed as sanitary waste in a securely lidded dumpster rented from a licensed solid waste company. Any decontamination water generated on this project will be collected, containerized in appropriate containers (i.e. 55-gallon drums), and staged pending waste characterization sampling. Upon completion of characterization sampling and profile development, approval will be obtained from ADEM prior to disposal at the appropriate facility. Further handling, management, and disposal of IDW/RDW are discussed in the Waste Management Plan.

9.0 REFERENCES

Alabama Department of Environmental Management (ADEM), 2005, Alabama Environmental Investigation and Remediation Guidance document, September.

Alabama Department of Environmental Management (ADEM), 2012, Corrective Measures Implementation Plan checklist Version 1, June.

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U.S. Environmental Protection Agency (EPA), 2007, SW-846 Test Method 6200: Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment, February.

U.S. Environmental Protection Agency (EPA), 2011, Science and Ecosystem Support Division Operating Procedure SESDPROC-107-R2, December.

SAMPLING AND ANALYSIS And QUALITY ASSURANCE/QUALITY CONTROL PLAN

Appendix A.1

Data Quality Objectives

DQO's were evaluated using the seven step EPA process based on *Data Quality Objectives Process for Hazardous Waste Site Investigations*, EPA/600/R-00/007, January 2000 and EPA website guidance as follows:

Step 1 – State the Problem	Do soil samples collected during the remediation meet the requirements for site closure?
Step 2 – Identify the Decision	Does the site meet ecological and human health cleanup target levels? **Identify Alternate Actions –** If the soil does not meet the cleanup goals, then additional remediation is needed. If the soil does meet the cleanup goals, then remediation has been completed (refer to the Sampling, Excavation, Treatment Flow Chart)
Step 3 – Identify Inputs to the Decision	The inputs consist of metal COC concentrations in soil, specifically antimony, copper, lead and zinc. **Define Sources –** Direct in situ XRF readings at sample locations and on composite samples, analytical samples from each grid location and TCLP results from soil stockpiles. **Basis for Action Levels –** Ecological and/or human health regulatory limits. **Identify Sampling Techniques and Analytical Methods –** Collection of soil samples in accordance with Section 4 of this document with direct XRF measurements of discrete and composite samples for screening and analytical testing using appropriate EPA Methods for analysis of characterization and waste samples.
Step 4 – Define the Study Boundaries	**Define Geographic Area –** 10,000 square foot (sf) grids sampled and tested separately. **Specify Defining Characteristics –** Metal COCs above Site cleanup levels in soil at each grid location. **Determine Scale of Decision Making –** The scale of decision making is based on ecological and human health goals. **Determine Time Frame –** Data will apply until metals are removed. **Determine When to Collect Data –** Prior to, during and following soil removal. **Identify Practical Constraints to Data Collection –** Limited in areas that are impacted by MEC.
Step 5 – Develop a Decision Rule	**Specify the Statistical Parameter that Characterizes the Population of Interest –** Regulatory requirements, site cleanup goals established by agreement, previously submitted remedial investigation are driving the cleanup goals. **Specify the Action Level for the Decision –** The cleanup goals are provided in the SSA to the CMIP. **Develop Decision Rule –** If soil concentrations of metals exceed the cleanup goals, then additional action is necessary. A soil remediation flow chart is provided in the CMIP.

Step 6 – Specify Limits on Decision Factors	**Determine the Possible Range of the Parameters of Interest –** Contamination concentrations will range from below detection limit to above cleanup goals. **Define Types of Decision Errors and Potential Negative Consequences, Select Baseline Condition –** Errors could come from the sampling strategy not providing representative samples of targeted cell or from measured XRF or reported analytical results not providing representative or accurate concentrations for a grid. Ho = soil in cell is contaminated at or above the cleanup goals Ha = soil in cell is below the cleanup target goals. The decision error (Type 1), false rejection on the null hypothesis (Ho) is more sever, resulting in a threat to human health in the environment whereas the Type 2 error of false acceptance, i.e. that the soil is above the cleanup goals when it is not, results in additional cost and scope. The key concern was judged to be the Type 1 error on XRF readings indicating that soil is below the cleanup goals. **Specify a Range Parameter Values Where There are Minor Consequences of a False Negative –** given the higher potential of error associated with XRF measurements, an error limit of plus or minus 5% will be assigned to XRF measurements. Error limits were not assigned to the other values because they are based on more rigorous and accurate methods and analysis.
Step 7 – Optimize the Design for Obtaining Data	**Review the DQO Outputs and Existing Environmental Data –** Data from the investigation document will be evaluated. Once particularly important aspect was the vertical dispersal of contamination based on the nature of the release, I.e. because these were firing ranges higher contamination was associated with impact areas and tends to be shallow due to limited bullet penetration into the soil. **Develop General Data collection Design Alternatives –** Numerous alternatives were considered in the data collection approach which included changes to the cell size, sample locations and aliquot distributions, screening and analytical methods and alternatives for analytical methods. **Formulate the Mathematical Expressions necessary for Each Design Alternative –** Not a prudent approach due to the nature and extent of contamination. **Select the Most Resource Effective Design that Satisfies All DQO. Document the Operational Details and Theoretical Assumptions of the Selected Design –** A cell size of 10,000 sf was selected as the optimal cell size due to the limited extent of vertical contamination, each cell would be remediated in one foot intervals. As noted by the sample logic flow diagram, a combination of XRF and analytical data will be used to evaluate each grid cell to determine if it meets cleanup goals.

SAMPLING AND ANALYSIS
And
QUALITY ASSURANCE/QUALITY CONTROL PLAN

Appendix A.2

Forms

XRF Calibration Form

(Site Name) *(City)* *(State)*

(Project No) *(Contract Title / Client Name)*

1. Initial Calibration Data: Date: ____________ Check PDA clock on XRF.

Is XRF warm-up Time: ____________ Agree?

> 15 Min? **Yes** **No** **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: ____________

Record Energy resolution: ____________ eV

2. START-of-Day calibration: **Instrument** Serial Number ____________

Blank-Si0$_2$ **Count:________sec**

Element	Conc (ppm) Certified	Conc (ppm) Detected	<RLs Accept?
As			
Pb			
Cu			
Zn			

Moderate Lead - **Count:______sec**

Element	Conc (ppm) Certified	Conc (ppm) Detected	%D Accepted?
As			
Pb			
Cu			
Zn			

Low Lead - **Count:________sec**

Element	Conc (ppm) Certified	Conc (ppm) Detected	<RLs Accept?
As			
Pb			
Cu			
Zn			

High Lead - **Count:______sec**

Element	Conc (ppm) Certified	Conc (ppm) Detected	%D Accepted?
As			
Pb			
Cu			
Zn			

Comments*: Not a NIST certified value. %D = difference of certified and measured values, divided by certified value, Express as %

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XRF Calibration Form

(Site Name) (City) (State)

(Project No) (Contract Title / Client Name)

3a. Continuing Calibration Data: Date: ________ Check XRF clock.
Is XRF warm-up Time: ________ Agree?
> 15 Min? **Yes** **No** **N/A** **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: ________

Record Energy resolution: ________ eV Source Strength: ________ mCi

3b. Continuing Calibration Data: Date: ________ Check XRF clock.
Is XRF warm-up Time: ________ Agree?
> 15 Min? **Yes** **No** **N/A** **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: ________

Record Energy resolution: ________ eV

XRF Calibration Form

(Site Name) (City) (State)

(Project No) (Contract Title / Client Name)

4. END-of-Day calibration: Date: ____________ Check XRF clock.

Is XRF warm-up Time: ____________ Agree?

