APPENDIX I-D

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN
FOR FACILITY RCRA CLOSURE PLAN

HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA

USEPA IDENTIFICATION NUMBER
AZD 081 705 402

TABLE OF CONTENTS

1. PROJECT DESCRIPTION 96

1.1. INTRODUCTION 96
1.1.1. Overall Project Objectives 96
1.1.2. QAPP Preparation Guidelines 96
1.2. SITE DESCRIPTION/FACILITY DESCRIPTION 97
1.2.1. Location 97
1.2.2. Facility/Site Size and Borders 97
1.2.3. Natural and Manmade Features 97
1.2.4. Topography 97
1.2.5. Local Geology and Hydrogeology 97
1.3. PROJECT OBJECTIVES AND USE OF DATA 97
1.4. SAMPLING NETWORK AND RATIONALE 98
1.5. PROJECT SCHEDULE 98

2. PROJECT ORGANIZATION AND RESPONSIBILITY 108

2.1. ORGANIZATION CHART 108
2.2. MANAGEMENT RESPONSIBILITIES 108
2.3. LABORATORY RESPONSIBILITIES 110
2.4. FIELD RESPONSIBILITIES 110

3. QUALITY ASSURANCE OBJECTIVES 112

3.1. PRECISION 112
3.1.1. Definition 112
3.1.2. Field Precision Objectives 112
3.1.3. Laboratory Precision Objectives 112
3.2. ACCURACY 112
3.2.1. Definition 112
3.2.2. Field Accuracy Objectives 112
3.2.3. Laboratory Accuracy Objectives 112
3.3. COMPLETENESS 113
3.3.1. Definition 113
3.3.2. Field Completeness Objectives 113
3.3.3. Laboratory Completeness Objectives 113
3.4. REPRESENTATIVENESS 113
3.4.1. Definition 113
3.4.2. Measures to Ensure Representative Field Data 113
3.4.3. Measures to Ensure Representative Laboratory Data 113
3.5. COMPARABILITY 114
3.5.1. Definition 114
3.5.2. Measures to Ensure Comparability of Field Data 114
3.5.3. Measures to Ensure Comparability of Laboratory Data 114
3.6. LEVEL OF QUALITY CONTROL EFFORT 114

4. SAMPLING PROCEDURES 116

4.1. FIELD SAMPLING BY MATRIX 116
4.1.1. Sample Location and Identification 116
4.1.2. Concrete and Soil Sampling Procedures for Chemical Analysis 117
4.2. FIELD QC SAMPLE COLLECTION/PREPARATION 121
4.3. CONTAINERS, PRESERVATIVES AND VOLUME REQUIREMENTS 121

4.4. Sample Handling and Documentation....121
4.5 Decontamination of Equipment....125

5. SAMPLE CUSTODY....127

5.1. Field Custody Procedures....127
5.2. Sample Packaging Procedures for Overnight Carrier....127
5.3. Laboratory Custody Procedures....128
5.4. Field Records and Documentation....128
5.5. Final Evidence Files Custody Procedures....128

6. CALIBRATION PROCEDURES AND FREQUENCY....129

6.1. Field Instrument Calibration....129
6.2. Laboratory Instrument Calibration....129

7. ANALYTICAL AND MEASUREMENT PROCEDURES....130

7.1. Laboratory Analytical and Measurement Procedures....130
7.1.1. List of Project Target Compounds and Estimated Quantitation Limits....130
7.1.2. List of Associated QC Samples....130

8. INTERNAL QUALITY CONTROL....136

8.1. Field Quality Control Checks....136
8.2. Laboratory Quality Control Checks....136

9. DATA REDUCTION, VALIDATION AND REPORTING....137

9.1. Data Reduction....137
9.1.1. Field Data Reduction Procedures....137
9.1.2. Laboratory Data Reduction Procedures....137
9.2. Data Validation....137
9.2.1. Field and Laboratory Data Validation....137
9.3. Data Reporting....143
9.4. Data Management....144

10. PERFORMANCE AND SYSTEM AUDITS....146

10.1. Field Performance and Systems Audits....146
10.2. Laboratory Performance and Systems Audits....146

11. PREVENTIVE MAINTENANCE....147

11.1. Field Instrument Preventive Maintenance....147
11.2. Laboratory Preventive Maintenance....147

12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS....148

12.1. Accuracy of Analytical Data....148
12.2. Precision of Analytical Data....148
12.3. Completeness Assessment....148

13. CORRECTIVE ACTION....150

13.1. Corrective Action during Field and Data Validation Activities....150
13.2. Laboratory Corrective Action....150

1. PROJECT DESCRIPTION

The following sections provide background information for the Resource Conservation and Recovery Act (RCRA) Closure Plan prepared for the Heritage Environmental Services, LLC ("Heritage") facility in Coolidge, Arizona.

1.1. Introduction

This Quality Assurance Project Plan (QAPP) was prepared to ensure that data gathered during analysis of concrete and soil samples specified in the Closure Plan are properly documented, meet specified data quality goals, and document those procedures or methods that will be utilized during implementation of the Closure Plan at the Heritage facility. The Closure Plan and this QAPP were prepared as parts of the RCRA Part B permit renewal application for the Heritage facility.

1.1.1. Overall Project Objectives

The primary objective of the Closure Plan is to establish procedures to close hazardous waste management units at the Heritage facility in accordance with the closure performance standard stated in Section 3.3 of the Closure Plan.

The Closure Plan requires sampling and analysis of concrete and underlying soils to verify concentrations of the constituents of concern are below levels of regulatory concern. These samples will be collected and analyzed in accordance with the Closure Plan and this QAPP. Sample results will be compared with the action levels specified in the Closure Plan and this QAPP.

1.1.2. QAPP Preparation Guidelines

Heritage has prepared this QAPP based on guidance provided in: Shupp, G. C., 1993, Model RCRA Quality Assurance Project Plans (QAPP) - Revision 1, USEPA Region 5 Environmental Sciences Division, Monitoring and Quality Assurance Branch, Quality Assurance Section.

The Closure Plan and QAPP are interrelated documents and often support one another with specific details. An Arizona Department of Health Services (ADHS)-licensed laboratory selected at the time of closure will implement a Quality Assurance Plan (QAP) and standard operating procedures (SOPs) that also support this QAPP. The ADHS-licensed laboratory will perform the analytical methods specified in this QAPP and their established quality assurance/quality control (QA/QC) procedures in accordance with the current versions of the selected ADHS-licensed laboratory's QAP and SOPs at the time of closure. During an actual closure event, the QAP in effect at the time of closure for the selected ADHS-licensed laboratory will be utilized by the testing laboratory.

1.2. Site Description/Facility Description

A brief description of the facility, its geological setting, and associated features are included in the Closure Plan and/or the RCRA Part B permit renewal application. The relevant sections of these documents are referenced in the following sections.

1.2.1. Location

A description of the facility location is provided in Section 2 of the Closure Plan.

1.2.2. Facility/Site Size and Borders

The facility property is approximately 88 acres with the facility occupying approximately 10 acres. Further information is provided in Section 2 of the Closure Plan.

1.2.3. Natural and Manmade Features

This information is addressed in Section B of the RCRA permit renewal application.

1.2.4. Topography

Site topography is addressed in Section B of the RCRA permit renewal application.

1.2.5. Local Geology and Hydrogeology

Local geology and hydrogeology are addressed in Section B of the RCRA permit renewal application.

1.3. Project Objectives and Use of Data

The primary objective of the Closure Plan is to establish procedures to close hazardous waste management units at the Heritage facility and to meet the requirements of the closure performance standard stated at 40 CFR 264.111, as incorporated by reference at AAC 18-8-264(A). To meet this objective, Heritage will perform the following:

- Collect data through sampling and analysis of concrete to verify that constituents of concern are below regulatory levels of concern, as specified in the Closure Plan;
- Collect data through sampling and analysis of underlying soils to verify that constituents of concern are below regulatory levels of concern, as specified in the Closure Plan;
- Collect data through sampling and analysis of underlying concrete or soil to define the extent of any environmental impact, as specified in the Closure Plan; and
- Collect data after any remediation efforts performed as part of closure to demonstrate that hazardous constituents are below levels that meet site-specific closure standards.

Data collected will be compiled and used to meet the appropriate objective(s) for each hazardous waste management unit undergoing closure. Heritage may also use these data for determining the requirements for proper disposal of any closure wastes. Table 1-1 summarizes the data quality objective levels, sample matrices, intended data usages, and parameters for the Closure Plan.

Hazardous waste management units at the Heritage facility include permitted container storage areas. A more detailed description of the facility including hazardous waste management units, hazardous waste management activities, and facility history are provided in the RCRA Part B permit.

To meet the above objectives, concrete samples will be collected and analyzed at each unit being closed, as described in the Closure Plan. In addition, soil samples will be collected and analyzed at final closure. Descriptions of specific sampling activities are provided in the Closure Plan. Section 4 of this QAPP describes procedures that will be followed during collection of samples. Section 7 of this QAPP outlines laboratory testing requirements for the closure.

1.4. Sampling Network and Rationale

The sampling network design and rationale is discussed in Section 7 of the Closure Plan. Section 7 of this QAPP specifies testing that will be performed, and Section 4 describes procedures that will be utilized during sampling. In addition, Section 7 of the Closure Plan specifies sampling methods and rationale as well as sampling frequencies and locations. Figures 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, and 1-8 identify the anticipated random sample locations for each of the unit(s) based on the selection criteria specified in Section 7 of the Closure Plan, including judgmental samples proposed for collection in sumps and trenches within the units designated for closure.

Background samples will be collected from a specified location at the facility that is not used for waste management operations. Additional information concerning background sampling is provided in Section 7 of the Closure Plan.

1.5. Project Schedule

As required by 40 CFR 264.112, as incorporated by reference at AAC 18-8-264(A), Heritage has prepared a proposed schedule for closure. This schedule is discussed in Section 8 of the Closure Plan.

Table 1-1
Sample Matrices, Parameters, Intended Data Usages,
And Data Quality Objectives
Heritage Environmental Services, LLC
Coolidge, Arizona

Sample Matrix	Field and Laboratory Testing	General Description of Intended Data Usages	Data Quality Objective Level
Soil	Table 7-1 QAPP Table 7-2 QAPP Table 7-3 QAPP Table 7-4 QAPP	Presence/Absence of Indicator Parameters Below or Above Specified Clean Closure Levels at Final Closure Evaluate Extent of any Contamination Verify Cleanup Standards Following any Remediation Activities Waste Disposal Characterization Risk Assessments	See Section 9.3
Concrete	Table 7-1 QAPP Table 7-2 QAPP Table 7-3 QAPP Table 7-4 QAPP	Presence/Absence of Indicator Parameters Below or Above Specified Clean Closure Levels at Final Closure Evaluate Extent of any Contamination Verify Cleanup Standards Following any Remediation Activities Waste Disposal Characterization Risk Assessments	See Section 9.3

FIGURE 1-1

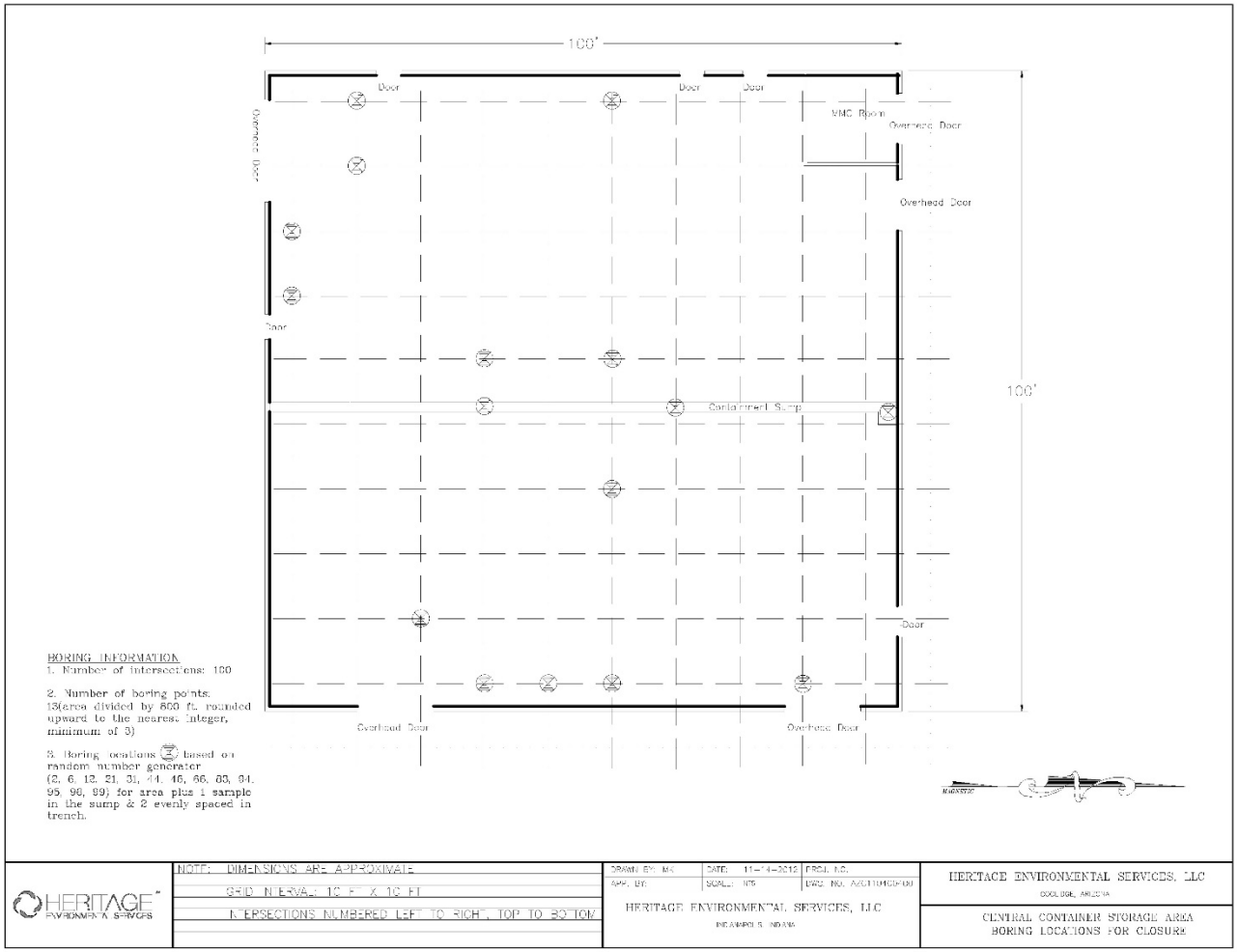

100'
Door
Door
Door
VMC Room
Overhead Door
Overhead Door
Door
Door
Containment Sump
100'
Door
Overhead Door
Overhead Door
BORING INFORMATION
1. Number of intersections: 100
2. Number of boring points: 13(area divided by 660 ft. rounded upward to the nearest integer, minimum of 3)
3. Boring locations based on random number generator (2, 6, 12, 21, 31, 41, 46, 66, 83, 84, 95, 96, 99) for area plus 1 sample in the sump & 2 evenly spaced in trench.
NOTE: DIMENSIONS ARE APPROXIMATE
GRID INTERVAL: 10 FT X 10 FT
INTERSECTIONS NUMBERED LEFT TO RIGHT, TOP TO BOTTOM
HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA
HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA
CENTRAL CONTAINER STORAGE AREA
BORING LOCATIONS FOR CLOSURE