> 15 Min? **Yes** **No** **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: ____________

Record Energy resolution: ____________ eV Source Strength: ____________ mCi

Blank-Si0$_2$ Count:________sec			
	Cone (ppm)		<DLs
Element	Certified	Detected	Accept?
As			
Pb			
Cu			
Zn			

Moderate Lead - Count:______sec			
	Cone (ppm)		%RPD
Element	Certified	Detected	Accepted?
As			
Pb			
Cu			
Zn			

Low Lead - Count:________sec			
	Cone (ppm)		%RPD
Element	Certified	Detected	Accept?
As			
Pb			
Cu			
Zn			

High Lead - Count:______sec			
	Cone (ppm)		%RPD
Element	Certified	Detected	Accept?
As			
Pb			
Cu			
Zn			

Comments*: Not a NIST certified value. %D = difference of certified and measured values, divided by certified value, Express as %

Matrix ENVIRONMENTAL

XRF Laboratory Sample Results Form

(Site Name) (City) (State)

(Project No) (Contract Title / Client Name)

1. General Sample Location and Identification

(circle one) **Floor:** **Sidewall** **Other**

(if "other" describe):

Sample Loc / Description

(location) (type)

to

(excavation depth, ft)

Location comments:

Date: Time:

Sample Number

Associated QC:

2. Sample Preperation:

(Check all that apply)

In situ	Drying	Crushing	Coarse Sieve
(pan prep)	(Temp:___C for ___hrs)		(#10,2mm)

Sample Prep Comments / Tar Observed?

3. Analytical Results: (all units are ppm)

Measurement Date:

Time:

Measurement No:

Count Time:

Elapsed Time:

	Original Analysis	
	Conc	Std Dev
As		
Pb		
Cu		
Zn		

Dup analysis*		RPD	
Conc	Std Dev	%	Comment

*if performed

Other Metals (Ni, Hg, Cr):

4. Analytical Team:

Form Completed by

Signature Date

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XRF Summary of Results

Site Name: City State

Location ID		Sampling Date		Prep			XRF Data		Conc (ppm)					Split to	Other
Location	No.	Date	Time	Pan	Lab	Frag?	Read No.	Count (sec)	As	Std	Pb	Std	Other Metals	Lab	Comments

April 2017

Laboratory Analytical Quality Assurance/Quality Control (QA/QC) Checklist

Project Name: ______________________ Project Number: ____________________
Laboratory: ______________________ Laboratory Report ID ________________
Date: ____________________________

The following checklist is provided to assist in Quality Assurance/Quality Control (QA/QC) procedures to evaluate laboratory analytical data quality. This checklist assumes that you have already determined the Data Quality Objectives (DQOs) for your site or project. The DQOs state the level of uncertainty that is acceptable in the analytical data. The level of the data package will vary depending on the project (e.g., site assessments versus permit compliance versus closure sampling.)

Check the Chain-of-Custody (COC) record.

Y or N Is the COC complete (including field personnel portions)?
Y or N Do the sample names on the report correspond to the sample names on the COC?
Y or N Did the laboratory run all of the requested tests?
**COC accuracy is very important for permits and closure sampling. The COC should track/account for the sample bottles form the laboratory to the field and back to the laboratory. When relinquishing/accepting samples the date and time should be the same for the exchange.*

Check laboratory method detection limit (MDL) against applicable cleanup target levels or regulatory standards.

Y or N Were any MDLs higher than your cleanup target levels?
Y or N or NA Can the laboratory re-run samples to provide the appropriate MDL (if applicable?

Interpreting Your Analytical Report

In general, there are three types of analytical methods used:
SM – Standards Method
EPA – United States Environmental Protection Agency Methods
ASTM – American Society for Testing and Materials
The analytical method is followed by a method number. In cases where multiple method numbers are used, the first number generally indicates the extraction method and the later refers to the analysis method.
Units are matrix specific, where liters indicate aqueous samples and kilograms indicate solid samples (e.g., soils, sediments, etc.). Common Qualifiers:
"J" notes that the value is estimated (estimate may have been caused by surrogate recovery exceedance, QC criteria were not met, or sample matrix interference).
"Q" notes that the samples were analyzed beyond acceptable hold times.
"U" indicates analyte was not detected in analysis.

Data validation – the process that determines if the laboratory data are of acceptable quality as defined by the project's DQOs.

Laboratory **precision** is measured in Relative Percent Difference (RPD).

RPD = [(x-y) * 200] / (x+y)

where x and y are the concentrations of each duplicate (or MS and MSD)

Data have acceptable precision the RPD is below the maximum limit (typically within 0-30%).

Laboratory **accuracy** is reported in percent recovery (%R)

%R = (found value / true value) * 100

Data are of acceptable accuracy when the %R falls within the control limits. Control limits are established by statistical analysis of matrix (or fortified) spikes.

Project Name: ______________________ Project Number: ____________________
Laboratory: ________________________ Laboratory Report ID ________________

To validate how well the laboratory performed the methods, examine the following:

Y of N Laboratory Control Sample (LCS) – Laboratory pure water is spiked with known amounts of target analytes. LCS% recovery fell within acceptable control limits.

Y or N Laboratory Control Sample Duplicate (LCSD) – a replicate split of the LCS, prepared, extracted, and analyzed just as the LCS. Only performed when there is not a sufficient amount of sample or when the method dictates an LCSD. LCSD % recovery fell within acceptable control limits.

To determine sample matrix effects on your project's analyses, review the following:

Matrix Spike (MS) – a known amount of the analyte to be tested is added to the sample.
Matrix Spike Duplicate (MSD) – another analyte enriched portion of the same sample.
Surrogate – an organic compound, which is similar in composition and behavior to the target analytes, but is not normally found in the samples. It is used to monitor system performance on each analytical analysis.

To validate sample matrix effects, examine the following:

Y or N MS/MSD pairs fell within acceptable control limits (RPD).
Y or N Do the surrogate recoveries fall within the acceptable limits/ranges for each analysis?

Key points to consider when evaluating data

Y or N Was the sample integrity maintained while sampling?
- ☐ Reviewed sample logs.
- ☐ Checked for proper sample container and preservation method.
- **Y or N** Was the analysis performed within the acceptable hold time?
- **Y or N** Is the method blank reported with each analysis?
- **Y or N** Are blank results acceptable (e.g., equipment, trip, and method blanks).

**Validation of blank data can identify contamination introduced either during sampling or in the laboratory.*

Y or N Does the data package level meet your DQOs?
Y or N Are surrogates reported for the appropriate analyses?
Y or N Do the QA/QC parameters meet the Quality Manual requirements?
Y or N Does the data make sense? (For example, dissolved concentrations should not exceed total concentrations?)
Y or N Do the results support field observations and measurements?
Y or N Do the results follow historical data trends?
- ☐ Made a list of all of the "hits" in the report.
- ☐ Verified method detection limit (MDL) of contaminant "hits" versus applicable cleanup target levels or standards.
- **Y or N** Are the MDLs acceptable?
- ☐ Verified "hits" versus historical site data.
- **Y or N** Are any of the "hits" new contaminants at the site?
  If you have new contaminants, consider having the laboratory re-run samples.

*****Review analytical reports as soon as they are received (so if re-runs are needed, they can be completed without having to re-sample).***

I have reviewed the aforementioned laboratory analytical results against the requirements of the *Matrix Environmental Services, LLC Quality Assurance Plan.* The analytical results contained within the laboratory report meet the data validation and QA/QC guidelines of the *Quality Assurance Plan*.

________________________ ____________________________ ________________
Signature Print name Date

Matrix ENVIRONMENTAL

Quality Control Audit Form

Client Name/Site Name:							
Site Address/Location:							
Project No.:				Project Manager:			
Site Supervisor:				Date:			
Field Crew:							
Other Personnel & Affiliation:							
Is this a follow-up audit?		Date of previous audit(s):					
Work plan or scope included?		Date issued:					
Was work plan or scope followed? Comments:							
Was a safety plan prepared for this site? Did personnel have a copy? Comments:							
Were daily or weekly safety reviews conducted? Was the safety plan followed? Comments:							
Additional comments or information:							
Check sections completed:	1.	2.	3.	4.	5.	6.	7.
Key:	1. Gerneral Procedures and Documentation (SESDPROCS-010, 011, 001, 002)						
	2. Ground Water Sampling (SESDPROCS-301-R2)						
	3. Soil and Sediment Sampling (SESDPROCS-300-R2, 200-R2)						
	4. Surface Water Sampling (SESDPROCS-201-R1)						
	5. Waste Characterization and Containerized Waste (SESDPROCS-302-R1)						
	6. Monitoring Well Installation (Not applicable & removed from forms section)						
	7. Findings and Correction Schedule (Note: If validating error corrective actions, attach Section 7 from the previous audit.)						
Note: Alabama Environmental Investigation and Remediation Guidance is lead document. Defaults to SESDs.							

GENERAL PROCEDURES AND DOCUMENTATION

Project Name: Date:
Is a bound field book being used to record daily activities?
Is the site name, date , and a page number present on each page?
Is the hand writing vlear and legible? Does the writing make sense?
Is each page initialed by the author? Is last page of each page signed by the author?
Are all blank lines and spaces lined out?
Is the introductory information, such as weather, personnel and subcontractors, materials and equipment, and purpose for field activities, written at the beginning of each day's entries?
Are field activities adequately documented in a bound field log book using indelible ink?
Are the daily activities entries complete and free of unexplained gaps in time?
Are all acronyms used defined in the beginning of each day's entries?
Are any/all errors in documentation corrected without obliteration?
What field instruments were used during this study? Have calibration logs been maintained?
Does the calibration log include the following infmation: • Equipment identification number • Date and time of calibration/calibration check • Calibration/calibration check result • Acceptance criteria for each calibration result • Identification of pass/fail for each calibration result • Corrective actions, including discontinuing use of a piece of equipment • Citation of specific calibration verification procedure used for the instrument (i.e. reference to the appropriate SESD)

GENERAL PROCEDURES AND DOCUMENTATION, continued

Is the following information related to field instrument and calibration standard iuse recorded in the field book: • Instrument brand name • Calibration standard brand name and concentration • Calibration standard expiration date • Information on how standard was formulated (pre-prepared by manufacturer or mixed in the field/office)
Are all calibration records and field screening results recorded in the correct units for the instrument?
Are the equipment calibration logs in the warehouse up to date?
Is each piece of screening or analytical field equipment being calibrated at the beginning, middle, and end of each day?
Are manufacturer calibration instruments present with each piece of equipment?
Was any/all rental equipment specified in the field book, including the rental agency and serial number for the equipment?
Were photos taken and a photo log maintained?
Have all cleaning procedures been adequately documented in the field book? This includes the following: • Cleaning steps in all procedures documented by description or reference to the SESDs • Date and time of cleaning procedured recorded • Type of equipment cleaned and intended use of equipment (to ensure proper procedure was used) • Description of all reagents and water used for cleaning • Deionized water is NOT being used for cleaning
Are field or construction dailies completed for each day of work, if required?
Are sampling logs required for the type of work being done? If so, review the following: • Are sampling logs the correct version? • Have the sampling logs been completely accurate? • Has all the required information been completed on the form? • Were the correct scenarios selected from the sampling log? • Are any calculations on the log correct? • Were the field readings accurately interpreted by the sampling crew?

GENERAL PROCEDURES AND DOCUMENTATION, continued

Is any other type of paperwork, such as manifests, truck logs, etc., appropriate for the type of field work being done? Is that paperwork being completed? Correctly?
Are the daily subcontractor logs being utilized? If not, why?
Was equipment properly wrapped / stored and protected form possible contamination or damage?
Were clean disposable gloves worn and changes frequently during site activities?
Is the work area clean and trash containerized?
Is the H&S briefing recorded in the field book? Are all personnel signing the acknowledgement?
Is a copy of the SESDS present? Is a map to the hospital located on the driver's seat or dash of the vehicle?
Are personnel adequately familiar with the scope of work? Do they understand the contaminants of concern at the site?
Are the appropriate backup and reference materials present (copy SOW, copies of subcontractor bids, copies for RFQs, etc.)?
FINDINGS:

SAMPLING: GROUNDWATER

Project Name:	Date:
Has the following information been recorded properly: • Purging equipment • Purging procedures • Well diameter, depth, and screened interval • Water table depth • Purge volume calculations, total volume purged, and pumping rates • Water level drawdown measurements during purging or pumping	
Were wells secured and protected after use? Were the well head conditions recorded?	
Which side of the casting was used for water level measurement?	
Was the contour map prepared before leaving the site? Have any anomalies in the data been addressed?	
Was total depth measured? If so, why? Was the variation from SESD noted in the field book?	
Was the water level indicator properly cleaned between wells?	
Were samples collected in proper order? (least suspected contamination to most contaminated?)	
What flow rate is being used during purging and sampling? How is the flow rate being calculated? How is the flow rate being verified (i.e. double-checked)?	
What purging criteria were applied? Were these the correct criteria?	
Were pH, conductivity, temperature, disolved oxygen, and turbidity readings stable prior to sampling?	
Were the field paramter instruments calibrated at the beginning, middle, and end of each day?	
Are equipment blank and other QC samples being collected according to the SESD (ie 5%)? Are the equipment blanks being analyzed for the correct parameters?	
Is the sampling equipment appripriate for the sample analyses?	
If using a submersible or other powered pump - is the generator located properly with respect to the wellhead? (downwind and at least 10 feet away)	

If using a submersible or other powered pump - describe the fueling procedures for the generator.
What was the maximum time allowed to elapse between purging and sampling activities? If time exceeded one hour, were stabilization parameters re-measured?
If a submersible pump was used, was it properly cleaned before and/or between wells?
Were the cleaning procedures adequately documented?
If a peristaltic pump was used to collect samples, what measures were taken to ensure the organic samples did not pass through the pumphead? Were these adequately documented?
Were samples iced within 15 minutes after collection?
Is the tubing intake for the purge pump correctly placed in the screened interval?
Were samples adequately identified with labels or tags?
Was the COC correctly completed and signed?
Gloves: • Worn by all samplers • Changed between each task • Not in contact with sample media or interior of sample containers • Unpowered
If collecting filtered metals samples, what was the size of the filter? Is filter size properly documented?
FINDINGS:

SAMPLING: SOIL, SEDIMENT, & SLUDGE

Project Name:	Date:
How were sample locations chosen? How were the sample loctaions located and are they located appropriately?	
What procedures and equipment were used to collect samples? Do they meet SESD requirements?	
If fuel-powered equipment is utilized during sample collection, is it located appropriately (downwind) and the location documented in the field book?	
If split spoon or DPT methods are used, is the following information recorded: • Same depth interval • Recovery (feet or %) • Determination of formation versus slough • Detailed lithologic information according to USCS • Field screening and analytical sampled, if collected, noted	
Were field screening samples handled properly: • Method referenced and followed • Placed into the appropriate sample containers • Proper amount of sample utilized • Spent samples properly disposed and documented	
Were analytical samples handled properly: • Appropriate equipment used for collected • Samples collected from "clean" to "dirty" • "Fresh" soil used for sample (NOT the same soil as used for screening) • Soil used for sample collected from center of sampling implement, away from walls of sampling • Appropriate implements used to fill sample jars (not fingers) • Proper labeling • Samples placed in sealed bags • Samples iced within 15 minutes of collection • Extra or spent sample material properly disposed and documented	

SAMPLING: SOIL, SEDIMENT, & SLUDGE, continued

Is the following sample information recorded in the field book: • Samples location (both horizontal and vertical location) • Samples analyses • Samples preservation
Was the COC correctly completed and signed?
What was the condition of the drilling and sampling equipment when it arrived on site? Was it noted by the field crew?
Was a decontamination area located where the cleaning activities would not cross-contaminate clean and/or drying equipment?
Are soil borings/sample locations and elevations adequately described in the field book?
Was clean equipment properly wrapped and stored in a clean area?
Was used equipment rinsed with water immediately after use?
Was the drilling/DPT rig(s) and equipment properly cleaned between locations? Properly documented and referenced in the field book?
Were all cuttings and waste containerized and properly labeled? If not, was proper documentation of why containerization was not necessary provided?
Were waste characterization samples collected and placed on a separate COC?
FINDINGS:

SAMPLING: SURFACE WATER

Project Name:	Date:
Are the sample locations and collection method in compliance with the SOW?	
How were sample locations chosen? How were the sample locations located and are they located appropriately?	
What procedures and equipment were used to collect samples? Do they meet SESD requirements?	
If fuel-powered equipment is utilized during sample collection, is it located appropriately (downwind) and the location documented in the field book?	
Did the sampler wade in the stream to collect the samples? If so, did the sampler remain downstream of the sample location?	
Were analytical samples handled properly: • Appropriate equipment used for collected • Samples collected from upstream • Soil sediments not collected alon with surface water • Appropriate implements used to fill sample jars (not fingers) • Proper labeling • Samples placed in sealed bags • Samples iced within 15 minutes of collection	
Is the following sample information recorded in the field book: • Sample location (both horizontal and vertical) • Samples analyses • Sample preservation	
Was the COC correctly completed and signed?	
FINDINGS:	

WASTE CHARACTERIZATION & CONTAINERIZED WASTE

Project Name: Date:
Is this site and waste regulated under CERCLA or RCRA?
Is IDW containerized per SESDs? If not, why? Is it properly documentd?
Are the IDW storage containers properly labeled? (this includes any drums being used to store trash)
Are the IDW storage containers intact? (check seals, dents, lids, bungholes)
Are the IDW storage containers stored and spaced properly?
How many waste are/were collected? Is the number of samples appropriate for the quantity of material to be characterized?
Were the characterization samples grab or composite samples?
How many aliquots were taken for the composite sample and how were the aliquots homogenized?
What type of equipment was used to collect the waste characterization samples?
What procedures were used to collect the waste characterization samples?
Were samples properly placed into the appropriate containers/bags and iced (if applicable) after collection?
Are the selected analyses appropriate for waste characterization, based on the site contaminants? Is the COC filled out correctly (using waste Method numbers, etc)?
Has any waste been stored onsite for longer than 90 days? If so, when will it be removed?
Was the waste characterization sampling adequately documented in the field log book: • Number of containers • Location of containers • Contents and percent filled • Sample time and date for each container

WASTE CHARACTERIZATION & CONTAINERIZED WASTE, continued

Was a separate COC completed for the waste characterization samples?
FINDINGS:

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FINDINGS AND CORRECTION SCHEDULE

Project Name:	Date:

Findings

Section #	**Comments:**

Correction Action Schedule

Correction Action Schedule	Schedule Completion	Completion Verification (QC Officer or PM signature)

SAMPLING AND ANALYSIS
And
QUALITY ASSURANCE/QUALITY CONTROL PLAN

Appendix A.3

Field Decontamination Procedures

(Referenced from Appendix E of ADEM, 2017, Alabama Environmental Investigation and Remediation Guidance [AEIRG], February.)

APPENDIX E - FIELD DECONTAMINATION PROCEDURES

E.1. Appendix Outline

E.2. Standard Cleaning Liquids

1. Soap should be a standard brand of phosphate-free laboratory detergent such as Liquinox®. Use of other detergent should be justified and documented in the field logbooks and inspection or investigative reports.

2. Solvent should be pesticide-grade isopropanol. Use of a solvent other than pesticide-grade isopropanol for equipment cleaning purposes should be justified in the study plan. Otherwise its use should be documented in field logbooks and inspection or investigative reports.

3. Tap water may be used from any municipal water treatment system. Use of an untreated potable water supply is not an appropriate substitute for tap water. Analyte free water (deionized water) is tap water that has been treated by passing through a standard

deionizing resin column. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds (i.e.: at or above analytical detection limits) as defined by a standard inductively coupled Argon Plasma Spectrophotometer (ICP) (or equivalent) scan. Analyte-free water obtained by other methods is appropriate as long as it meets the above analytical criteria. Organic/analyte free water is defined as tap water that has been treated with activated carbon and deionizing units. A portable system to produce organic/analyte free water under field conditions is available. At a minimum, the finished water should meet the analytical criteria of analyte free water and should contain no detectable pesticides, herbicides, or extractable organic compounds, and no VOCs above minimum detectable levels as determined by the Region 4 laboratory for a given set of analyses. Organic/analyte free water obtained by other methods is appropriate, as long as it meets the above analytical criteria.

4. Other solvents may be substituted for a particular purpose if required. For example, removal of concentrated waste materials may require the use of either pesticide-grade hexane or petroleum ether. After the waste material is removed, the equipment should be subjected to the standard cleaning procedure. Because these solvents are not miscible with water, the equipment should be completely dry prior to use.

E.3. Decontamination Pad

E.3.1 Decontamination Pad Specifications - The pad should be constructed in an area known or believed to be free of surface contamination. The pad should retain all decontamination fluids and site contaminants. If possible, locate the pad on a level, paved surface that is well drained. Pads located off pavement are subject to being shut down for extended periods following rain events due to standing water, equipment mired in mud, excessive mud on the pad, etc. The pavement also provides a firm support for heavy items such as augers. The pad should include a berm or wall that is 8 to 12 inches and completely surrounds the pad. Low cost walls can be constructed of unmortared concrete blocks, railroad ties, lumber, etc. The pad should include a small shallow sump dug in one corner of the pad. A hole can be made in the pavement, or a corner of the pad can extend beyond the paved area. The sump should be deep enough to contain the intake line of a pump. The pad should be lined with an impervious material with no seams within the pad. This material should either be easily relaced (disposable) or repairable. If a disposable liner is not chosen for the liner, a patch kit should be available to repair holes and tears. The area the liner is to cover should be swept or pressure washed prior to laying down the liner. Sawhorses or racks constructed to hold equipment while being cleaned should be high enough above the ground to prevent equipment from being splashed. The sawhorses or rack legs should be cushioned with small pieces of lumber, rubber, etc., to avoid puncturing the liner.

E.3.2 Operation of the Decontamination Pad - When drilling wells, organic-free water should be generated on-site to provide a sufficient quantity to avoid serious project delays. Both organic-free water and solvent should be applied using Teflon® spray nozzles. Spent solvent is a hazardous waste. Unless specifically cited in the approved study plan, spent solvent should be kept separate from other decontamination fluids. The decontamination pad should be drained as needed to keep standing water to a minimum. Standing water easily splashes onto cleaned equipment. Cleaned equipment should be moved from the working area of the pad and completely wrapped to avoid splashing.

Gasoline powered equipment (pump, steam jenny, generator, etc.) should be kept downwind of the decontamination pad while it is running. Safety glasses with splash shields or goggles, and latex gloves should be worn during all cleaning operations. Solvent rinsing operations will be conducted in the open (never in a closed room). No eating, smoking, drinking, chewing, or any hand to mouth contact should be permitted during cleaning operations. At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material designated by the site project leader, but only after all waste/rinse water has been pumped into containers for disposal. No solvent rinsates will be placed in the pit. Solvent rinsates should be collected in separate containers for proper disposal. See Appendix D.7 of this document for proper handling and disposal of these materials. If the decontamination pad has leaked excessively, soil sampling may be required.

E.4. Decontamination of Drilling Equipment

E.4.1 Introduction - Cleaning and decontamination of all equipment should occur at a designated area (decontamination pad) on the site. Tap water (potable) brought on the site for drilling and cleaning purposes should be contained in a pre-cleaned tank of sufficient size so that drilling activities can proceed without having to stop and obtain additional water. A steam cleaner and/or high pressure hot water washer capable of generating a pressure of at least 2500 PSI and producing hot water and/or steam (200° F plus), with a soap compartment, should be obtained.