FIGURE 1-2

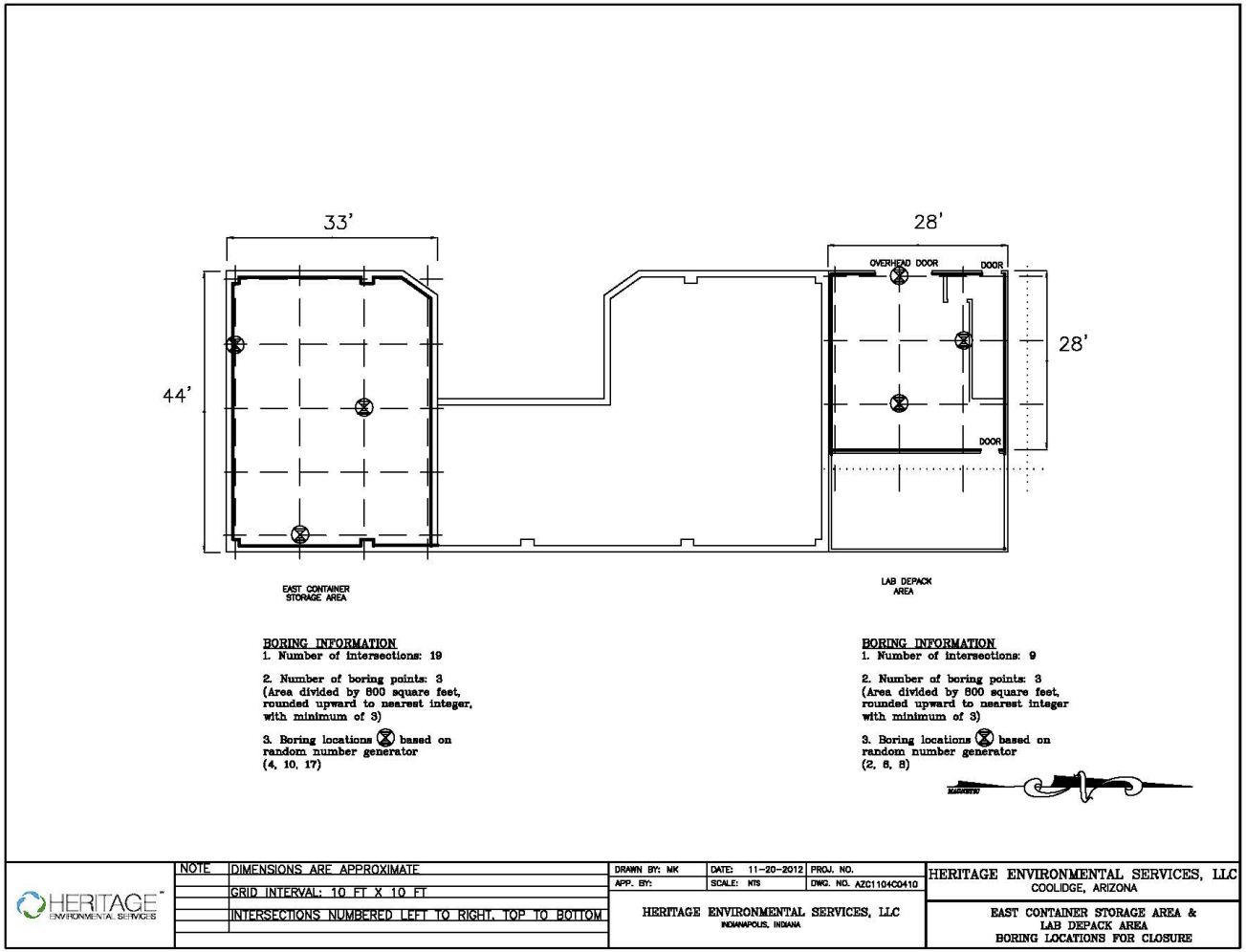

33'
28'
44'
28'
OVERHEAD DOOR
DOOR
DOOR
EAST CONTAINER STORAGE AREA
LAB DEPACK AREA
BORING INFORMATION
1. Number of intersections: 19
2. Number of boring points: 3
(Area divided by 800 square feet, rounded upward to nearest integer, with minimum of 3)
3. Boring locations ⊗ based on random number generator
(4, 10, 17)
BORING INFORMATION
1. Number of intersections: 9
2. Number of boring points: 3
(Area divided by 800 square feet, rounded upward to nearest integer with minimum of 3)
3. Boring locations ⊗ based on random number generator
(2, 6, 8)
HERITAGE ENVIRONMENTAL SERVICES
NOTE
DIMENSIONS ARE APPROXIMATE
GRID INTERVAL: 10 FT X 10 FT
INTERSECTIONS NUMBERED LEFT TO RIGHT, TOP TO BOTTOM
DRAWN BY: MK
DATE: 11-20-2012
PROJ. NO.
APP. BY:
SCALE: NTS
DWG. NO. AZC1104C0410
HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA
HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA
EAST CONTAINER STORAGE AREA &
LAB DEPACK AREA
BORING LOCATIONS FOR CLOSURE

FIGURE 1-3

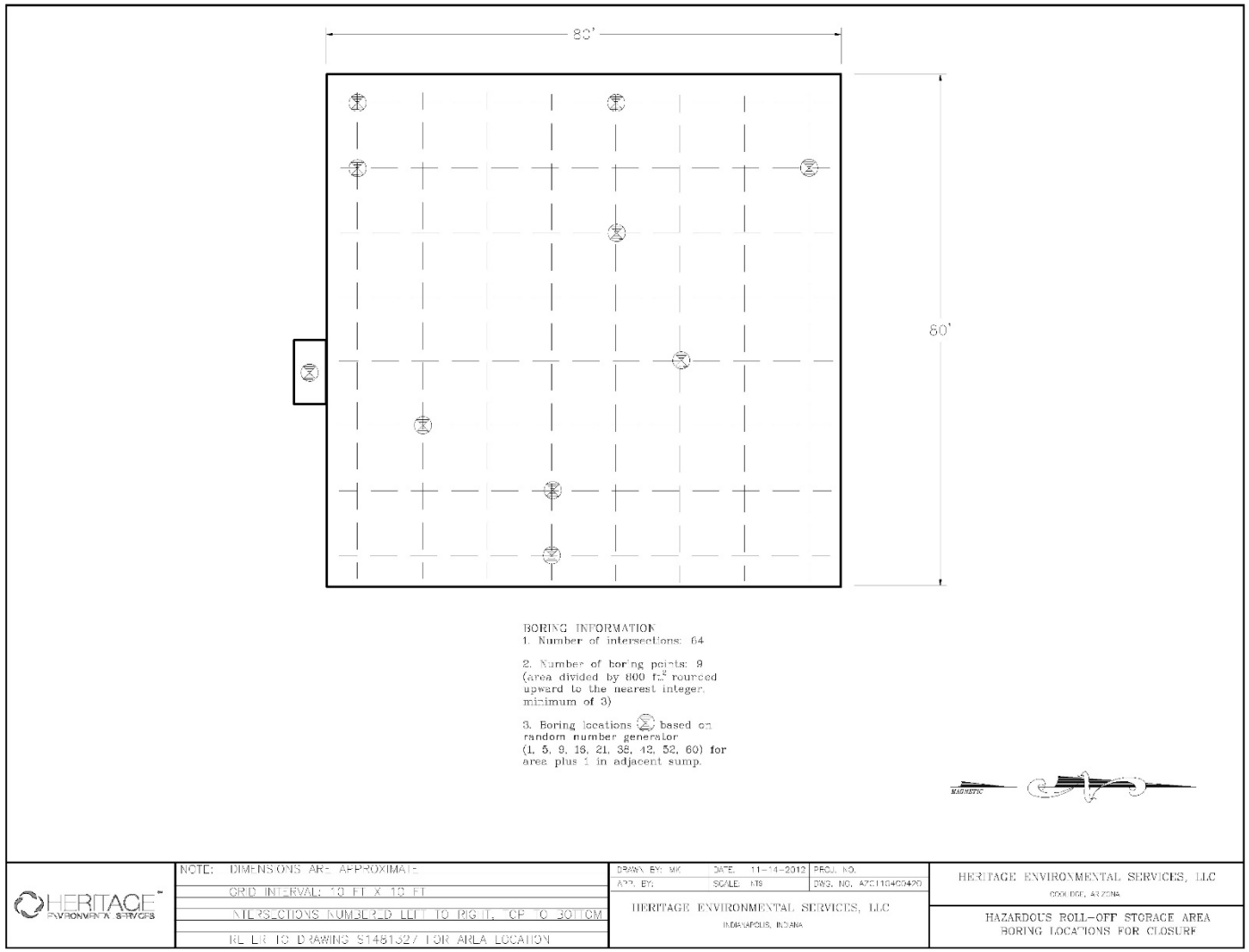

80'
80'
BORING INFORMATION
1. Number of intersections: 64
2. Number of boring points: 9
(area divided by 800 ft.² rounded upward to the nearest integer, minimum of 3)
3. Boring locations (Σ) based on random number generator (1, 5, 9, 16, 21, 38, 42, 52, 60) for area plus 1 in adjacent sump.
MAGNETIC
HERITAGE ENVIRONMENTAL SERVICES
NOTE: DIMENSIONS ARE APPROXIMATE
GRID INTERVAL: 10 FT X 10 FT
INTERSECTIONS NUMBERED LEFT TO RIGHT, TOP TO BOTTOM
REFER TO DRAWING S1481327 FOR AREA LOCATION
DRAWN BY: MK
DATE: 11-14-2012
PROJ. NO.
APP. BY:
SCALE: NTS
DWG. NO. AZC11840D420
HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA
HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA
HAZARDOUS ROLL-OFF STORAGE AREA
BORING LOCATIONS FOR CLOSURE

FIGURE 1-4

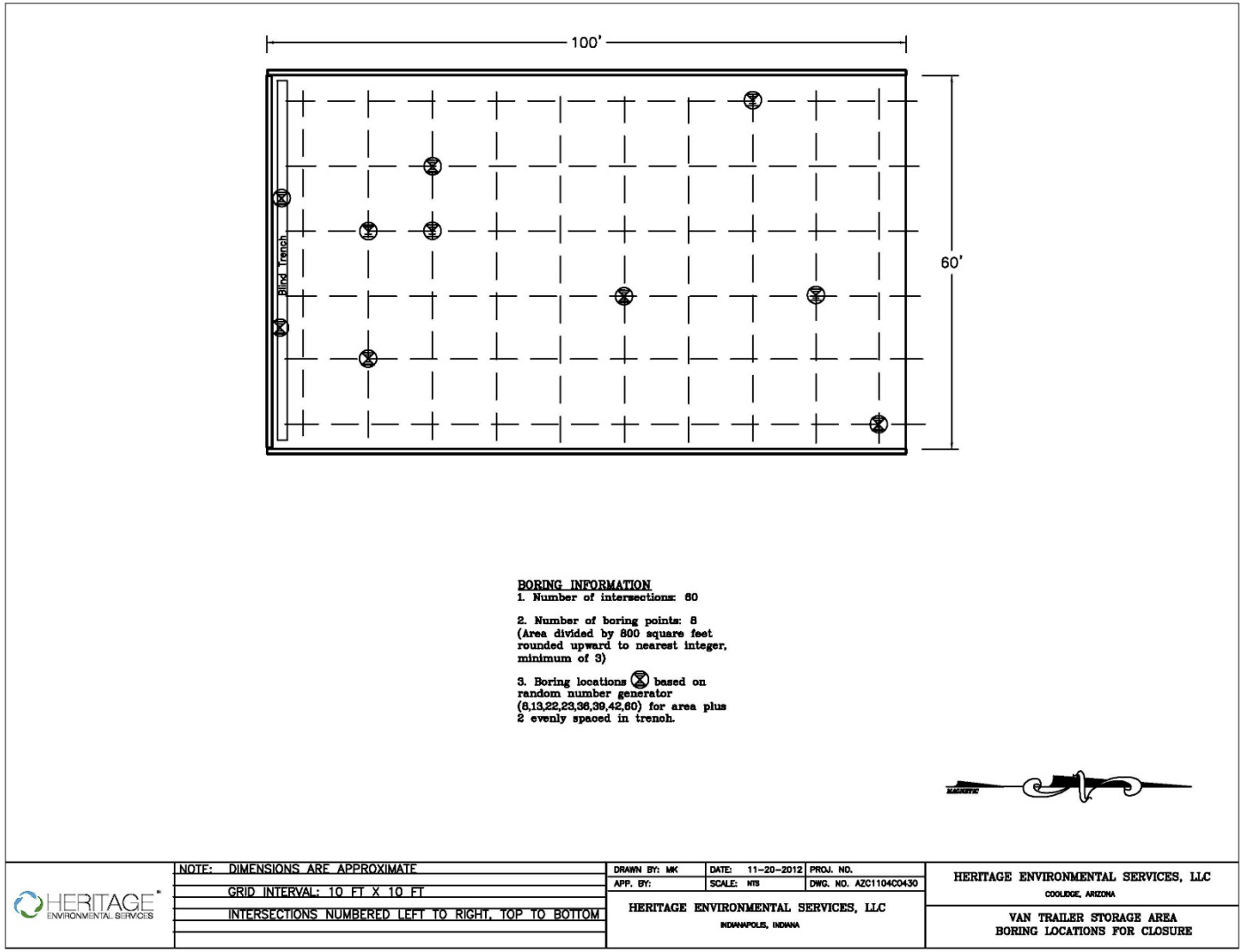

100'
60'
Blind Trench
BORING INFORMATION
1. Number of intersections: 60
2. Number of boring points: 8
(Area divided by 800 square feet
rounded upward to nearest integer,
minimum of 3)
3. Boring locations based on
random number generator
(8,13,22,23,36,39,42,60) for area plus
2 evenly spaced in trench.
HERITAGE ENVIRONMENTAL SERVICES
NOTE: DIMENSIONS ARE APPROXIMATE
GRID INTERVAL: 10 FT X 10 FT
INTERSECTIONS NUMBERED LEFT TO RIGHT, TOP TO BOTTOM
DRAWN BY: MK
DATE: 11-20-2012
PROJ. NO.
APP. BY:
SCALE: NTS
DWG. NO. AZC1104C0430
HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA
HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA
VAN TRAILER STORAGE AREA
BORING LOCATIONS FOR CLOSURE

FIGURE 1-5

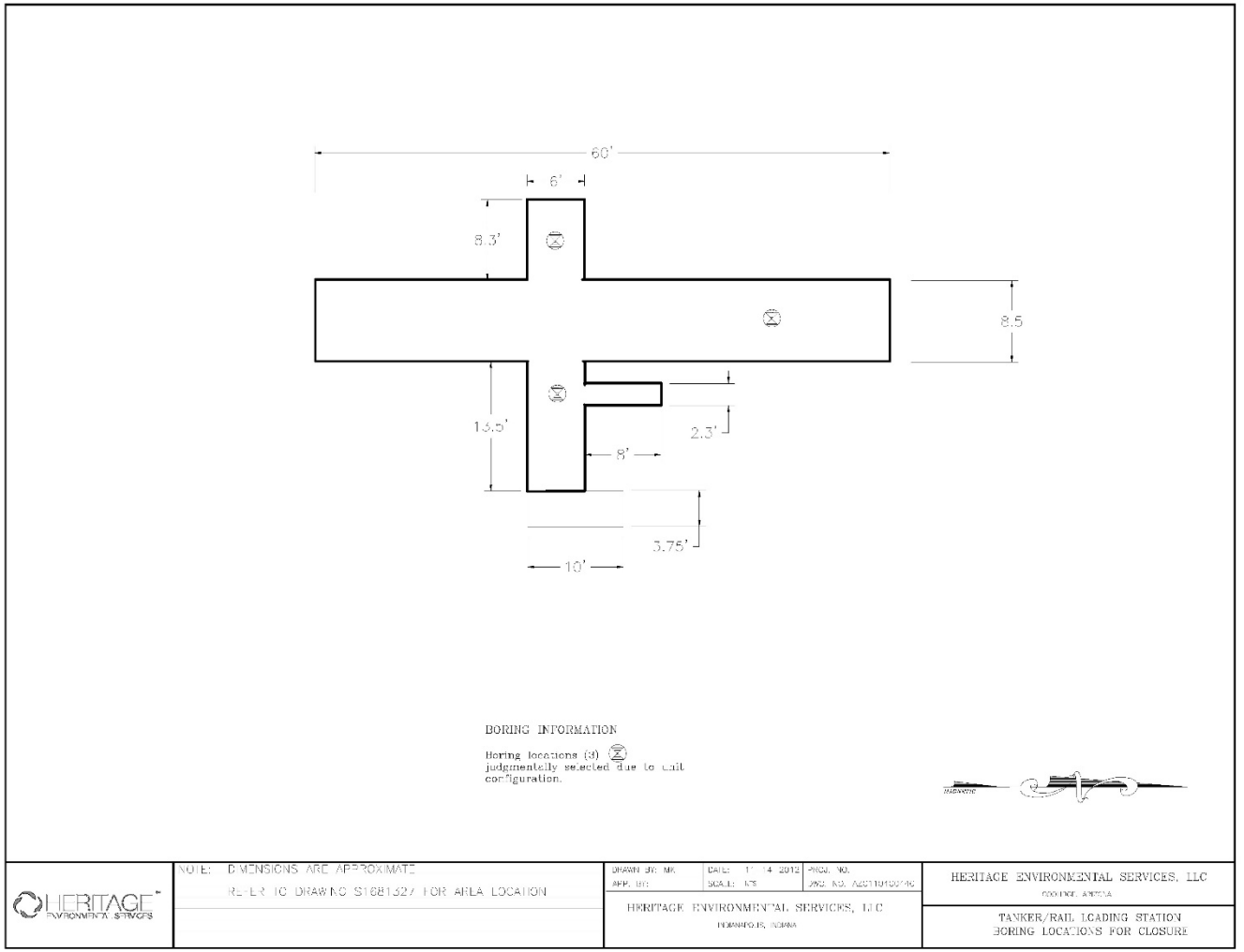
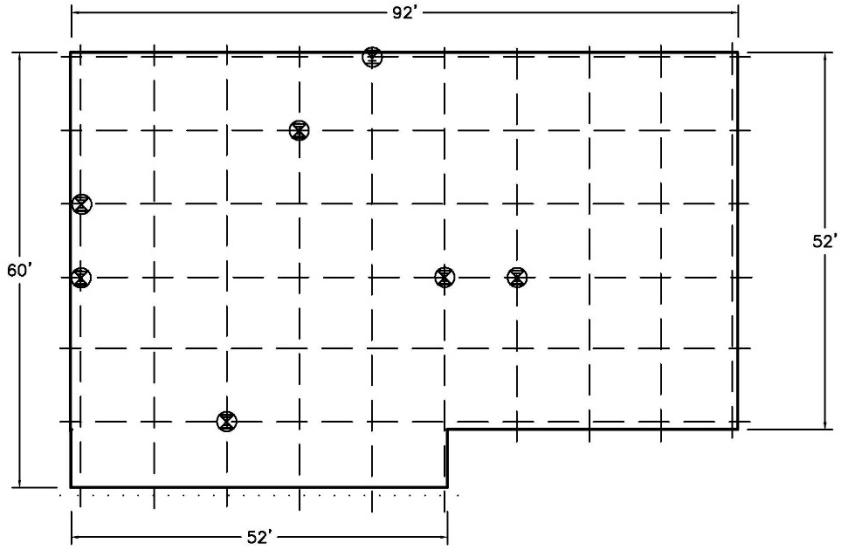

60'
6'
8.3'
8.5
15.5'
2.3'
8'
3.75'
10'
BORING INFORMATION
Boring locations (3) judgmentally selected due to tank configuration.
NOTE: DIMENSIONS ARE APPROXIMATE
REFER TO DRAWING S1081527 FOR AREA LOCATION
DRAWN BY: MK
APP. BY:
DATE: 11-14-2012
SCALE: NTS
PROJ. NO.
DWG. NO. AZDT1081705
HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA
HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA
TANKER/RAIL LOADING STATION
BORING LOCATIONS FOR CLOSURE

FIGURE 1-6



BORING INFORMATION
1. Number of intersections: 60

2. Number of boring points: 7
(Area divided by 800 square feet, rounded upward to nearest integer, minimum of 3)

3. Boring locations ⊗ based on random number generator
(5,14,21,31,36,37,53)

HERITAGE ENVIRONMENTAL SERVICES

NOTE: DIMENSIONS ARE APPROXIMATE
GRID INTERVAL: 10 FT X 10 FT
INTERSECTIONS NUMBERED LEFT TO RIGHT, TOP TO BOTTOM

DRAWN BY: MK	DATE: 11-20-2012	PROJ. NO.
APP. BY:	SCALE: NTS	DWG. NO. AZC1104C0450

HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA

HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA

VAN TRAILER STORAGE AREA
LOADING/UNLOADING STATION
BORING LOCATIONS FOR CLOSURE

FIGURE 1-7

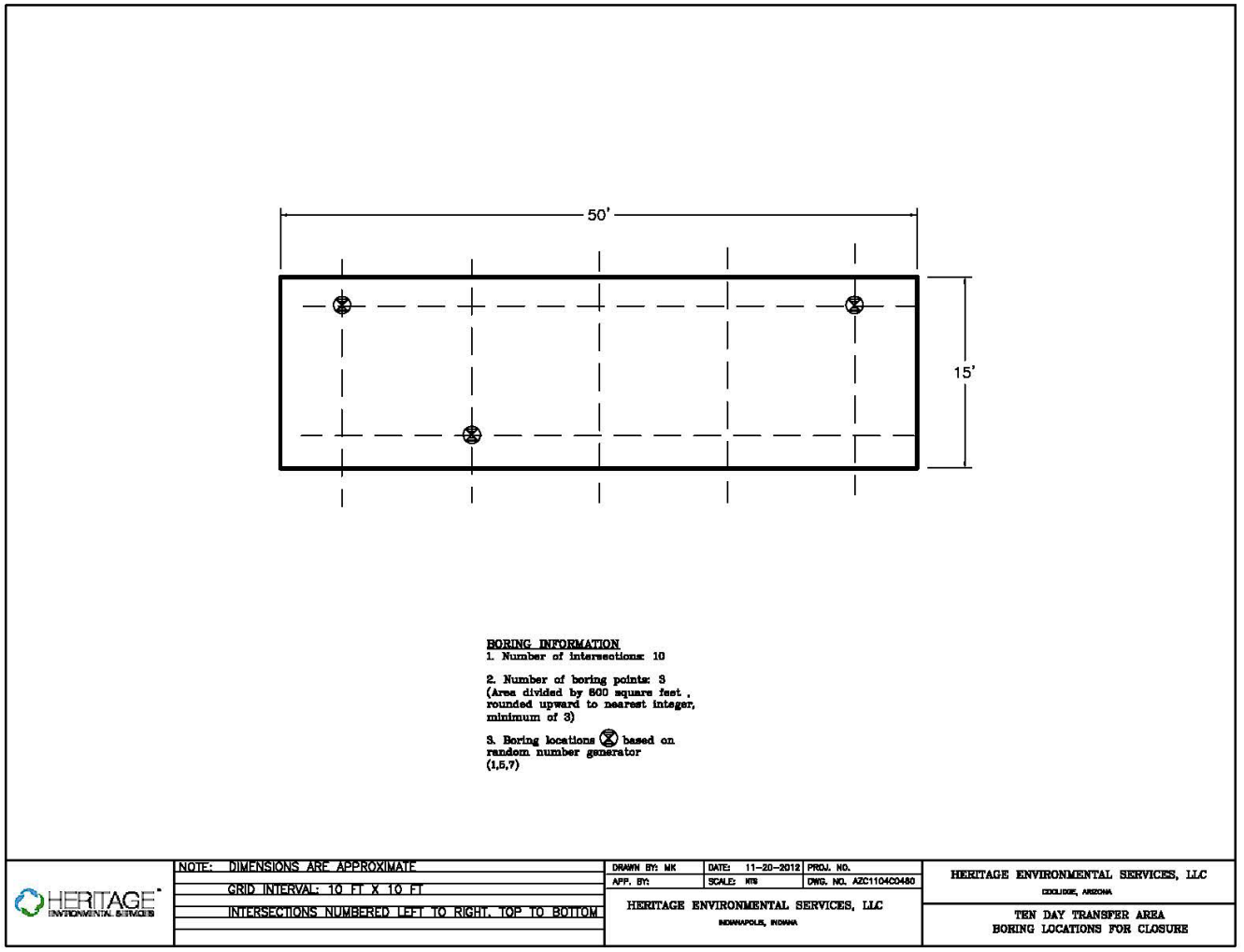
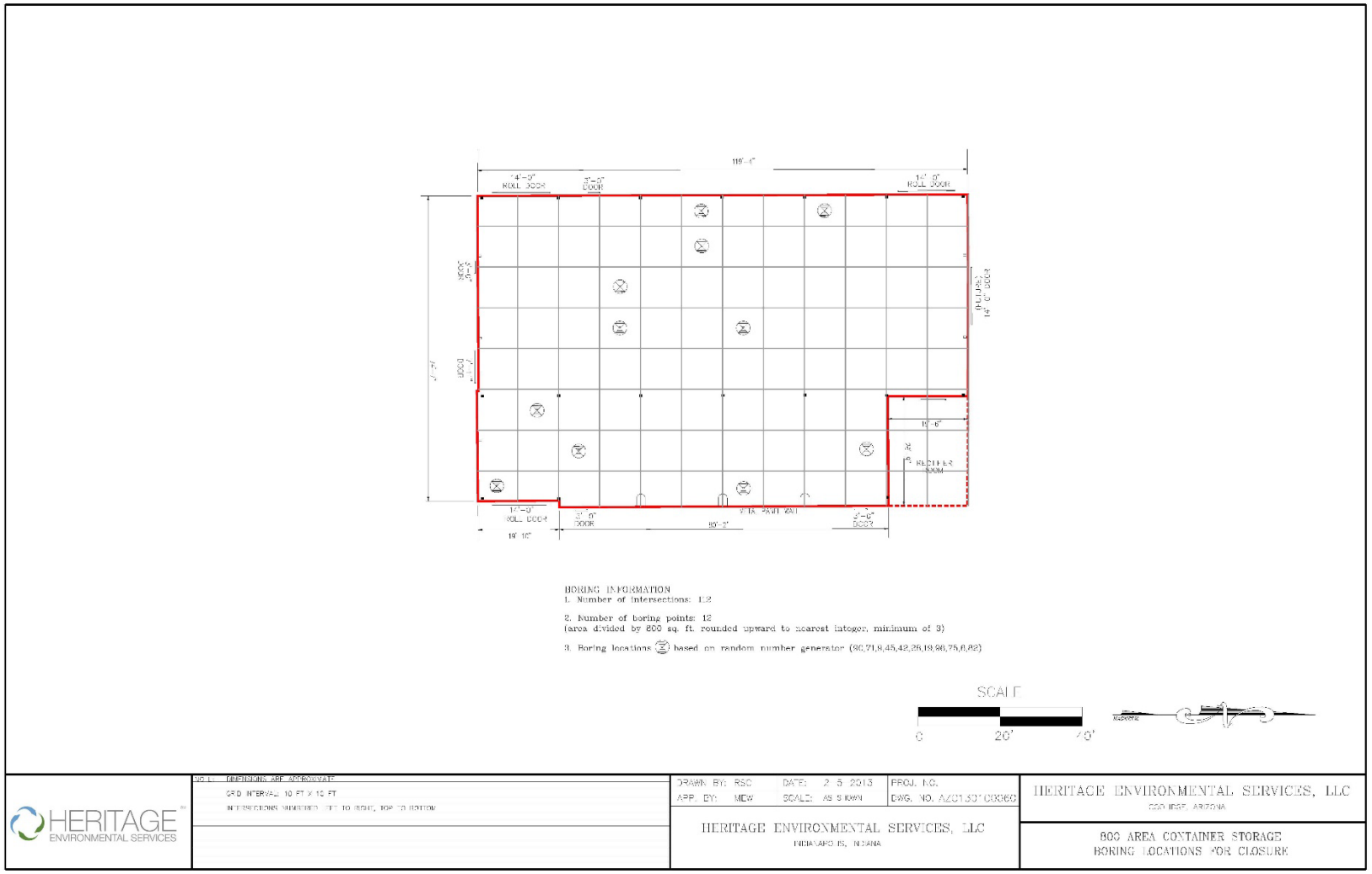

50'
15'
BORING INFORMATION
1. Number of intersections: 10
2. Number of boring points: 3
(Area divided by 500 square feet , rounded upward to nearest integer, minimum of 3)
3. Boring locations ⊗ based on random number generator
(1,5,7)
NOTE: DIMENSIONS ARE APPROXIMATE
GRID INTERVAL: 10 FT X 10 FT
INTERSECTIONS NUMBERED LEFT TO RIGHT, TOP TO BOTTOM
DRAWN BY: MK
DATE: 11-20-2012
PROJ. NO.
APP. BY:
SCALE: NTS
DWG. NO. AZC1104C0480
HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA
HERITAGE ENVIRONMENTAL SERVICES, LLC
COOLIDGE, ARIZONA
TEN DAY TRANSFER AREA
BORING LOCATIONS FOR CLOSURE

FIGURE 1-8


119'-4"
14'-0" ROLL DOOR
3'-0" DOOR
14'-0" ROLL DOOR
RETAINER 14'-0" DOOR
15'-6"
RECTIFIER ROOM
14'-0" ROLL DOOR
3'-0" DOOR
80'-2"
3'-0" DOOR
19'-10"
PIT & PART WALL
BORING INFORMATION
1. Number of intersections: 132
2. Number of boring points: 12
(area divided by 800 sq. ft. rounded upward to nearest integer, minimum of 3)
3. Boring locations based on random number generator (90,71,8,45,42,26,19,86,75,6,92)
SCALE
0
20'
40'
NORTH
SCALE: DIMENSIONS ARE APPROXIMATE
GRID INTERVAL: 10 FT X 10 FT
INTERSECTIONS NUMBERED LEFT TO RIGHT, TOP TO BOTTOM
DRAWN BY: RSC
DATE: 2 5 2013
PROJ. NO.
APP. BY: MEW
SCALE: AS SHOWN
DWG. NO. AZC1.30 C0060
HERITAGE ENVIRONMENTAL SERVICES, LLC
INDIANAPOLIS, INDIANA
HERITAGE ENVIRONMENTAL SERVICES, LLC
GOODYEAR, ARIZONA
800 AREA CONTAINER STORAGE
BORING LOCATIONS FOR CLOSURE
HERITAGE
ENVIRONMENTAL SERVICES

2. PROJECT ORGANIZATION AND RESPONSIBILITY

The following sections describe the responsibilities of each participant involved in the implementation of the Closure Plan. The various quality assurance, field, laboratory, and management responsibilities of key project personnel are described in the following sections. Heritage may perform some or all of the field activities during closure. Alternatively, Heritage may retain a qualified contractor(s) to perform some or all of the field activities during closure. An ADHS-licensed laboratory will perform laboratory testing of samples collected during closure.

2.1. Organization Chart

The organizational structure for implementing closure is shown on Figure 2-1.