E.4.2 Preliminary Cleaning and Inspection - All drilling, and sampling equipment should be sandblasted before use if painted, and/or there is a buildup of rust, hard or caked matter, etc., that cannot be removed by steam cleaning (soap and high pressure hot water), or wire brushing. Sandblasting should be performed prior to arrival on-site, or well away from the decontamination pad and areas to be sampled. Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pull-downs, spindles, cathead, etc.) should be steam cleaned (soap and high pressure hot water) and wire brushed (as needed) to remove all rust, soil, and other material which may have come from other hazardous waste sites before being brought on-site. Printing and/or writing on well casing, tremie tubing, etc., should be removed before use. Emery cloth or sandpaper can be used to remove the printing and/or writing. Most well material suppliers can supply materials without the printing and/or writing if specified when ordered. The drill rig and other equipment associated with the drilling and sampling activities should be inspected to insure that all oils, greases, hydraulic fluids, etc., have been removed and all seals and gaskets are intact with no fluid leaks. PVC or plastic materials such as tremie tubes should be inspected. Items that cannot be cleaned are not appropriate and should be discarded.

E.4.3 Drill Rig Field Cleaning Procedure - Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chin pull-downs, spindles, cathead, etc.) should be steam cleaned (soap and high pressure hot water between boreholes.

E.4.4 Field Cleaning Procedure for Drilling Equipment - The following is the standard procedure for field cleaning augers, drill stems, rods, tools, and associated equipment. This procedure does not apply to well casings, well screens, or split-spoon samplers used to obtain samples for chemical analyses. Clean with tap water and soap, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high pressure hot water with soap) may be necessary to remove matter that is difficult to remove with the brush. Drilling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. Hollow-stem augers, drill rods, etc., that are hollow or have holes that transmit water or drilling fluids, should be cleaned on the inside with vigorous brushing. Rinse thoroughly with tap water. Remove from the decontamination pad and cover with clean, unused plastic. If stored overnight, the plastic should be secured to insure that it stays in place.

E.5. Decontamination Procedures for Sampling Equipment

E.5.1 Trace Organic and Inorganic Constituent Sampling Equipment (Teflon® and Glass) - Wash equipment thoroughly with soap and hot tap water using a brush or scrub pad to remove any particulate matter or surface film. Rinse equipment thoroughly with hot tap water. Rinse equipment with 10 % nitric acid solution. Small and awkward equipment such as vacuum bottle inserts and well bailer ends may be soaked in the nitric acid solution instead of being rinsed with it. Fresh nitric acid solution should be prepared for each cleaning session. Rinse equipment thoroughly with analyte-free water. Rinse equipment thoroughly with solvent and allow to air dry for at least 24 hours. Wrap equipment in one layer of aluminum foil. Roll edges of foil into a “tab” to allow for easy removal. Seal the foil wrapped equipment in plastic and label. Note: If the sampling equipment is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone, hexane, or petroleum ether to remove the materials before proceeding with the first step. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with Step 1. If the equipment cannot be cleaned utilizing these procedures, it should be discarded.

E.5.2 Stainless Steel or Steel - Wash equipment thoroughly with soap and hot tap water using a brush or scrub pad to remove any particulate matter or surface film. Rinse equipment thoroughly with hot tap water. Rinse equipment thoroughly with analyte-free water. Rinse equipment thoroughly with solvent and allow to air dry for at least 24 hours. Wrap equipment in one layer of aluminum foil. Roll edges of foil into a “tab” to allow for easy removal. Seal the foil wrapped equipment in plastic and label. Note: If the sampling equipment is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone, hexane, or petroleum ether to remove the materials before proceeding with the first step. In extreme cases, it may be necessary to steam-clean the field equipment before proceeding with Step 1. If the equipment cannot be cleaned utilizing these procedures, it should be discarded.

E.5.3 Cleaning Procedures for Tubing (Silastic® Pump Tubing) - The Silastic® pump tubing in the automatic samplers and peristaltic pumps should be replaced after each study. After installation, the exposed ends should be capped with clean, unused aluminum foil. Only new Teflon® should be used for the collection of samples for trace organic compounds or ICP analyses and should be pre-cleaned as follows:

(a) Teflon® tubing should be precut in 10, 15 or 25-foot lengths before cleaning.
(b) Rinse outside of tubing with solvent.
(c) Flush interior of tubing with solvent.
(d) Dry overnight in the drying oven.
(e) Coil and cap ends with aluminum foil.
(f) Wrap tubing in one layer of aluminum foil.
(g) Roll edges of foil into a “tab” to allow for easy removal.
(h) Seal the foil wrapped tubing in plastic and label.

E.5.4 Stainless Steel Tubing - Wash with soap and hot tap water using a long, narrow, bottle brush. Rinse equipment thoroughly with hot tap water. Rinse equipment thoroughly with analyte-free water. Rinse equipment thoroughly with solvent and allow to air dry for at least 24 hours. Cap ends with aluminum foil. Wrap tubing in one layer of aluminum foil. Roll edges of foil into a “tab” to allow for easy removal. Seal the foil wrapped tubing in plastic and date. Note: If the sampling equipment is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone, hexane, or petroleum ether to remove the materials before proceeding with the first step. In extreme cases, it may be necessary to steam-clean the field equipment before proceeding with Step 1. If the equipment cannot be cleaned utilizing these procedures, it should be discarded.

E.5.5 Glass Tubing - New glass tubing should be cleaned by rinsing thoroughly with solvent and air dried for at least 24 hours. Tubing should be wrapped completely with aluminum foil and sealed in plastic (one tube/pack) to prevent contamination during storage.

E.5.6 Cleaning Procedures for Miscellaneous Equipment:

(a) Well Sounders and Tapes - Wash with soap and tap water. Rinse with hot tap water. Rinse with analyte-free water. Allow to air dry overnight. Wrap equipment in aluminum foil, seal in plastic, and date.

(b) Fultz® Pump - Caution: to avoid damaging the Fultz® Pump never run pump when dry and never switch directly from forward to reverse mode without pausing in the “OFF” position. Pump a sufficient amount of hot soapy water through the hose to flush out any residual purge water. Using a brush or scrub pad, scrub the exterior of the contaminated hose and pump with hot soapy water. Rinse hose with analyte-free water and recoil onto the spool. Pump a sufficient amount of tap water through the hose to flush out soapy water (approximately one gallon). Pump a sufficient amount of analyte-free water through the hose to flush out the tap water, and then empty the pump and hose by placing pump in reverse. Do not allow pump to run dry. Rinse the pump housing and hose with analyte-free water. Place pump and reel in clean polyethylene bag or wrap in clean polyethylene film. Ensure that a complete set of new rotos, tow fuses and a set of cables are attached to the reel.

(c) Goulds® Pump - Caution: never plug the pump in while cleaning. Remove garden hose (if attached), and clean separately. Using a brush or scrub pad, scrub the exterior of the hose, electrical cord and pump with soap and tap water. Do not wet the electrical plug. Rinse with analyte-free water. Air dry. Place pump and hose in clean plastic bag and label.

(d) Redi-Flo® Pump - Caution: make sure that the controller is not plugged in and do not wet the controller. Wipe the controller box with a damp cloth. Remove any excess water immediately. Let the controller box dry completely. Caution: make sure the pump is not plugged in. Remove garden hose (if attached) and ball check valve. Clean these items separately. Using a brush or scrub pad, scrub the exterior of the electrical cord and pump with soap and tap water. Do not wet the electrical plug. Rinse with tap water. Rinse with analyte-free water. Completely air dry. Place equipment in clean plastic bag. Completely dismantle ball check valve. Check for wear and/or corrosion, and replace as needed. Using a brush, scrub all components with soap and hot tap water. Rinse with analyte-free water. Completely air dry. Reassemble the ball check valve and re-attach to Redi-Flo® pump head. Note: The analyte-free water within the Redi-Flo® pump head should be changed upon return from the field according to the manufacturer's instructions.