2.2. Management Responsibilities

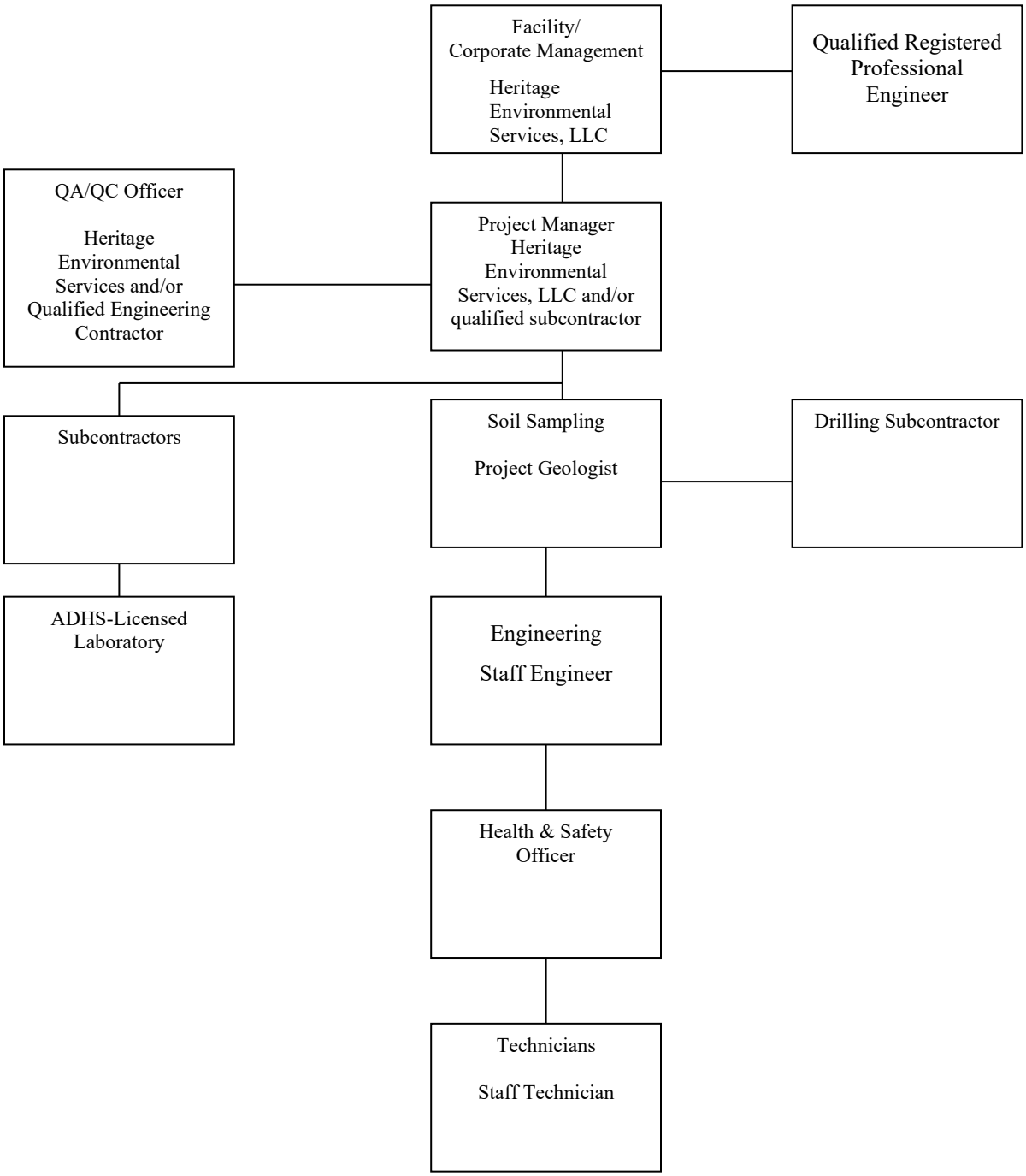
Heritage Environmental Services - Heritage technical representatives and management will be responsible for compliance with the requirements established in the approved Closure Plan. Heritage management responsibilities will include:

- acquiring and applying technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- ensuring activities are performed in accordance with the Closure Plan requirements;
- providing review and approval of reports and plans to ensure that appropriate technical information is accurate and complete; and
- ensuring closure certification is submitted to the appropriate regulatory agency(ies).

Qualified Registered Professional Engineer - The qualified registered Professional Engineer will be responsible for observing key closure activities. The qualified registered Professional Engineer will review final work products to ensure that work quality complies with the specifications of the Closure Plan. The qualified registered Professional Engineer will ensure that the quality of data is acceptable, complete, and meets Closure Plan criteria, and that closure was performed in accordance with the procedures of the Closure Plan. Finally, the qualified registered Professional Engineer will be responsible for providing certification of closure.

Project Manager - The Project Manager will be responsible for coordination of all work performed during closure. The Project Manager will be responsible for reviewing all documentation and reports. With guidance and assistance from technical personnel, the Project Manager will ensure that the quality of the data is acceptable, complete, and meets Closure Plan objectives. The Project Manager will independently review select data generated to ensure that the work quality complies with the requirements specified in this QAPP, correct non-conformance with specified procedures, and provide technical supervision to personnel assigned to the project. The Project Manager will have the authority to direct field personnel, perform QAPP corrective action associated with the project, assign personnel to perform project activities, and control performance of the project.

Figure 2-1
Organizational Chart
Heritage Environmental Services, LLC



Quality Assurance Responsibilities

QA/QC Officer - The QA/QC officer will be responsible for ensuring that implementation of the project is performed in accordance with specified procedures. The QA/QC officer will review technical reports and will ensure that reports meet or exceed the specified quality requirements established in the Closure Plan and QAPP. In addition, the QA/QC officer or designee will be responsible for data validation of all sample results from the analytical laboratory.

2.3. Laboratory Responsibilities

The ADHS-licensed laboratory will be responsible for providing sampling kits, preparing samples for testing, performing analysis of samples, ensuring that data generated is accurate, and that the data conforms to the requirements of this QAPP or internal quality assurance/quality control and standard operating procedures (SOPs). (Note: Data validation by the project manager, or designee, will also be performed. See Section 9 of this QAPP). Analytical work will be conducted by ADHS-licensed laboratories in accordance with their established quality assurance/quality control protocols and standard operation procedures for the analytical methods specified in this QAPP.

The laboratory's Quality Assurance Manager, along with all laboratory personnel, will be responsible for the quality of data generated internally, the quality of data presented on external reports, ensuring that internal procedures are followed, and performing corrective action after identification of non-conformance. Laboratory Management will be responsible for internal audit functions. The laboratory Quality Assurance Manager or designee will be responsible for performing internal performance and system audits at the laboratory.

2.4. Field Responsibilities

During closure, Heritage technical personnel and/or subcontractors will collect and evaluate technical data. Following is a description of key personnel that will perform work at the facility.

Project Geologist - The Project Geologist or designee will be responsible for soil sampling activities and ensuring that all field work and report development associated with such activities conforms to requirements of this QAPP and the Closure Plan. The Project Geologist will be responsible to the Project Manager and will assist the Project Manager with day to day implementation of soil sampling, assessment of data, preparation of technical reports, overseeing subcontractor efforts, and identification of non-conformance with the specified requirements and correction of non-conformance with specified requirements.

Health and Safety Officer - All project personnel will be responsible for their safety and the safety of others. The Health and Safety Officer will provide technical expertise and guidance to the Project Manager with respect to safety and health issues. The Health and Safety Officer will be responsible for ensuring that implementation of the Closure Plan is performed in a safe manner.

Drilling Subcontractor - As field conditions warrant, a drilling subcontractor(s) may be used to install soil borings and obtain concrete cores at the facility. The drilling subcontractor(s) will perform work under the direction of the Project Geologist or designee. The drilling subcontractor(s) will be responsible for installation of concrete

and soil borings, obtaining samples using downhole collection devices, decontaminating drilling and sampling devices, properly sealing boreholes, maintaining drilling equipment, and performing any reporting function required for Licensed Drillers in the State of Arizona.

3. QUALITY ASSURANCE OBJECTIVES

The overall Quality Assurance (QA) objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory testing, and reporting that will provide quality data to evaluate compliance with the closure performance standard as specified in the Closure Plan. A secondary QA objective is to achieve Quality Control (QC) acceptance criteria for precision and accuracy (see Sections 3.1 and 3.2 for further discussion). Completeness, representativeness, and comparability are also important aspects of QA (see Sections 3.3 through 3.5 for further discussion). Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

3.1. Precision

3.1.1. Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

3.1.2. Field Precision Objectives

Field precision will be assessed through the collection and measurement of field duplicate samples. Field duplicates will be collected at a frequency of one duplicate for each 20 samples or less. At least one field duplicate for each matrix type will be collected.

3.1.3. Laboratory Precision Objectives

Precision in the laboratory will be assessed through the calculation of relative percent differences and relative standard deviations for three or more replicate samples. The ADHS-licensed laboratory's QAP describes the laboratory precision objectives and procedures.

3.2. Accuracy

3.2.1. Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

3.2.2. Field Accuracy Objectives

Accuracy in the field will be assessed through the use of field and trip blanks and adherence to sample collection, preservation requirements, and holding times. One field blank per day and one trip blank per day will be collected when samples are collected for organics analysis. In addition, field samples will be submitted as matrix spike/matrix spike duplicates to be spiked by the laboratory to evaluate the accuracy of data based on actual field matrices.

3.2.3. Laboratory Accuracy Objectives

Accuracy in the laboratory will be assessed through the analysis of matrix spikes or standard reference materials and the determination of percent recoveries. The equations to be used by the laboratory for calculation of accuracy are part of the ADHS-licensed laboratory's QAP. Accuracy control limits are maintained as part of the ADHS-licensed laboratory's QAP for the methods being performed.

3.3. Completeness

3.3.1. Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2. Field Completeness Objectives

Field completeness is a measure of the amount of valid field measurements obtained from measurements collected during the project. The equation for completeness is presented in Section 12.3 of this QAPP. Field completeness for this project is anticipated to be between ninety and one hundred percent.

3.3.3. Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements collected during a project. Further discussion of specific measurements and the equation used to measure completeness are provided in Section 12.3 of this QAPP.

3.4. Representativeness

3.4.1. Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, process conditions, or an environmental condition.

3.4.2. Measures to Ensure Representative Field Data

Representativeness is dependent on the proper design of the sampling program. Adherence to the sampling techniques and following specified sampling plans will ensure that representative data is collected. The sampling network was designed to provide data representative of facility conditions during closure. During development of this network, careful consideration was given to evaluating whether or not representative data would be collected.

Soil sample locations will be selected using a simple random sampling scheme. This method was chosen as the most efficient and practical manner to accurately determine whether constituents are present in soil at regulatory levels of concern. Simple random sampling is the method recommended in EPA Publication No. SW-846 ("Test Methods for Evaluating Solid Waste, Physical/Chemical Methods") for sampling heterogeneous non-stratified materials. Analysis of soil samples from randomly chosen locations in the areas undergoing closure for the appropriate parameters will indicate whether constituents remain in the soil at levels of regulatory concern.

3.4.3. Measures to Ensure Representative Laboratory Data

Representativeness in the laboratory will be ensured by following proper analytical procedures, evaluating matrix duplicates, and meeting holding times.

3.5. Comparability

3.5.1. Definition

Comparability is an expression of the confidence with which one data set can be compared with another.

3.5.2. Measures to Ensure Comparability of Field Data

Comparability is dependent on the proper design of the sampling program and will be satisfied by ensuring the sampling procedures are followed. Comparability will also be dependent on the sample matrices and the assessment of sample matrices when comparing field measurements. Section 4 of this QAPP provides a detailed discussion of sampling procedures.

3.5.3. Measures to Ensure Comparability of Laboratory Data

Analytical data will be compared when similar sampling and analytical procedures are followed and documented. Comparability will be dependent on the sample matrices and the assessment of sample matrices when comparing field measurements.

3.6. Level of Quality Control Effort

During implementation of the Closure Plan, trip blanks, field blanks, method blanks, matrix duplicates, standard reference materials, and matrix spikes will be used to assess the quality of data generated from sampling and analysis.

Field/Trip Blanks - Field blanks and trip blanks will be submitted for analysis of organic constituents by sampling personnel to evaluate potential external contamination resulting from sampling procedures, sample handling, and/or sample testing. Because all sample collection at the facility will be performed in a similar manner using prescribed procedures to minimize the potential for cross contamination (see Section 4 of this QAPP), field blanks and trip blanks will be collected at a frequency of one field blank and one trip blank per day when samples are being collected for organic constituents. Depending on the equipment being used during the sampling and analysis program, equipment rinse blanks will also be collected as field blanks.

Method Blanks - Method blanks will be used within the laboratory to assess laboratory contamination resulting from laboratory procedures and practices. The frequency of analysis for method blanks is specified in the ADHS-licensed Laboratory's QAP.

Matrix Spike/Matrix Spike Duplicates - During closure, Heritage will be collecting matrix spikes and matrix spike duplicates for testing at the laboratory. Site-specific matrix spikes and matrix spike duplicates will be utilized to evaluate method performance with matrices submitted and to evaluate precision of the testing. Matrix spike and matrix spike duplicates will be collected at a frequency of one set per twenty or fewer samples for each type of sample matrix.

Field Duplicates - Field duplicates will be collected and tested to evaluate sample reproducibility or precision for each type of sample matrix. Field duplicates will be collected at a frequency of one duplicate for each twenty or fewer samples for each type of sample matrix. Field duplicates will also be utilized to evaluate the potential for external contamination resulting from sample handling or testing.

Field QC samples will be collected in a manner similar to the actual field samples collected for each matrix. In addition to field QC samples, QA objectives will be met by utilizing experienced, trained personnel for supervising sampling and following prescribed sampling procedures. Sampling procedures are described in Section 4.

4. SAMPLING PROCEDURES

Detailed procedures for collection of samples during closure are provided in the following sections.

4.1. Field Sampling by Matrix

4.1.1. Sample Location and Identification

The following nomenclature will be used to properly label samples submitted for testing. The sample nomenclature will be used for all sample labels, sample submission sheets, and chain-of-custody records to maintain consistency in the labeling procedures and allow efficient handling of a potentially large number of samples. In addition to a standardized sample designation format, date and time of collection and the company name will be included on labels, sample submission sheets, chain-of-custody records, and laboratory analysis reports.

Following is a description of the nomenclature to be used for the samples collected during closure.

Concrete Samples

The following nomenclature will be used to label concrete samples:

C-HAZARDOUS WASTE MANAGEMENT UNIT - CONSECUTIVE BORING NUMBER

- The "C" indicates that the sample is a concrete sample.
- The hazardous waste management unit identifies the area from which the sample was collected.
- The sample location is the designated location of each boring or sample location at each hazardous waste management unit.

For example:

A concrete sample collected at the Central Storage Area at sample location 3 would be labeled:

C-Central Storage Area-03

Soil Samples

Soil samples will be labeled as follows:

SS - HAZARDOUS WASTE MANAGEMENT UNIT - SAMPLE LOCATION - DEPTH OF SAMPLE OR INTERVAL

- The "SS" indicates that the sample is a soil sample.
- The hazardous waste management unit identifies the area from which the sample was collected.
- The sample location is the designated location of each boring or sample location at each hazardous waste management unit.

For example:

A soil sample collected from 0 to 1 foot below grade at the Central Storage Area at sample location 3 would be labeled:

SS-Central Storage Area-03-0-1

Field Quality Assurance/Quality Control Samples

QA/QC samples for soil and concrete samples will be labeled in the same format as shown in the previous two sections along with a modifier to designate the type of QA/QC sample and/or analysis to be performed.

Following is a list of modifiers to be added to the sample description for samples collected as spikes or duplicates in the field:

Matrix Spikes - (MS)
Matrix Spike Duplicates - (MSD)
Field Matrix Duplicates - (D)

Blanks

Blanks will be collected during closure as part of the field QA/QC program. Blanks will be labeled in consecutive order as they are submitted to the analytical laboratory. Blanks will have a modifier designating them as blanks. Trip blanks will be modified with "(TB)" and field blanks will be designated with "(FB)." For example:

The fifth soil field blank submitted to the laboratory would be labeled as "SS-5 (FB)." Blanks will be cross-referenced to specific samples by comparing dates of submission with the samples submitted.

4.1.2. Concrete and Soil Sampling Procedures for Chemical Analysis

The following is a description of the concrete and soil sampling procedures that will be followed during closure. Samples will be collected using decontaminated equipment best suited for the type of samples being collected. Equipment expected to be used to collect concrete and soil samples is described in Section 7 of the Closure Plan. Selection of sample locations is described in Section 7.1 of the Closure Plan. Sample frequency, sample depth, and sample collection methods are described in Sections 7 of the Closure Plan.

When a sample has been collected, it will be brought to the surface and removed from the sampler. Soil and concrete samples being tested for volatile organic compounds will be immediately containerized following the requirements of USEPA SW-846 5035. The remaining portion of the sample will be placed into a mixing bowl. During initial screening analysis, a portion of each sample will be placed in a sample screening container and the headspace will be scanned with an organic vapor analyzer (e.g., PID or FID; see Section 7.1). Samples will be carefully placed into the appropriate sample containers provided by the testing laboratory. Sampling personnel will wear disposable gloves or use a stainless steel or disposable plastic sample scoop to transfer samples to sample containers. Disposable gloves and/or scoops will be replaced prior to collecting each sample.

Soil or concrete selected for volatile organic compound analysis will be placed into containers following the procedure of USEPA SW-846 5035 prior to placing other

portions of the sample into the appropriate containers. After completing the volatile organic compound portion of the sample collection process, the remaining portion of sample in the bowl will be mixed to the extent possible. After mixing, the sample will be placed in the sample containers. All samples will be collected and transferred to the appropriate containers in a manner so as to minimize exposure to the environment.

Sample recording and chain-of-custody procedures are detailed in Sections 4.4 and 5. Soil samples will be described in the field by a Project Geologist or his designee using the Modified United States Department of Agriculture Soil Classification System (see Figure 4-1). A log of each soil boring (similar to Figure 4-2) will be generated in the field. Because of the shallow depth of the soil borings, the boring may be left open until closure activities have been completed or filled with cement/concrete mixture.

Figure 4-1

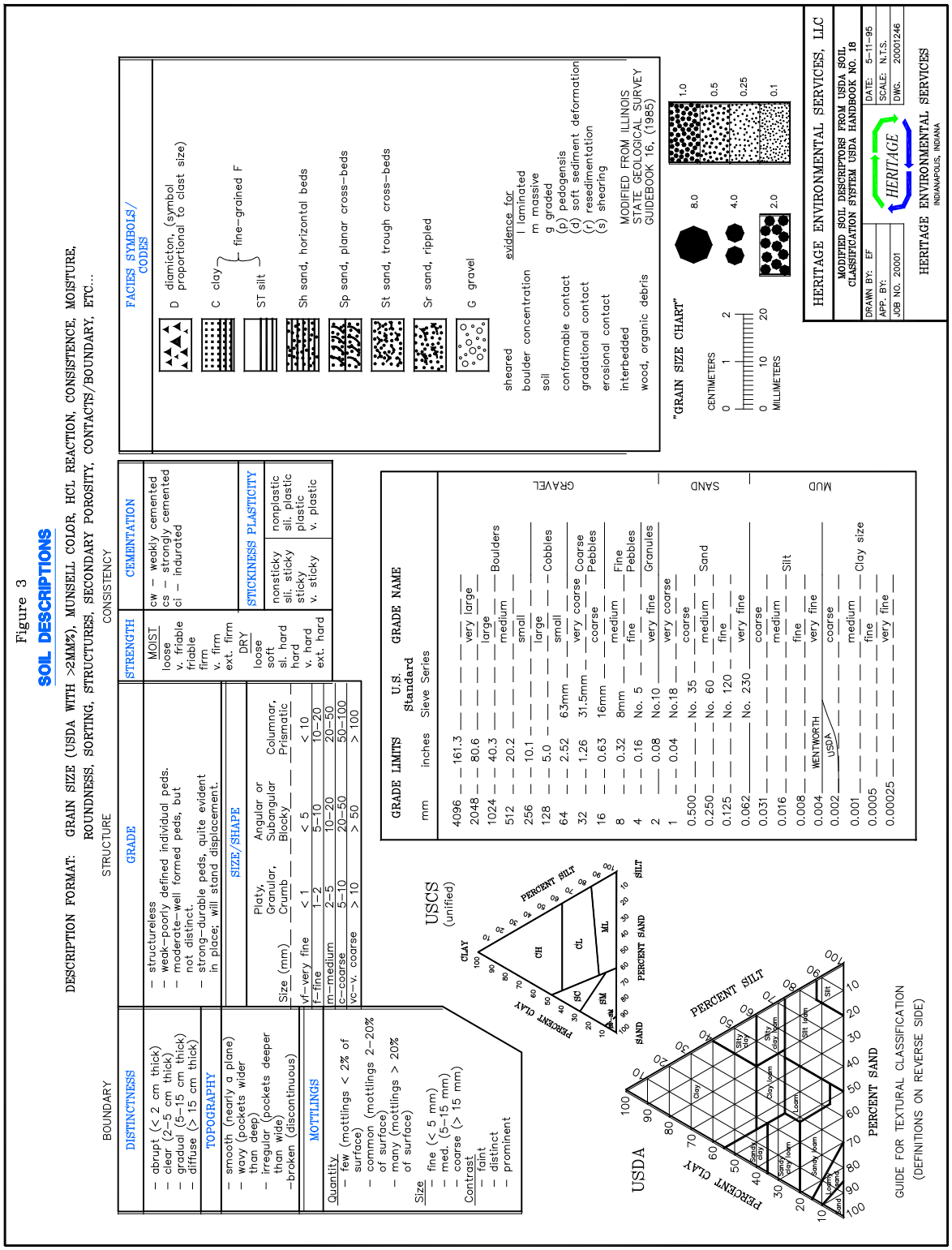


Figure 3
SOIL DESCRIPTIONS
DESCRIPTION FORMAT: GRAIN SIZE (USDA WITH >2MM%), MUNSELL COLOR, HCL REACTION, CONSISTENCE, MOISTURE, ROUNDNESS, SORTING, STRUCTURES, SECONDARY POROSITY, CONTACTS/BOUNDARY, ETC...
BOUNDARY
DISTINCTNESS
– abrupt (< 2 cm thick)
– clear (2–5 cm thick)
– gradual (5–15 cm thick)
– diffuse (> 15 cm thick)
TOPOGRAPHY
– smooth (nearly a plane)
– wavy (pockets wider than deep)
– irregular (pockets deeper than wide)
–broken (discontinuous)
MOTTLINGS
Quantity
– few (mottlings < 2% of surface)
– common (mottlings 2–20% of surface)
– many (mottlings > 20% of surface)
Size
– fine (< 5 mm)
– med. (5–15 mm)
– coarse (> 15 mm)
Contrast
– faint
– distinct
– prominent
STRUCTURE
GRADE
– structureless
– weak–poorly defined individual peds.
– moderate–well formed peds, but not distinct.
– strong–durable peds, quite evident in place; will stand displacement.
SIZE/SHAPE
Size (mm) | Platy, Granular, Crumb | Angular or Subangular Blocky | Columnar, Prismatic
vf–very fine < 1 < 5 < 10
f–fine 1–2 5–10 10–20
m–medium 2–5 10–20 20–50
c–coarse 5–10 20–50 50–100
vc–v. coarse > 10 > 50 > 100
CONSISTENCY
STRENGTH
MOIST
loose
v. friable
friable
firm
v. firm
ext. firm
DRY
loose
soft
sl. hard
hard
v. hard
ext. hard
STICKINESS PLASTICITY
nonsticky | nonplastic
sli. sticky | sli. plastic
sticky | plastic
v. sticky | v. plastic
CEMENTATION
cw – weakly cemented
cs – strongly cemented
ci – indurated
USCS (unified)
USDA
PERCENT CLAY
PERCENT SILT
PERCENT SAND
GUIDE FOR TEXTURAL CLASSIFICATION
(DEFINITIONS ON REVERSE SIDE)
GRADE LIMITS
mm
inches
U.S. Standard Sieve Series
GRADE NAME
GRAVEL
SAND
MUD
4096 161.3 very large Boulders
2048 80.6 large
1024 40.3 medium
512 20.2 small
256 10.1 large Cobbles
128 5.0 small
64 2.52 63mm very coarse Coarse Pebbles
32 1.26 31.5mm coarse
16 0.63 16mm medium Fine Pebbles
8 0.32 8mm fine
4 0.16 No. 5 very fine Granules
2 0.08 No.10 very coarse
1 0.04 No.18 coarse
0.500 No. 35 medium Sand
0.250 No. 60 fine
0.125 No. 120 very fine
0.062 No. 230 coarse
0.031 medium
0.016 fine Silt
0.008 WENTWORTH very fine
0.004 USDA coarse
0.002 medium Clay size
0.001 fine
0.0005 very fine
0.00025
FACIES SYMBOLS/ CODES
D diamicton, (symbol proportional to clast size)
C clay
fine–grained F
ST silt
Sh sand, horizontal beds
Sp sand, planar cross–beds
St sand, trough cross–beds
Sr sand, rippled
G gravel
sheared
boulder concentration
soil
conformable contact
gradational contact
erosional contact
interbedded
wood, organic debris
evidence for
l laminated
m massive
g graded
(p) pedogensis
(d) soft sediment deformation
(r) resedimentation
(s) shearing
MODIFIED FROM ILLINOIS STATE GEOLOGICAL SURVEY GUIDEBOOK 16, (1985)
"GRAIN SIZE CHART"
CENTIMETERS
MILLIMETERS
8.0
4.0
2.0
1.0
0.5
0.25
0.1
HERITAGE ENVIRONMENTAL SERVICES, LLC
MODIFIED SOIL DESCRIPTORS FROM USDA SOIL CLASSIFICATION SYSTEM USDA HANDBOOK NO. 18
DRAWN BY: EF
APP. BY:
JOB NO. 20001
DATE: 5-11-95
SCALE: N.T.S.
DWG. 20001246
HERITAGE
HERITAGE ENVIRONMENTAL SERVICES
INDIANAPOLIS, INDIANA

Figure 4-2 Example Boring Log

HERITAGE ENVIRONMENTAL SERVICES, LLC
EXAMPLE BORING LOG

Sheet ____ of ____

CLIENT: JOB SITE: Job No.:

DEPTH FEET	DESCRIPTION	BLOW COUNTS	ORGANIC VAPOR READINGS		SAMPLE DEPTH	REC. (%)	FIELD OBSERVATIONS
- 2.0	Example Form				0-4		
- 4.0							
- 6.0					4-8		
- 8.0							
- 10.0					8-12		
- 12.0							
- 14.0					12-16		
- 16.0							
- 18.0					16-20		
- 20.0							

DATE DRILLED:_____
DRILLED BY:
_____
_____
DRILLING METHOD:_____
SAMPLING METHOD:_____
INITIAL WATER:_____

CORE SIZE:_____
WEATHER/SITE CONDITIONS:
TOTAL DEPTH:_____
FINAL WATER:_____

BORING NO.:
_____
SURFACE ELEV:_____
GEOLOGIST:_____
GROUT HOLE:_____
WELL INSTALLED:
_____

ADDITIONAL REMARKS/OBSERVATIONS:
* = Sample submitted for lab analysis

4.2. Field QC Sample Collection/Preparation

Generally, QA/QC samples will be collected in the same manner as any other sample. The QA/QC samples will be managed, handled, and documented as they would for actual samples. For matrix spike, matrix spike duplicates, and field duplicates, samples will be placed in the same types of containers as the samples. Efforts will be made to ensure that matrix spike, matrix spike duplicates, and field duplicates are handled in the same manner as the actual samples. For example, the QA/QC samples will be collected at the same time as the actual samples using the same equipment, each sample will be packaged and handled as an actual sample, and the QA/QC samples will be analyzed along with the actual samples.

Trip blanks, as necessary, will be prepared by the testing laboratory. The testing laboratory will utilize deionized water in 40-milliliter Teflon lined septum vials and an appropriate amount of preservative. The testing laboratory will prepare a sufficient number of trip blanks to be included with all coolers containing samples being tested for volatile organic constituents immediately prior to the containers leaving the laboratory.

For equipment field blanks, the equipment used for sampling will be decontaminated using the prescribed procedures. After fully decontaminating the equipment, deionized water will be poured over the equipment and decanted into the appropriate containers and packaged in the same manner as actual samples. For other types of field blanks, deionized water will be used to prepare field blanks.

4.3. Containers, Preservatives and Volume Requirements

Table 4-1 provides information that includes holding times, sample preservation, and container descriptions.

4.4. Sample Handling and Documentation

This section presents procedures for proper handling and documentation of environmental samples:

- The appropriate amount of chemical preservatives, if any, will be placed in the sample containers prior to sample collection. This is usually performed by the testing laboratory.
- Once samples are collected, caps will be screwed tightly onto containers.
- A sample label will be completed using a water resistant marker. See Section 4.1.1 for labeling requirements. The label will contain the project name, date, and time of collection. An example label is provided as Figure 4-3. Each sample will also be documented using forms similar to Figure 4-4.
- Sample containers will be placed in Zip-Loc bags (or equivalent) to keep them dry and contain their contents in the case of breakage during transport.
- Samples will then be placed in ice chests containing ice. Samples must be packed with sufficient cushioning material to prevent breakage of glass sample containers during transport. The samples will be transported to the laboratory and stored prior to analysis, if necessary, under refrigeration at 4 degrees Centigrade.

Table 4-1
Sample Volume, Containers and Preservation
Techniques Aqueous and Soil/Concrete Samples
Heritage Environmental Services, LLC
Coolidge, Arizona

Parameter Class[1]	Container[2][5]	Preservative	Holding Time[3]	Sample Volume[4]
Semi-Volatile Organic Compounds (Base/Neutral, Acid Extractables) Pesticides/Herbicides	4-1 liter glass jar with Teflon-lined cap (aqueous)	Iced to ≤6□C (aqueous/soil/concrete)	Semi-Volatile Organics: 14 days until extraction 40 days after extraction Pesticides/Herbicides: 7 days until extraction 40 days after extraction	4 liters (aqueous)
	1-1 liter glass jar with Teflon-lined cap (soil/concrete)			1 liter (soil)
Volatile Organic Compounds	2-40 ml VOA vials with Teflon-lined septum (aqueous)	HCl to pH <2; Iced to ≤6□C (aqueous)	14 days	80 ml, no headspace (aqueous)
	SW-846 5035 Container and 2 oz. Glass Container (soil/concrete)	Iced to ≤6 □C (soil/concrete)		SW-846 5035 Container (TerraCor, Encore) and 2 oz. Glass container filled completely (soil/concrete)
Metals	1-1 liter polyethylene (aqueous)	HNO_3 to pH <2; Iced to ≤6 °C (aqueous)	6 Months Mercury is 28 days Hexavalent chromium is 7 Days	1 liter (aqueous)
	1 liter glass Teflon-lined cap (soil/concrete)	Iced to ≤6□C (soil/concrete)		1 liter (soil/concrete)
Cyanide	500 ml polyethylene (aqueous)	NaOH to pH >12; Iced to ≤6 °C	14 days	500 ml
	1 liter glass Teflon-lined cap (soil/concrete)	Iced to ≤6□C (soil/concrete)		1 liter (soil/concrete)

(1) Tables 7-1, 7-2, 7-3 and 7-4 list constituents to be analyzed.
(2) Sample containers utilized for this effort will be provided by the testing laboratory.
(3) The start of holding times will be the date of collection.
(4) For matrix spike/matrix spike duplicates, additional sample volume may be collected.
(5) Other acceptable container types or volumes at the time of closure may be used.

Figure 4-3
Example of Sample Label

Date Sampled	Time Sampled
Company Name	
Sample Description	
Laboratory Use Only	Preservative

Figure 4-4 Example of Sample Submission/Chain of Custody Form

TO ENSURE PROPER HANDLING OF SAMPLES PLEASE COMPLETE THE SHADED AREAS OF THIS FORM

HERITAGE ENVIRONMENTAL SERVICES, LLC.

COMMERCIAL LABORATORY OPERATIONS

7901 West Morris Street Indianapolis IN 46231

www.heritage-enviro.com (800)827-4374 Fax: (317) 486-5095

I -

Bill to Customer:

Project Name:

Z Quote No: (Given to you by your contact)

PO No. or Project/Activity ID:

PRINT HERITAGE TSR NAME:

CUSTOMER STATUS: New / Existing

If no previous credit has been established with Heritage, **prepayment** (check,VISA,etc) is required at the time of sample submittal to the laboratory.