(e) Little Beaver® - The engine and power head should be cleaned with a power washer, steam jenny, or hand washed with a brush using soap to remove oil, grease, and hydraulic fluid from the exterior of the unit. Do not use degreasers. Rinse thoroughly with tap water. Auger flights and bits should be inspected thoroughly. If severe rust, corrosion, paint, or hardened grout is present, the equipment will require sandblasting prior to cleaning. Clean with tap water and soap, using a brush if necessary, to remove particulate matter and surface films. Steam-cleaning (high pressure hot water with soap) may be necessary to remove matter that is difficult to remove with the brush. Augers that are steam-cleaned should be placed on racks or saw horses at least 2 feet above the ground. Rinse thoroughly with tap water. Completely air dry. Remove and wrap with clean, unused plastic and return to storage.

(f) Field Analytical Equipment - Field instruments for in situ water analysis should be wiped with a clean, damp cloth. The probes on these instruments (pH, conductivity, DO, etc.) should be rinsed with analyte-free water and air-dried. Any desiccant in these instruments should be checked and replaced, if necessary, each time the equipment is cleaned.

(g) Ice Chests and Shipping Containers - Ice Chests and reusable containers should be washed with soap (interior and exterior) and rinsed with tap water and air-dried before storage. If in the opinion of the field investigators the container is severely contaminated with concentrated waste or other toxic material, it should be cleaned as thoroughly as possible, rendered unusable, and properly disposed.

(h) Garden Hose - Brush exterior with soap and tap water. Rinse with tap water. Flush interior with tap water until clear (minimum of one gallon). Completely air dry. Coil and place in clean plastic bag.

E.6. Preparation of Disposable Sample Containers

No disposable sample container (with the exception of the glass and plastic compositing containers) may be reused. All disposable sample containers will be stored in their original packing containers. When the packages of uncapped sample containers are opened, they should be placed in new plastic garbage bags and sealed to prevent contamination during storage.

E.6.1 Plastic Containers us ed for "Classical" Parameters - Plastic containers used for oxygen demand, nutrients, classical inorganics, and sulfides have no pre-cleaning requirement. However, only new containers may be used.

E.6.2 Glass Bottles for Semi-Volatile GC/MS Analytes - These procedures are to be used only if the supply of pre-cleaned, certified sample bottles is disrupted. If desired, pesticide-grade methylene chloride may be substituted for pesticide-grade isopropanol. In addition, 1:1nitric acid may be substituted for the 10% nitric acid solution. Wash bottles and jugs, Teflon® liners, and caps with hot tap water and soap. Rinse three times with tap water. Rinse with 10% nitric acid solution. Rinse three times with analyte-free water. Rinse bottles, jars, and liners (not caps) with solvent. Oven-dry bottles, jars, and liners at 125°C and allow to cool. Place liners in caps and closed containers. Store in contaminant-free area.

E.6.3 Glass Bottles for Volatile GC/MS and TOX Analyses - These procedures are to be used only if the supply of pre-cleaned, certified sample bottles is disrupted. Wash vials, bottles and jars, Teflon® liners and septa, and caps with hot tap water and laboratory detergent. Rinse all items with analyte free analyte-free water. Oven-dry at 125°C and allow to cool. Seal vials, bottles and jars with liners or septa as appropriate and cap. Store in a contaminant-free area.

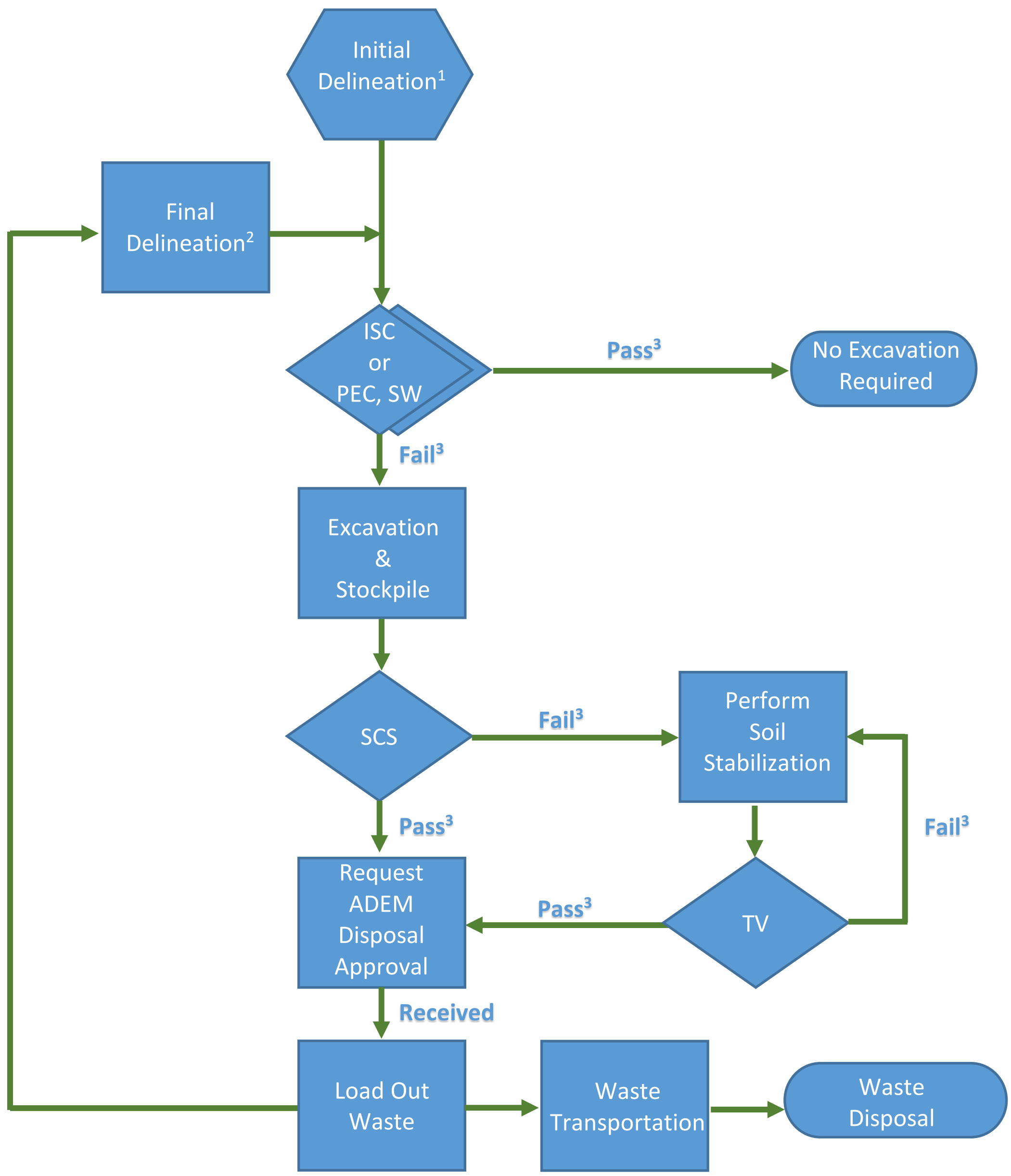
E.6.4. Plastic Bottles for ICP Analytes - These procedures are to be used only if the supply of pre-cleaned, certified sample bottles is disrupted. Wash bottles and caps with hot tap water and soap. Rinse both with 10% nitric acid solution. Rinse three times with analyte-free water. Invert bottles and dry in contaminant-free environment. Cap bottles. Store in contaminant-free area.

SAMPLING AND ANALYSIS And QUALITY ASSURANCE/QUALITY CONTROL PLAN

Appendix A.4

Sampling, Treatment, and Excavation Flow Chart

Sampling, Treatment, and Excavation Flow Chart



Setup

Decision Task

Multiple Decision Task

Task

Complete or Endpoint

ISC – Initial Site Characterization Composite Soil Sample
SCS – Stockpile Characterization Composite Soil Sample
TV – Treatment Verification Composite Soil Sample
PEC – Post Excavation Composite Soil Sample
SW – Post Excavation Sidewall Soil Samples

Notes:

1 Initial Delineation of impacted areas using 10,000 square foot (sf) grid system.
2 Final Delineation of remediated areas using 2,500 sf grids and sidewall samples.
3 Laboratory analytical and XRF sample results will be compared to site remediation standards.