Sampled By:

Analyses Requested (Note special detection limits or methods)

Send Report To:

Co:

Add:

Attn:

Phone: ( ) Yes

Fax: ( )

E-mail:

Sample Turn Around Time

Standard: Rush Date / / Mo Day Yr

(Accelerated TAT subject to Additional Charge)
(Date must be Accepted and Approved by Lab)

Date Sampled	Time sampled	Comp	Grab	Sample ID and/or Location where your sample was taken	Sample Type (Matrix): DW, GW, WW, Soil, Oil, Sludge, Swipe, Other	Number Of Containers										Remarks:	Lab use only Sample No.
	AM PM																
	AM PM																
	AM PM																
	AM PM																
	AM PM																
	AM PM																
	AM PM																
	AM PM																
	AM PM																
	AM PM																

Relinquished by: (Signature)	Date/Time /	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time /	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time /	Received by: (Signature)	
Received for Lab by: (Signature)	Date	Temp.	°C
	Time	ROI:	Yes / No

Distribution: White original and Yellow copies to accompany sample to the laboratory.
Pink copy to be retained by the client.

Laboratory use only	Yes	No
Custody seals present/intact?		
Broken containers?		
COC agree with sample labels?		
Correct containers for testing?		
Headspace issues acceptable?		
Holding time(s) acceptable?		
Preservative pH's acceptable?		
Was pH left unadjusted?		

Comments:

- Samples will be delivered to the testing laboratory via overnight carrier or via ground transportation. Samples not shipped or delivered on the day collected will be stored on ice in a secure area consistent with chain-of-custody requirements (see Section 5).
- The following recordkeeping items will be used to document sample collection and handling:

  Boring Logs (Figure 4-2)
  Sample Labels (Figure 4-3)
  Chain-of-Custody/Sample Submission Sheets (Figure 4-4)
  Analytical Records (sent by the testing laboratory to a designated representative)
  The information typically recorded in the field records for samples collected during closure includes the information shown in Table 4-2.
- Prior to sampling, all personnel will be briefed on sample handling, chain-of-custody, and documentation procedures.

4.5 Decontamination of Equipment

To mitigate the potential for cross-contamination and the introduction of contaminants from external sources, all field sampling equipment will be decontaminated. Decontamination will be performed between each concrete or soil sample location unless dedicated sampling equipment is used.

Sampling equipment will be decontaminated in the following manner:

- Equipment will be washed with potable "tap" water or distilled water and phosphate free soap solution, followed by a thorough rinse with distilled deionized water. Equipment will be decontaminated in tubs, five-gallon buckets, or other suitable containers.
- Equipment will be allowed to air dry unless prohibited by weather conditions. If the sampling equipment requires storage for a long period of time prior to collection of the next sample, the equipment will be wrapped in aluminum foil or stored in a suitable container.
- Gloves or other disposable materials contacting the sample media will be discarded after each sample has been obtained. These items will be replaced prior to collection of a sample to minimize the probability of cross-contamination between samples.

Heavy equipment, such as augers, drilling rods, hand tools, and heavily soiled sampling equipment, will be decontaminated using pressurized hot water between each soil boring.

Wastes generated during the collection of samples (drill cuttings, decontamination fluids, etc.) will be managed in accordance with Section 7.4 of the Closure Plan.

Table 4-2
Information Typically Recorded in Field Records

Location of sampling
Contact person
Address
Location of facility
Type of sample
Parameters to be analyzed
Preservation and treatment
Number and volume of sample containers
Description of sampling method
Date and time of collection
Sampler's name
Sample number
Laboratory(ies)
Field observations (if any)
Field measurements (if any)

5. SAMPLE CUSTODY

The following chain-of-custody procedures are intended to document sample possession from the time of sample collection until disposal and provide sufficient evidence in project files for all testing activities.

A sample is under custody if it is:

- In one's actual possession;
- In view after being in physical possession;
- In one's possession and placed in a secured location; or
- In a secured area, accessible to authorized personnel only.

5.1. Field Custody Procedures

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the testing laboratory with the chain-of-custody intact.

- A label identifying the sample will be affixed to the sample. The labels will be completed with waterproof ink unless prohibited by environmental conditions.
- A chain-of-custody record similar to that shown in Figure 4-4 will be completed in the field. The original will accompany the samples and copies will be retained at intermediate steps.
- Each time responsibility for custody of the samples changes, the new custodian will sign the record and note the date. A copy of the signed record will be made and retained by the previous custodian except for commercial carriers (e.g., Federal Express, UPS, etc.). In this case, airbills or shipping receipts will be utilized for documenting custody of samples provided the chain-of-custody remains sealed inside with the samples. As few people as possible will handle the samples.

Samples collected on Fridays or Saturdays will remain in the possession of samplers following prescribed chain-of-custody procedures until they can be delivered on Monday during normal business hours. Additional procedures for samples with short holding times will be initiated as necessary.

5.2. Sample Packaging Procedures for Overnight Carrier

The following procedures will be implemented in the event that shipment via commercial carrier is required.

- Confirm that each sample is properly labeled and sealed. Note the sample numbers and be sure that samples are in the cooler with their respective chain-of-custody.
- Place each sample in a plastic Zip-Loc (or equivalent) bag and remove air to conserve space.
- In the bottom of a dry cooler, place absorbent for cushioning and absorption of water. If present, be sure that the drain on the cooler is taped and sealed inside and outside.
- Place a large, empty plastic bag in the cooler and fill it with cushioning material (e.g., bubble wrap or Styrofoam).
- Place the samples on ice and cover with additional cushioning material and additional bags of ice.

- Twist the plastic bag to create a "goose-neck". Seal the plastic bag by wrapping tape around the "goose-neck."
- Fill the remainder of the cooler with absorbent and cushioning material.
- Tape the completed chain-of-custody and other pertinent information for the testing laboratory in a Zip-Loc bag and seal. Attach the chain-of-custody materials to the cooler.
- Close the lid on the cooler and wrap strapping tape or duct tape securely around the lid of the cooler to prevent water from leaking out of the cooler. Wrap tape around the cooler to securely hold the lid and cooler together.
- Place "This Side Up" stickers or arrows on the cooler and properly complete shipping labels. Affix the bill of lading to the cooler. Be sure that the samples are marked for "next day" delivery and deliver the samples to the appropriate collection point.

5.3. Laboratory Custody Procedures

The ADHS-licensed laboratory will follow its specified procedures for maintaining custody in the laboratory as described in its QAP.

5.4. Field Records and Documentation

Field records will serve as the way to record data collecting activities as they are performed. Pre-printed forms or logbooks will be used to record field activities. Entries will be in as much detail as possible in order to reconstruct pertinent field activities without reliance on memory.

Pre-printed forms or logbooks will be used for recording sample-specific data. The data will be entered and sampling personnel will maintain custody of the forms or log books. The forms or logbooks will document observations and measurements during sample collection (see Table 4-2). Observations and measurements that will be recorded include any instrument measurements, sample descriptions, position measurements, sampling equipment, persons performing sampling, date of collection, and time of collection. All entries will be made in ink. If an incorrect entry is made, the information will be crossed out with a single strike mark.

5.5. Final Evidence Files Custody Procedures

Project documentation will be maintained at the offices of Heritage. Access to project files is limited to employees of Heritage and any contract employees involved in the closure. Pertinent documentation will also be provided to the ADEQ upon request. Complete project files will include:

- project plans and specifications;
- data records;
- relevant photographs, maps, and drawings;
- chain-of-custody documentation;
- analytical data packages provided by the testing laboratory;
- data validation reports;
- pertinent references and technical literature;
- technical reports; and
- pertinent correspondence and other information.

6. CALIBRATION PROCEDURES AND FREQUENCY

The following sections describe calibration procedures and their frequency for both field and laboratory instruments.

6.1. Field Instrument Calibration

The organic vapor analyzer (PID or FID) used for field screening soil samples (see Section 7.1) will be calibrated daily. The calibration procedures will follow standard manufacturer's instructions and procedures to ensure that the equipment is functioning properly. A standard calibration span gas will be used and the instrument span potentiometer control will be adjusted, if necessary. If the span potentiometer requires resetting, the span potentiometer will be set following the manufacturers instructions. After allowing the instrument to warm-up, an ink marker will be used to test deflection of the instrument and ensure it is working properly.

In the event field personnel experience failure of instruments, back-up or replacement instruments will be utilized to collect field data.

6.2. Laboratory Instrument Calibration

Calibration procedures for the laboratory testing being performed during closure will follow the selected ADHS-licensed laboratory's QAP for organic and inorganic constituent testing. A description of the laboratory instrumentation, standard traceability, standard sources and preparation, calibrations, instrument performance parameters, and instrument calibration criteria will be part of the QAP.

7. ANALYTICAL AND MEASUREMENT PROCEDURES

The following sections present the analytical methods and measurement procedures that will be used during closure. Soil and concrete samples will be collected during closure activities at the facility in accordance with the procedures specified in the Closure Plan and this QAPP. Samples collected during closure will be analyzed at a laboratory licensed by the ADHS.

7.1. Laboratory Analytical and Measurement Procedures

The following sections present laboratory analytical procedures and standard operating procedures for the laboratory testing being performed during closure. During implementation of this QAPP, the laboratory will utilize methods series from the most current edition of US EPA SW-846 at the time of closure.

7.1.1. List of Project Target Compounds and Estimated Quantitation Limits

A complete listing of project target compounds and estimated quantitation limits is provided in Tables 7-1, 7-2, 7-3, and 7-4. Method detection limits have been determined for the methods being performed on the instruments used at the laboratory. A discussion of method detection limit determination by the ADHS-licensed laboratory will be specified in the QAP utilized at the time of closure.

7.1.2. List of Associated QC Samples

A list of instrumental and preparation QC samples and frequency of analysis for methods performed will be specified in the QAP for the ADHS-licensed laboratory. Section 4.2 describes field QC samples that will be collected during closure.

Table 7-1
Parameters, Analytical Methods, Clean Closure Levels, and Sensitivities for Inorganic Constituents
Heritage Environmental Services, LLC
Coolidge, AZ

Parameter	Analytical Methods[1]		Clean Closure Levels[2]	Estimated Quantitation Limits[3]	
	Soils	Water	Soils/Concrete	Soils (mg/kg)	Water (mg/l)
Aluminum	6010B	6010B	76,000	5.0	0.050
Antimony	6010B	6010B	31	0.50	0.0050
Arsenic, total [4]	6010B	6010B	10	0.50	0.0050
Barium, total	6010B	6010B	15,000	1.0	0.010
Beryllium	6010B	6010B	150	0.50	0.0040
Cadmium, total	6010B	6010B	39	0.50	0.0050
Calcium	6010B	6010B		5.0	0.10
Chromium, III/VI[4]	6010B/7196A	6010B/7196A	120,000/30	1.3/1.0	0.010
Cobalt	6010B	6010B	900	1.0	0.010
Copper	6010B	6010B	3,100	1.0	0.010
Iron	6010B	6010B		2.0	0.020
Lead, total [4]	6010B	6010B	400	1.0	0.0050
Magnesium	6010B	6010		1.0	0.10
Manganese	6010B	6010	3,300	1.0	0.10
Mercury, total	7471A	7470	23	0.13	0.00020
Nickel, total	6010B	6010B	1,600	0.50	0.0050
Potassium	6010B	6010		20	0.10
Selenium, total	6010B	6010B	390	0.50	0.0050
Silver, total	6010B	6010B	390	1.0	0.010
Sodium	6010B	6010B		1.0	0.10
Thallium	6010B	6010B	5.2	0.50	0.010
Vanadium	6010B	6010B	78	1.0	0.010
Zinc	6010B	6010B	23,000	2.0	0.020
Cyanide, free	9010B/9012A	6010B	1,200	0.25	0.005

[1] Analytical method reference US EPA SW 846.
[2] The method version specified in the current edition of SW 846 at the time of closure will be used. Sample preparation methods for samples collected are as follows:
Soil Matrix – Acid digestion Preparation - ICP/FAA SW 846 3050A CVAA – SW 846 7471 (modified)
Cyanide – Distillation is US EPA SW 846 9010B
Water Matrix - Acid digestion Preparation - ICP/FAA SW 846 3005 CVAA – SW 846 7470
[3] Clean Closure Levels were obtained from A. A. C. R 18-7-205, Appendix A for Residential Soil Remediation Levels as of May 5, 2007.
EQLs are determined on a wet weight basis. The estimated quantitation limits provided are the lowest concentrations that can be reliable determined by Heritage Laboratories within specified conditions. The quantitation limits listed herein are provided for guidance and may not always be achievable. The EQLs are highly matrix dependent and matrix interferences may increase the EQLs.
[4] Arsenic clean closure level will be based on the background concentration or SRL, whichever is higher. Hexavalent Chromium may be analyzed for or may be assumed to be present at a 1:6 CrVI/CrIII if total chromium is analyzed. Lead based on IEVBK Model.

Table 7-2
Parameters, Clean Closure Levels, and Sensitivity for
Volatile Organic Constituents (SW-846 Method 8260B)(1)
Heritage Environmental Services, LLC
Coolidge, Arizona

TARGET COMPOUND LIST	CLEAN CLOSURE LEVELS(2)	ESTIMATED QUANTITATION LIMITS(3)	
Parameter	Soil/Concrete (mg/kg)	Low Level Soil/Sediment (mg/kg)	Water (mg/l)
Acetone	2100.0	0.100	0.100
Acrolein	0.10	0.05	0.05
Acrylonitrile	1.9	0.070	0.070
Benzene	0.62	0.005	0.005
Bromodichloromethane	6.3	0.005	0.005
Bromoform	560.0	0.005	0.005
Bromomethane	6.8	0.010	0.010
Carbon disulfide	7.5	0.005	0.005
Carbon tetrachloride	1.6	0.005	0.005
Chlorobenzene	65.0	0.005	0.005
Chloroethane	N/A	0.010	0.010
Chloroform	2.5	0.005	0.005
Chloromethane	12.0	0.010	0.010
Dibromochloromethane	53.0	0.005	0.005
1,3-Dichloropropene	2.4	0.005	0.005
Dichlorodifluoromethane	94.0	0.005	0.005
1,1-Dichloroethane	500.0	0.005	0.005
1,2-Dichloroethane	2.5	0.005	0.005
1,1-Dichloroethene	0.36	0.005	0.005
1,2-Dichloropropane	3.1	0.005	0.005
Ethylbenzene	1500.0	0.005	0.005
Fluorotrichloromethane	380	0.005	0.005
2-Hexanone	NA	0.050	0.050
Methylene chloride	77.0	0.005	0.005
Methyl ethyl ketone	7100.0	0.100	0.100
4-Methyl-2-pentanone	770	0.050	0.050
Styrene	3300.0	0.005	0.005
1,1,2,2-Tetrachloroethane	4.4	0.005	0.005
Tetrachloroethene	53.0	0.005	0.005
Tetrahydrofuran	NA	0.025	0.025
Toluene	790.0	0.005	0.005
1,2-Dichloroethene (total)	35	0.005	0.005
1,1,1-Trichloroethane	1200.0	0.005	0.005
1,1,2-Trichloroethane	6.5	0.005	0.005
Trichloroethene	27	0.005	0.005
Vinyl acetate	780.0	0.01	0.01
Vinyl chloride	0.016	0.010	0.010
Xylenes (total)	2800	0.005	0.005

(1) The method versions specified in the current edition of SW846 at the time of closure will be used.
(2) Clean Closure Levels were obtained from A.A.C. R 18-7-205 Appendix A for Residential Soil Remediation Levels as of December 31, 2001.
(3) EQLs are determined on a wet weight basis. The EQLs listed herein are provided for guidance and may not always be achievable. EQLs are highly matrix dependant and matrix interference may increase the EQLs.
N/A – Not Available

Table 7-3
Parameters, Clean Closure Levels, and Sensitivity for
Semivolatile Organic Constituents (SW-846 Method 8250/8270C)[1]
Heritage Environmental Services, LLC
Coolidge, Arizona