APPENDIX B

WASTE MANAGEMENT PLAN

WASTE MANAGEMENT PLAN

Site-Wide Corrective Measures Implementation Plan for Soil Remediation
Fort McClellan
Anniston, Alabama

Prepared For:

McCLELLAN DEVELOPMENT AUTHORITY

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(revised September 2017)

Revision: 1

WASTE MANAGEMENT PLAN

Soil Remediation
Fort McClellan Sitewide
Anniston, Alabama
Revision 1

Prepared and Approved by:

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Matrix Environmental Services | Project Manager

Date: 9/18/17

ALABAMA LICENSED No. 28773 PROFESSIONAL ENGINEER ALEXANDER M SMITH JR.

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Appendix

LIST OF ACRONYMS

AEIRG	Alabama Environmental Investigation and Remediation Guidance
C&D	construction and demolition
CFR	Code of Federal Regulations
CMIP	Corrective Measures Implementation Plan
CMIR	Corrective Measures Implementation Report
ECP	Erosion Control Plans
IDW/RDW	investigation and remediation derived wastes
MDA	McClellan Development Authority
MES	Matrix Environmental Services, LLC.
OSHA	Occupational Health and Safety Administration
RCRA	Resource Conservation and Recovery Act
SAP/QA/QCP	Sampling and Analysis Plan and Quality Assurance/Quality Control Plan
SDS	safety data sheet
SWPPP	Storm Water Pollution Prevention
TCLP	toxicity characteristic leaching procedure
USEPA	United States Environmental Protection Agency
WMP	Waste Management Plan

1.0 INTRODUCTION

This Waste Management Plan (WMP) was prepared by Matrix Environmental Services, LLC. (Matrix) for the McClellan Development Authority (MDA) as Appendix B to the Site-Wide Corrective Measures Implementation Plan (CMIP), Fort McClellan. The purpose of the WMP is to provide a more detailed description of how contaminated and regulated material will be handled, managed, documented, and disposed, if required, during the course of this project.

2.0 CONTAMINATED MATERIAL OPERATIONS PLAN

An important part of preventing the spread of contamination from the project sites to the surrounding environment is the control and proper handling of generated waste. There are a number of different types of waste streams that will likely be generated during these projects. These include vegetative waste, general construction and demolition debris, metals-impacted soil, investigation and remediation derived wastes (IDW/RDW), recyclable materials, sanitary waste, and other regulated materials (i.e., oil, gas, diesel, etc.). The following describes the general process for controlling, storing, managing, transporting, and disposing of contaminated and regulated materials and touches briefly upon the non-hazardous waste streams. Characterization, handling, storage, management and disposal of contaminated material will conform to policies and procedures in the Alabama Environmental Investigation and Remediation Guidance (AEIRG) document and/or appropriate United States Environmental Protection Agency (USEPA) rules and procedures.

2.1 Control and Disposal of Construction and Demolition Debris

All regulated construction and demolition (C&D) debris will disposed of at either the McClellan Industrial Waste Landfill or another suitable offsite landfill. C&D generated during the demolition of site structures will be sampled in accordance with Section 4.2 of the Sampling and Analysis Plan and Quality Assurance/Quality Control Plan (SAP/QA/QCP) prior to disposal.

The remediation contractor will assign personnel to the landfill as necessary to receive C&D debris, place the material into the landfill and cover the C&D debris with supplied fill materials.

2.2 Control and Disposal of Non-Hazardous Waste

Non-hazardous waste (i.e., metals-impacted soil) will be generated, handled, managed and disposed as part of this corrective measures implementation. It is anticipated that the remediation contractor will also generate IDW (i.e., personnel protective equipment, plastic sheeting, etc.) during the course of site activities. Control and disposal of non-hazardous waste will be conducted in accordance with the existing ADEM regulations. The process of characterizing, handling, managing and disposing of non-hazardous waste generated during site activities is discussed in the following sections.

2.2.1 Waste Determination Procedures

The waste streams mentioned above will be sampled and characterized in accordance with the Section 4.2 of the SAP/QA/QCP in Appendix A of the CMIP to ensure that material is disposed of appropriately.

2.2.2 Non-Hazardous Waste Accumulation and Storage

As part of the remediation process, metals impacted soils will be excavated and stockpiled in their original cell. The stockpiles will then undergo characterization sampling to determine if stabilization is required for non-hazardous disposal. Once it has been determined that all contaminated soils are non-hazardous (with or without stabilization), Matrix will submit the characterization samples to ADEM for disposal approval. Once MES has obtained approval, the non-hazardous metals-impacted soil will be directly loaded into dump trucks for transport and disposal at the Cedar Hill Landfill. All stockpiles will be managed in accordance with the Storm Water Pollution Prevention (SWPPP) and the Site Erosion Control Plans (ECPs). Soil stockpiles will be covered at the end of the day or if inclement weather is anticipated. Each soil stockpile will be covered with 6-milimeter polyethylene sheeting to prevent contact with rainwater or stormwater. Soil stockpile covers will be anchored down by placing weights along the perimeter of the sheeting and on top of the pile in strategic locations. The remediation contractor will ensure that any generated stormwater will be diverted around and away from stockpiled soils utilizing berms, silt fencing and/or wattles, as necessary. Handling, tracking, and disposal of metals-impacted soil are discussed in the following section.

2.2.4 Management Procedures for Transportation and Disposal of Non-Hazardous Waste

All excavated soils will be properly evaluated and characterized pursuant to landfill requirements and in accordance with the SA/QC/QCP through laboratory analysis of representative samples. Excavated soils will either be non-hazardous when the stockpile is created or will require stabilization prior to offsite disposal. Only material with analytical results less than the Resource Conservation and Recovery Act (RCRA) toxicity characteristic concentrations will be designated for transport and offsite disposal. Once ADEM disposal approval has been received, excavated soils and successfully stabilized soils will be disposed at an ADEM-approved Subtitle D Landfill. A special waste profile sheet provided by the landfill will be completed and submitted to the landfill for review as part of the landfill's stipulated approval process. Disposal under this waste profile will be supported by analytical results that demonstrate the metals-impacted soil is non-hazardous (passes toxicity characteristic leaching procedure (TCLP) RCRA eight metals).

All loaded trucks leaving the site will pass through a construction exit and be visually inspected for the presence of mud and dirt. Any visible mud and dirt will be removed from the truck wheels, undercarriage, and tailgate using dry decontamination procedures before exiting the site. Dry decontamination will be performed using brooms and brushes. Wet decontamination procedures will be available should the dry procedures prove to be ineffective. All loaded trucks will be covered with a tarp to prohibit the loss of soil during transport. All tarps will be secured and free of rips or tears before the trucks leave the site. The most direct hauling route between the site and landfill will be utilized by the transporter.

A Non-Hazardous Waste Tracking Log will be maintained to track each shipment of waste that is transported offsite for disposal. An example Non-Hazardous Waste Tracking Log is included in **Appendix B.1**. The log will identify the type of material being transported, the excavation area number from which the material has been loaded, the date and time that the material left the site, the truck identification number, the special waste manifest number accompanying the load and the estimated weight of each loaded truck. The location identification of the excavation area will be generated using the location identification process described in Section 5.1 of the SAP/QA/QCP.

A non-hazardous special waste manifest will accompany each load and will be signed by Matrix on behalf of the MDA and truck drive before the material leaves the site and by a representative of the landfill when the load is received at the disposal facility. A copy of the signed manifest will be retained and filed in the remediation contractor's administrative trailer. Upon arrival at the landfill, the manifest will be signed and a copy of the landfill-executed manifest returned to the remediation contractor. The remediation contractor will cross check and match the returned manifests with the original copy of the shipping manifest. The Non-Hazardous Waste Tracking Log will also be used to track the receipt of completed and signed manifests. Landfill weight tickets will also be used for verification of quantities transported. All the above mentioned documentation will be included in the Corrective Measures Implementation Report (CMIR).