TARGET COMPOUND LIST	CLEAN CLOSURE LEVEL[2]	ESTIMATED QUANTITATION LIMITS[3]	
Parameter	Soils / Concrete	Soils[4] (mg/kg)	Water[4] (mg/l)
BASE NEUTRAL ORGANIC COMPOUNDS			
Acenaphthene	3900.0	0.33	0.010
Acenapthylene	NA	0.33	0.010
Anthracene	20000.0	0.33	0.010
Benz(a)anthracene	6.1	0.33	0.010
Benzo(a)pyrene	0.61	0.33	0.010
Benzo(b)fluoranthene	6.1	0.33	0.010
Benzo(ghi)perylene	NA	0.33	0.010
Benzo(k)fluoranthene	61.0	0.33	0.010
Benzyl Alcohol	20000.0	0.33	0.010
Benzylbutylphthalate	13000	0.33	0.010
Bis(2-chloroethoxy)methane	NA	0.33	0.010
Bis(2-chloroethyl)ether	0.43	0.33	0.010
Bis(2-chloroisopropyl)ether	25.0	0.33	0.010
Bis(2-ethylhexyl)phthalate	320.0	0.33	0.010
4-Bromophenylphenylether	NA	0.33	0.010
Carbazole	220.0	0.33	0.010
4-Chloroaniline	260.0	0.33	0.010
2-Chloronapthalene	5200	0.33	0.010
4-Chlorophenylphenylether	NA	0.33	0.010
Chrysene	610.0	0.33	0.010
Dibenz(a,h)anthracene	0.61	0.33	0.010
Dibenzofuran	260	0.33	0.010
1,2-Dichlorobenzene	1100.0	0.33	0.010
1,3-Dichlorobenzene	500.0	0.33	0.010
1,4-Dichlorobenzene	190.0	0.33	0.010
3,3'-Dichlorobenzidine	9.9	0.66	0.020
Diethylphthalate	52000.0	0.33	0.010
Dimethylphthalate	650000.0	0.33	0.010
Di-n-butylphthalate	6500	0.33	0.010
Dinitrobenzenes	6.5	0.33	0.050
2,4-Dinitrotoluene	130.0	0.33	0.010
2,6-Dinitrotoluene	65.0	0.33	.010
Di-n-octylphthalate	1300.0	0.33	0.010
Fluoranthene	2600.0	0.33	0.010
Fluorene	2600.0	0.33	0.010
Hexachlorobenzene	2.8	0.33	0.010
Hexachlorobutadiene	13.0	0.33	0.010
Hexachlorocyclopentadiene	450.0	0.33	0.010
Hexachloroethane	65.0	0.33	0.010
Indeno(1,2,3-cd)pyrene	6.1	0.33	0.010
Isophorone	4700.0	0.33	0.010
2-Methylnaphthalene	NA	0.33	0.010
Naphthalene	2600.0	0.33	0.010
2-Nitroaniline	3.9	1.6	0.050

TARGET COMPOUND LIST	CLEAN CLOSURE LEVEL(2)	ESTIMATED QUANTITATION LIMITS(3)	
Parameter	Soils / Concrete	Soils(4) (mg/kg)	Water(4) (mg/l)
3-Nitroaniline	NA	1.6	0.050
4-Nitroaniline	NA	1.6	0.050
Nitrobenzene	18.0	0.33	0.010
N-Nitroso-diphenylamine	910.0	0.33	0.010
N-Nitroso-di-n-propylamine	0.63	0.33	0.010
Phenanthrene	NA	0.33	0.010
2-Picoline	NA	1.6	0.050
Pyrene	2000.0	0.33	0.010
Pyridine	65.0	1.6	0.050
Tetrachlorobenzenes	20.0	0.33	0.010
Toluenediamine	NA	1.6	0.050
1,2,4-Trichlorobenzene	570.0	0.33	0.010
Benzoic Acid	260000.0	1.6	0.050
ACID EXTRACTABLE ORGANIC COMPOUNDS			
4-Chloro-3-methylphenol	NA	0.33	0.010
2-Chlorophenol	91.0	0.33	0.010
2,4-Dichlorophenol	200.0	0.33	0.010
2,4-Dimethylphenol	1300.0	0.33	0.010
4,6-Dinitro-2-methylphenol	NA	1.6	0.050
2,4-Dinitrophenol	130.0	1.6	0.050
2-Methylphenol	3300.0	0.33	0.010
4-Methylphenol	330.0	0.33	0.010
2-Nitrophenol	NA	0.33	0.010
4-Nitrophenol	NA	1.6	0.050
Pentachlorophenol	25.0	1.6	0.050
Phenol	39000.0	0.33	0.010
Tetrachlorophenol	20000.0	0.33	0.010
2,4,5-Trichlorophenol	6500.0	0.33	0.010
2,4,6-Trichlorophenol	400.0	0.33	0.010

(1) The method versions specified in the current edition of SW-846 at the time of closure will be used.
(2) Clean Closure Levels were obtained from A.A.C. R 18-7, (205) Appendix A for Residential Soil Remediation Levels as of December 31, 2001.
(3) EQLs are determined on a wet weight basis. The EQLs listed herein are provided for guidance and may not always be achievable. EQLs are highly matrix dependant and matrix interference may increase the EQLs.

NA – Not Available

Table 7-4
Parameters, Clean Closure Levels, and Sensitivity for
Herbicides and Pesticides (SW-846 Method 8181A/8151A)(1)
Heritage Environmental Services, LLC
Coolidge, Arizona

TARGET COMPOUND LIST	CLEAN CLOSURE LEVELS(2)	ESTIMATED QUANTITATION LIMITS(3)	
Parameter	Soil / Concrete	Soils(4) (mg/kg)	Water(4) (mg/l)
Aldrin	0.26	0.008	0.00005
Alpha-BHC	NA	0.008	0.00005
Alpha-Chlordane	3.4	0.08	0.0005
Beta-BHC	0.026	0.008	0.00005
Delta-BHC	NA	0.008	0.00005
4,4'-DDD	19.0	0.016	0.0001
4,4'-DDE	13.0	0.016	0.0001
4,4'-DDT	13.0	0.016	0.0001
Dieldrin	0.28	0.016	0.0001
Endosulfan I	390	0.008	0.00005
Endosulfan II	390	0.016	0.0001
Endosulfan Sulfate	390	0.016	0.0001
Endrin	20.0	0.016	0.0001
Endrin Ketone	NA	0.016	0.0001
Gamma-BHC (Lindane)	NA	0.008	0.0005
Gamma-Chlordane	3.4	0.08	0.0005
Heptachlor	0.99	0.008	0.00005
Heptachlor Epoxide	0.49	0.008	0.00005
Methoxychlor	330.0	0.08	0.0005
Toxaphene	4.0	0.16	0.001
2,4,5-Trichlorophenoxyacetic acid	650.0	0.020	0.001
2,4-Dichlorophenoxyacetic acid (2,4-D)	650.0	0.20	0.01
Silvex (2,4,5-TP)	NA	0.020	0.001

(1) The method versions specified in the current edition of SW-846 at the time of closure will be used.
(2) Clean Closure Levels were obtained from A.A.C. R 18-7, (205) Appendix A for Residential Soil Remediation Levels as of December 31, 2001.
(3) EQLs are determined on a wet weight basis. The EQLs listed herein are provided for guidance and may not always be achievable. EQLs are highly matrix dependant and matrix interference may increase the EQLs.
(4) The following preparation methods will be used for preparation of samples submitted for testing of herbicides/pesticides:

Herbicides	Diazomethane Herbicide Derivatization
Pesticides Solids (sonication)	SW-846 3550
Pesticides Aqueous (liquid/liquid)	SW-846 3510

NA – Not Available

8. INTERNAL QUALITY CONTROL

8.1. Field Quality Control Checks

Quality control parameters for the field activities are described in previous sections. Section 4.2 summarizes field quality control parameters. Section 7.1 provides field measurement procedures. QC procedures for field instruments include calibration of the instruments as described in Section 6.1.

8.2. Laboratory Quality Control Checks

For laboratory analyses, quality control procedures are method specific. Specific analytical methods being performed for closure are provided in Tables 7-1, 7-2, 7-3, and 7-4. The ADHS-licensed laboratory's QAP and SOPs describe internal quality control procedures for each method being performed.

9. DATA REDUCTION, VALIDATION AND REPORTING

The following sections describe data reduction activities, data validation and acceptance, and reporting of data.

9.1. Data Reduction

Data reduction will be performed by the engineering contractor and/or Heritage technical staff and the testing laboratory.

9.1.1. Field Data Reduction Procedures

After completing field activities, field-collected data will be compiled for inclusion into project files. The data generated will be checked for completeness and accuracy to ensure that all data required for each measurement is available and complete. Duplicated data will be cross checked to ensure consistency with other data developed during field activities. Pertinent data generated in the field will be tabulated for inclusion in a technical report.

9.1.2. Laboratory Data Reduction Procedures

Laboratory data reduction is performed by the testing laboratory in accordance with the ADHS-licensed laboratory's QAP and related procedures.

9.2. Data Validation

Data validation will be performed by both the ADHS-licensed laboratory and independently by the engineering contractor and/or Heritage technical staff.

9.2.1. Laboratory Data Validation

Laboratory personnel will perform a review of raw data generated during laboratory testing. Data validation by the laboratory primarily includes information associated with method performance requirements. Data reviewed by the analyst(s) include:

- calibration blanks;
- calibration verification standards used to verify calibration;
- detection limits and dilution of sample;
- instrument performance based on manufacturer specifications;
- instrument test/calibration requirements;
- quantitative, qualitative raw data generated (print-outs, graphical displays, etc.), and compound identification;
- internal reagent blanks, duplicates, and spike data; and
- quality control requirements for the method being performed.

Data generated by the analyst(s) will be reviewed by the analyst(s) to ensure that data collection meets acceptance criteria specified in the analytical method. If acceptance criteria are met, the analyst will proceed with completion of analyses (including data recordation and review). If the criteria are not met, the analyst will perform corrective action.

9.2.2. Field and Laboratory Data Validation

The engineering contractor and/or Heritage technical staff will independently validate data generated to ensure that samples were properly collected, evaluate quantitative and qualitative acceptance criteria, ensure that the data generated appears reasonable for the expected outcome (if known), and the information

generated is consistent with known site characteristics. The Project Manager, Project Geologist, or designee will be responsible for performing field and laboratory data validation. Data validation will be performed in general conformance with USEPA guidelines established for the Contract Laboratory Program with the exception of detailed analysis of instrument operational data, instrument calibration, confirmation of quantitation, and confirmation of compound identification. Internal QC procedures utilized by the laboratory will be performed in accordance with the current edition of USEPA SW-846 operating requirements and the ADHS-licensed laboratory's QAP and SOPs for the type of testing being performed to ensure that these QC criteria have been met.

Items that may be examined after receipt of analytical data include but are not limited to the following:

- Review of sample holding times for each compound class;
- Review of results from field blank and trip blanks submitted to the testing laboratory and comparison with concurrently submitted sample batches;
- Review of laboratory reagent blanks;
- Review of surrogate recoveries and matrix spike analyses;
- Review of estimated quantitation limits to ensure compliance with USEPA SW-846 guidelines;
- Evaluation of duplicates;
- General quality of data generated by the testing laboratory during closure; and
- Evaluation of data acceptance criteria for the testing performed including accuracy, precision, sensitivity, and completeness.

The following is a description of the quantitative and qualitative procedures that will be performed by the engineering contractor and/or Heritage technical staff during data validation. Table 9-1 summarizes the criteria selected for validation, the acceptance criteria, and guidelines for corrective action.

Review of Holding Times

Holding times for each compound class will be reviewed for each sample to ensure that the samples submitted were tested within prescribed holding periods for the types of compounds tested. The applicable holding times are specified on Table 4-1 of this QAPP. In addition to holding time evaluation, sample chain-of-custody will be reviewed and the condition of the samples arriving at the testing laboratory will be considered. Deviations in holding times or unusual sample handling occurrences will be noted. Corrective action may be performed for samples not meeting holding time acceptance criteria upon review of data.

Table 9-1
Data Validation Acceptance Criteria and Guidelines for Data Validation Activities
Heritage Environmental Services, LLC
Coolidge, Arizona[1],[2]

DATA VALIDATION PARAMETER	EVALUATION PROCEDURE	ACCEPTANCE CRITERIA	GUIDELINES FOR CORRECTIVE ACTION
Holding Time	Compare date of sample collection on chain-of-custody with date of analysis on laboratory reports.	Each sample should meet holding times specified in Table 4-1 of this QAPP.	Analytical results flagged as estimated concentrations or as estimated sensitivity. Samples may be collected depending on relative importance.
Field, Trip, and Method Blanks	Compare results of field, trip, and method blanks for the presence of field or laboratory contamination.	Contaminants are not present in the blanks.	Reject parameters based on criteria presented in Section 9.2.2 of this QAPP. Request that laboratory review data. Carefully consider type of blank, compounds present, and origin of contaminants; qualitatively evaluate data based on importance. Modify sampling procedures or laboratory SOPs.
Surrogate Spikes for Organic Compounds	Review reported percentage recovery for certain organic compounds. Review data to determine if specifications were met on initial run. Check for laboratory notes indicating difficulty with surrogate recoveries. Verify the following circumstances if necessary: 1. If any two surrogates within a semivolatile fraction were out of specification reanalysis should be performed. 2. If any surrogate for volatiles out of specification, reanalysis. 3. Recoveries of less than ten percent require reanalysis 4. Blank data out of specification requires reanalysis of samples.	For volatile organic constituents the acceptance criteria for surrogate spikes are listed on Table 8, USEPA SW-846 Method 8240. For semivolatile organic constituents the acceptance criteria for surrogate spikes are listed on Table 8 of USEPA SW-846 Method 8270. For pesticides/herbicides the acceptance criteria for surrogate spike are specified by USEPA SW-846 Methods 8080, 8150, and 8151 as criteria for developing "in-house" limits. Refer to the QAP of the ADHS-licensed laboratory for surrogate recovery criteria.	Accept data as modified. Sample results flagged as estimated values when: 1. Two semivolatile surrogates are out of specification but have recoveries greater than ten percent. 2. One volatile surrogate is out of specification but has a recovery of greater than 10 percent. 3. Sample results for a fraction should be rejected if two semi-volatile or one volatile surrogate is less than ten percent recovery and results are negative. 4. Positive sample results for a fraction should be estimated if two semivolatile or one volatile surrogate is less than 10 percent recovery. Reanalyze sample in accordance with procedures, resample and reanalyze. Review data and discuss specific results with testing laboratory in a qualitative manner to determine if reanalysis or modification of procedures should be performed to meet desired objectives.

(1) Table 9-1 is provided as guidance only. Specific determinations of data validity should be based on review of the data and circumstances associated with the samples tested and guidance regarding data validation.
(2) With the exception of field measurements, analytical methods will follow the current version of "Test Methods For Evaluating Solid Wastes" (SW-846) (current edition with updates) at the time of closure.