2.2.5 IDW/RDW Management and Disposal

The remediation contractor will generate IDW and/or RDW during the course of site activities. IDW/RDW will be stored in a separate containment area pending waste characterization sampling and final disposition. Analytical results, if required, the associated chain of custody, and disposal manifests will be retained and stored in the remediation contractor administrative trailer. IDW/RDW waste characterization sampling and analysis procedures are included in Section 8.0 of the SA/QC/QCP. Any documentation generated will be included in the CMIR.

3.0 REGULATED MATERIALS OPERATION PLAN

During the course of site activities, the remediation contractor may generate regulated waste materials (i.e., used oil, oil filters, scrap tires, and antifreeze) associated with the field remediation activities. The following sections present the operation plan for handling and disposing of such materials.

3.1 Management Procedures for Regulated Materials

It may be necessary for the contractor and/or their subcontractors to bring regulated materials (oils, gas, diesel, etc.) on site. If regulated materials are required for use during a phase of this work, they will be controlled, managed and inventoried in accordance with the applicable sections of the AEIRG document and 49 Code of Federal Regulations (CFR) and 29 CFR 1910. The remediation contractor will complete the regulated materials inventory list upon mobilization to the site and provide it to Matrix. The list will be updated as needed.

Regulated materials will only be stored in containers constructed of materials consistent with the safety data sheet (SDS) recommendations. Containers of regulated material will be marked to identify the regulated chemical contained and with the appropriate hazard warning. Stored regulated material will be segregated according to hazard class and compatibility. Regulated materials may be stored in a lockable job-site trailer, container or contractor vehicles as far away from Site remediation activities as possible.

Regulated materials will be managed to prevent release to the environment. Gasoline will be stored in marked Occupational Health and Safety Administration (OSHA) approved Type I or Type II safety cans in volumes not to exceed 5-gallons or the volumes listed in the Materials of Trade Exemption Rule (49 CFR 173.6) if stored in contractor vehicles. Diesel fuel will be stored in properly marked OSHA approved Type I or Type II safety cans not to exceed 5-gallons or on contractor vehicles in auxiliary fuel tanks in volumes not to exceed volumes listed in 49 CFR 173.6. Compressed gas cylinders will be stored in upright position with valves shut and caps securely fastened in accordance with the U.S. Army Corp of Engineers document Safety and Health Regulations (EM 385-1-1). All other regulated material containers will be stored in upright position with caps securely fastened. Regulated materials stored in contractor vehicles will not exceed quantities listed in 49 CFR 173.6.

3.2 Management Procedures for Recyclable Regulated Materials

The remediation contractor and their subcontractor(s) will recycle materials such as used oil, antifreeze, oil filters, lead-acid batteries, scrap tires, paper and plastic products, and cleaning fluids where possible or otherwise dispose of them through a licensed facility offsite. Used antifreeze will be recharged where possible. Otherwise the same process will be followed as utilized for used oil. The recycler may be able to accept an oil and antifreeze combination. If so, then one container can serve both purposes. The recycler may be tasked with performing all testing necessary to characterize the used oil/antifreeze liquids. Used lead-acid batteries shall be stacked on a platform with secondary containment capabilities or placed inside an acid-proof container and covered from rainfall. An appropriate transporter shall be called upon after the accumulation of sufficient used batteries to fill the storage container. All parts-cleaning fluids are to be used repeatedly until the product is no longer capable of cleaning. Either the material is mixed with new product or the liquids will be required to be processed as a potentially regulated (hazardous) material. The sludge is also to be characterized and disposed of accordingly. Analytical results, if required, the associated chain of custody, and disposal manifests will be retained and stored in the remediation contractor administrative trailer.

No materials will be disposed on the ground. All regulated materials will be kept away from high traffic areas and active work zones. Surface water runoff and direct rainfall contact with the stored materials will be prevented.

3.3 Used Oil Management Procedures

Used oil will be collected in a properly labeled drum or tank until such time as the container becomes full. Secondary containment will be provided for these containers unless it is stored indoors and is controlled from entering into any floor drains. The used oil filters will be drained and the oil collected and put in the used oil container. The container(s) will be kept covered until such time as a used oil transporter is called to recycle the oil. Whenever someone contributes into the container, the container will be checked to determine the remaining capacity. Upon reaching approximately 80% capacity, the used oil will be recycled or disposed of according to the disposal facilities requirements. No drums exceeding 55 gallons shall be transported without the appropriate transporter registration. Analytical results, the associated chain of custody, and disposal manifests will be retained and stored in the remediation contractor administrative trailer. This information will be included in the CMIR.

3.4 Pollution Prevention and Regulated Materials Minimization Procedures

The remediation contractor will actively minimize the use of regulated materials and the generation of regulated waste. The remediation activities will require that petroleum, reagent/Portland cement, and some limited amounts of regulated substances be brought to the site as part of the work. As mentioned above, these substances will primarily be associated with the operation of equipment. The principal threat of a substance release is from equipment refueling and maintenance procedures.

In order to minimize the potential for pollution through a release or spill, the following procedures will be followed when storing fuel:

- Only approved tanks and containers will be used for fuels and chemicals. With respect to fuel, the dispensing container will be equipped with a flame arrestor. All fuel containers will be stored in a lined bermed area solely designated for fuel storage.

- The container will be placarded with appropriate warning signs and labels.
- All sources of ignition (open flame or smoking) will be prohibited in fuel storage area.
- At least one portable fire extinguisher will be located adjacent to the fuel storage area berm.
- A spill kit consisting of sorbent material, diapers, shovels, and drums or buckets will be located on site near the fuel storage area.
- SDS will be maintained and personnel will be trained in handling the materials.
- Subcontractors will be required to follow the same house keeping procedures as remediation contractor personnel.

The following procedures will be followed when refueling equipment:

- All over-the-road vehicles will be fueled off-site;
- All fueling of off-road vehicles should be conducted at one location on the site (if feasible).
- All workers should take great care to prevent overfilling tanks or spilling fuels during fueling operations.
- NO SMOKING OR OPEN FLAME will be allowed while fueling any equipment.
- All engines should be shutoff during fueling operations.
- Subcontractors will be required to follow the same house keeping procedures as remediation contractor personnel.

3.5 Sanitary Waste Disposal

All sanitary wastes and trash are to be collected and disposed in accordance with Appendix G, Table II of the AERIG document. Sanitary waste collected from portable units (i.e., port-o-lets) will be collected at a minimum of once a week by a licensed sanitary waste management contractor. All non-hazardous PPE and disposable sampling equipment will be bagged and placed in a securely lidded dumpster rented from a licensed solid waste company. Material in the dumpster will be hauled away as needed by the solid waste company.

3.6 Hazardous Waste Disposal

The generation of any hazardous waste at remediation projects at Fort McClellan is not expected. Any material that cannot be rendered non-hazardous and must be disposed of as hazardous waste will be disposed at an appropriate Subtitle C Landfill, such as Waste Management's Subtitle C landfill located in Emelle, Alabama. MES and the remediation contractor will coordinate the disposal and transportation activities for hazardous materials. All trucks will be inspected and manifested as presented in **Section 2.2.4** before leaving the project site.

WASTE MANAGEMENT PLAN

Appendix B.1

Non-Hazardous Waste Tracking Log

Non-Hazardous Waste Load Tracking

Former Ft. McClellan

PROJECT:

Date	Load	Cell ID	Material Type	Truck ID	Manifest Number	Time On- Site	Load Time	Time Off- Site
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
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	32							
	33							
	34							
	35							
	36							
	37							
	38							
	39							
	40							
	41							
	42							

Form Completed by: ______________________________ Date: ________________