DATA VALIDATION PARAMETER	EVALUATION PROCEDURE	ACCEPTANCE CRITERIA	GUIDELINES FOR CORRECTIVE ACTION
Matrix Spike/ Matrix Spike Duplicate	Determine precision and accuracy of analytical procedures for matrices sampled. Determine percent recoveries for spiked samples and calculate relative percent difference for comparing matrix spikes and matrix spike duplicates using equations in Table 12-1 of this QAPP.	SEMI VOLATILE ORGANIC CONSTITUENTS: Percent Recovery: Fifth column of Table 6 in USEPA SW-846 Method 8270 Relative Percent Difference: Base Neutral Soil - RPD < 32 % Base Neutral Aqueous - RPD < 25% Acid Extractable Soil - RPD < 43 % Acid Extractable Aqueous - RPD < 45% VOLATILE ORGANIC CONSTITUENTS: Percent recovery: Fifth column of Table 6 in USEPA SW-846 Method 8240 Relative Percent Difference: Soil - RPD < 25 % Aqueous - RPD < 25%	Modify sample results by flagging data based on acceptance criteria. Qualitatively determine potential cause for not meeting specifications for percent recovery and relative percent difference. Flag for the following: 1. Estimated values for not meeting recovery criteria and relative percent difference criteria for inorganics. 2. See USEPA document entitled: Laboratory Data Validation, Functional Guidelines for Evaluation of Inorganic Analyses for further details regarding validation.
		PESTICIDES/HERBICIDES: Percent recovery: Fourth column of Table 3 in USEPA SW-846 Method 8080; Fourth column of Table 3 in USEPA SW-846 Method 8150. Third column of Table 4 in USEPA SW-846 Method 8151 METALS AND CYANIDE: Percent recovery: 75 to 100 percent unless sample concentrations exceed spike concentration by 4 times Relative Percent Difference: Soils - RPD < 35 % or RPD < quantitation limits in Table 7-1 of this QAPP if results are less than 5X of the quantitation limit Aqueous - RPD <20% or RPD < quantitation limits if results are less than 5X quantitation limit.	Review data and discuss specific results with testing laboratory in a qualitative manner to determine if reanalysis or modification of procedures should be performed to meet desired objectives. Resample for constituents that would be rejected based on analytical results. Determination based on results of samples at the same location, in the vicinity, and relative importance of the measurement. Review criteria specified in the ADHS-licensed laboratory's QAP.

(1) Table 9-1 is provided as guidance only. Specific determinations of data validity should be based on review of the data and circumstances associated with the samples tested and guidance regarding data validation.
(2) With the exception of field measurements, analytical methods will follow the current version of "Test Methods For Evaluating Solid Wastes" (SW-846) (current edition with updates) at the time of closure.

DATA VALIDATION PARAMETER	EVALUATION PROCEDURE	ACCEPTANCE CRITERIA	GUIDELINES FOR CORRECTIVE ACTION
Field Duplicates	Compare field duplicate with original result and calculate a relative percent difference for the parameter to indicate the precision of sample results using equation in Table 12-1 of this QAPP.	Acceptance criteria for evaluating precision are provided above in section describing Matrix Spike/Matrix Spike Duplicates See Section 9.2.2 for additional discussion of acceptance criteria	For corrective action guidelines see section describing corrective action for matrix spike/matrix spike duplicates
Sensitivity/Estimated Quantitation Limits	Compare the analytical results for each parameter with the method sensitivity for each parameter provided in Tables 7-1, 7-2, 7-3, and 7-4 of this QAPP.	Positive results are above the lowest estimated quantitation limit provided in Tables 7-1, 7-2, 7-3, and 7-4 of this QAPP. If dilution is required as a result of matrix interference the estimated quantitation limits will be adjusted by the laboratory and the lowest estimated quantitation limits may not be achievable.	Concentrations reported below the estimated quantitation limit will be "BDL" or below detection limits for samples that do not require dilution. For samples requiring dilution, values reported between the lowest estimated quantitation limit in Tables 7-1, 7-2, 7-3, and 7-4 and the reported estimated quantitation limit should be flagged as estimated. Review sensitivity data and discuss specific results with testing laboratory in a qualitative manner to determine if reanalysis or modification of procedures should be performed to meet desired objectives. Resample for constituents that would be rejected based on sensitivity. Determination based on results of samples at the same location, in the vicinity of the sample, and relative importance of the measurement.
General Quality of Data	Qualitatively evaluate the performance of the laboratory based on completeness evaluation, the quality of data generated, and other intangible factors. Summarize qualitative evaluation in writing. Calculate completeness of data using equation in Table 12-1 of this QAPP.	Completeness of data should range between 90 and 100 percent complete.	Review completeness data and discuss results with testing laboratory in a qualitative manner to determine if reanalysis or modification of procedures should be performed to meet desired objectives.

(1) Table 9-1 is provided as guidance only. Specific determinations of data validity should be based on review of the data and circumstances associated with the samples tested and guidance regarding data validation.
(2) With the exception of field measurements, analytical methods will follow the current version of "Test Methods For Evaluating Solid Wastes" (SW-846) (current edition with updates) at the time of closure.

Review of Blank Data

Blank data (field, trip, or method) will be compared with data provided for each sample batch submitted with a particular blank. Data will be rejected from further consideration for common laboratory constituents if the sample result is less than or equal to ten times the highest result reported in the blank analysis. For samples containing constituents ten times greater than that reported in blanks, validity of the samples will be determined on a case-by-case basis. Similarly, the presence of common laboratory constituents will be evaluated on a case-by-case basis depending on frequency of detection and the quantitation level reported. Common laboratory contaminants could include, among others:

- methyl ethyl ketone;
- methylene chloride;
- phthalate esters;
- toluene; and
- acetone.

Data will be rejected for other constituents detected if the sample result for a particular constituent is less than or equal to five times the highest result reported in the blank analysis. For samples with constituent concentrations five times greater than that detected in the blanks, validity of the samples will be determined on a case-by-case basis.

Suspected contamination of samples as a result of blank evaluations will be noted in the data validation reports and on tabulations of data. Sample results will be presented as reported with a note. Sample results will not be corrected by subtracting the blank value from a sample result.

Review of Spike Data

Surrogate recoveries (for volatile organic, semi-volatile organic, and pesticide/herbicide constituents) and spike recoveries will be examined to determine if the reported results are within USEPA SW-846 guidelines for the constituent being evaluated. Surrogate spike recoveries outside the control limits will be noted. Explanations, if available, will be provided for the surrogate spike recoveries not reported within the range specified in USEPA SW-846. Table 9-1 provides acceptable surrogate spike recovery ranges. Section 12 provides the equation used to calculate percent recovery for spikes.

Matrix spike and matrix spike duplicate testing will be performed on samples collected during closure. The percent recoveries will be compared to published USEPA SW-846 recommendations for percent recovery. The relative percent difference will be calculated for the matrix spike/matrix spike duplicate using the equation provided in Section 12. Table 9-1 provides acceptance criteria for the relative percent difference in each media.

Deviation from the acceptance criteria for percent recoveries and relative percent difference will be noted in the data validation report and on tabulations of data contained in technical reports. Acceptance, qualification, or rejection of data will be determined on a case-by-case basis depending on the end use of the data.

Review of Estimated Quantitation Limits

Estimated quantitation limits (EQL), or estimated quantitation limits as applicable for each organic and inorganic constituent to be tested are listed on Tables 7-1, 7-2, 7-3, and 7-4. The EQL provided in the tables represents the lowest EQL to be reported for each constituent by the ADHS-licensed testing laboratory. Any value for a particular constituent reported below the EQL listed in Tables 7-1, 7-2, 7-3, and 7-4 will be considered invalid and below detection limits or "BDL."

Although not anticipated, matrix interferences from organic and inorganic constituents could occur. If warranted, the EQL will be adjusted using a multiplier In accordance with USEPA SW-846 recommendations for the method being performed. During validation of data, matrix interferences will be noted in the data validation report or on tabulations of data, if warranted. An appropriate data qualifier may be added to the data in the event the qualifier is warranted.

Review of Field Duplicate Analyses

As part of field QC, field duplicate samples will be collected and submitted to the testing laboratory. The field duplicate data will be validated based on the presence or absence of the constituent in each sample and the relative percent difference between duplicate analyses. The acceptance criteria for the field duplicates are summarized on Table 9-1. Results will be appropriately noted if the field duplicate does not meet the acceptance criteria.

In addition, sample results will be considered "below detection limits" or not detected if either the sample or the field duplicate detect a compound that is not detected in the other sample particularly if the reported concentration is at or below the EQL. These circumstances will be reported in the data validation report.

General Quality of Data

A discussion of the data quality for analytical results received from the testing laboratory will be provided after completing data validation. Information concerning unusual requirements or circumstances surrounding the testing of the samples may be provided by the laboratory. The quality of data will also be evaluated by calculation of a percent completeness for the entire analytical data package. The goal for completeness is 100 percent. Realistically, the estimated percent complete should be in the range between 90 and 100 percent. Equations for calculating completeness are provided in Section 12.

9.3. Data Reporting

Laboratory analysis reports and supporting documentation will be provided by the testing laboratory to Heritage and the engineering contractor. The laboratory will archive all data in a variety of storage media in accordance with the procedures of the ADHS-licensed laboratory's QAP. The information submitted by the laboratory will include the following where applicable to the testing being conducted:

- certificates of analysis, including analytical results, sampling dates, analysis dates, analytical methods used, and estimated quantitation limits (EQLs);
- quality assurance reports, including method blank results, matrix duplicate results (as applicable), matrix spike/matrix spike duplicate (MS/MSD) results, laboratory control samples, surrogate recoveries, method blanks, and laboratory control samples;

- signed chain-of-custody forms;
- tuning results (GC-MS);
- initial and continuing calibration results;
- method of standard addition (ICP) or serial dilution analysis (ICP), as applicable; and
- internal standard areas as applicable.

Raw data consisting of chromatograms, recorder outputs, mass spectrum reports, computer printouts, charts, graphs, bench sheets, or any other hard copy data generated during sampling and analysis will be provided upon written request for a period of three years from the date of analysis.

Upon receipt of reports, the data will be validated by the engineering contractor and/or Heritage technical staff. The data will be tabulated for inclusion in technical reports. Laboratory analysis reports, chain-of-custody records, and the validation reports will be provided in technical reports regarding closure.

9.4. Data Management

A significant amount of data could be generated during final closure of the facility. To ensure effective data management, the following data management plan will be implemented to document and track investigation data and results.

All data will be recorded and managed through the use of field records such as chain-of-custody and sample log books. Chain-of-custody forms as shown in Figure 4-4 will be included in technical reports regarding closure. The field records, which will serve as a record of activities taking place during the sample collection process, will be completed by the designated sampling personnel and will be maintained in Heritage's files. Information recorded in the field records will include data listed in Table 4-2, as well as locations of soil samples, depth intervals for soil samples, sampling procedure modifications (if required), sample identification numbers, field measurements, descriptions of samples, and other pertinent activities or occurrences encountered during sample procurement activities.

As described in Section 4.1.1 of this QAPP, the samples will be identified on the basis of a uniquely assigned alpha numeric code to ease sorting of data from each unit undergoing closure. This will serve to distinguish samples from different matrices, to distinguish depth intervals, and to distinguish possible multiple sampling events from similar sampling locations. The testing laboratory will also assign a unique, sequential alpha-numeric code to each sample received for analysis.

Analytical data will be summarized and presented in tabular format for each medium sampled or each analytical constituent, as appropriate. Data may also be sorted on the basis of other factors including, location, depth, stratigraphic horizon, and/or hazardous waste management unit. Applicable QA/QC sample results will be tabulated along with analytical data for comparative purposes. A summary of potential data presentation methods is provided in Table 9-2. Laboratory analysis reports, QA/QC data, data validation summaries, and data collection forms will be included with technical reports.

Table 9-2
Potential Data Presentation Methods
Heritage Environmental Services, LLC
Coolidge, Arizona

Tabular Displays

Analytical Data

- List of constituents of concern and other monitoring parameters
- Display sorted results
- Compare study and background data
- Data reduction for statistical analysis
- Summary data

Graphical Displays

Display Site Features

- Layout and topography
- Sampling locations and sampling grids
- Boundaries of sampling area

10. PERFORMANCE AND SYSTEM AUDITS

Performance and systems audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in this QAPP. Performance and systems audits will be performed by the testing laboratory and the project manager. The following sections describe the performance and systems audit requirements established for closure.

10.1. Field Performance and Systems Audits

The Project Manager will perform a continual audit of the data as it is generated or provided to the Project Manager for completeness and compliance with this QAPP. The Project Manager will have overall responsibility for ensuring that work is checked for completeness and compliance with this QAPP either by actually performing the auditing function or delegating the authority to qualified personnel based on the complexity of the auditing function. The Project Manager will conduct an evaluation of sample collection activities at the beginning of the project. Personnel performing activities associated with the project will be instructed to check the work that they are responsible for and ensure that checks are performed for pertinent calculations, tabulations of data, and other technical work products.

Technical reports and pertinent technical correspondence prepared by the Project Manager will be internally reviewed by personnel preparing the documents as well as the Project Manager. The final work product will be reviewed by the Project Manager for completeness, compliance of data generated with this QAPP, technical content, and conclusions.

Data completeness and compliance with this QAPP will be determined by reviewing all data generated in the field including field forms, reviewing chain-of-custody records, laboratory data packages, performing data validation activities, and reviewing other pertinent data to ensure that data generated during closure is complete and in compliance with this QAPP. Final reports will be checked to ensure that pertinent data generated in the reports are correctly presented in the report or incorporated into appendices.

10.2. Laboratory Performance and Systems Audits

The internal performance audit procedure of the ADHS-licensed laboratory will be described in the laboratory's QAP.

11. PREVENTIVE MAINTENANCE

Preventive maintenance is an ongoing activity that will be performed during closure. Generally, preventive maintenance will be performed as specified by the manufacturer of the equipment or in accordance with the procedures being performed during closure.

11.1. Field Instrument Preventive Maintenance

Field instruments used during closure will be maintained in general conformance with the manufacturer's recommendations. Individuals performing field activities will follow manufacturer's instructions for calibration and maintenance of the equipment. If the equipment is faulty, it will be decontaminated and repaired in the field or replaced with back-up equipment prior to performing additional testing. If required, faulty equipment will be decontaminated and returned to the manufacturer for repair.

11.2. Laboratory Preventive Maintenance

The ADHS-licensed laboratory will have a continuous preventive maintenance program in place. Section 10 of the Heritage Laboratories QAP summarizes preventive maintenance performed for a variety of laboratory equipment. Instruments for analyzing for metals, cyanide, volatile organic constituents, semi-volatile organic constituents, and pesticides/herbicides are of interest. In addition to routine preventive maintenance, method-specific USEPA SW-846 requirements for preventive maintenance will be performed. The analytical methods to be utilized during closure are provided on Tables 7-1, 7-2, 7-3, and 7-4 of this QAPP.

12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

The following sections describe the procedures and equations that will be used in assessing the accuracy, precision of analytical data, and completeness of data collection associated with closure.

12.1. Accuracy of Analytical Data

Accuracy is defined as the degree of conformity of a measurement to a true value or known standard. Analytical data will be assessed for accuracy by evaluating percentage recovery for various spiked samples. The accuracy will be calculated for matrix spikes, matrix spike duplicates, and internal laboratory spikes. Spikes will be utilized to provide project specific accuracy evaluation for the media sampled at the facility. Table 12-1 provides the equation to be used to calculate the percent recoveries when evaluating accuracy. Acceptance criteria for evaluation of spike data are provided in Table 9-1.

12.2. Precision of Analytical Data

Precision for the testing will be evaluated by calculating relative percent differences for matrix spike/matrix spike duplicate results and field duplicate testing of samples. Precision is defined as the degree of refinement or reproducibility of a particular measurement. Field duplicates will serve to evaluate test results from two samples at the same location. Acceptance criteria for evaluation of precision are provided in Table 9-1. The equation to be used to calculate relative percent difference is provided in Table 12-1.

12.3. Completeness Assessment

Generally, completeness will be assessed by evaluation of valid data generated during the project versus data not meeting QC requirements established in this QAPP. Completeness for each sample is defined as meeting all QA/QC requirements evaluated during data validation for each parameter tested. The measure of completeness for each parameter will consider whether:

- A valid result is obtained for each parameter tested without rejection of the data (e.g., accuracy and precision acceptance criteria for each constituent are met);
- All chain-of-custody requirements for each parameter are satisfied;
- Holding time established for each parameter is met;
- Data subject to blank evaluation will be considered; and
- Sensitivity requirements are met (excluding analytical interferences requiring dilution of samples).

The equation for calculating completeness is provided in Table 12-1. The use of completeness will serve as a measure for assessing the success of the sampling event(s). However, final evaluation of the data will be qualitative based on the relative degree of importance that the sample represents in order to meet the project objectives.

Table 12-1
EQUATIONS USED TO DETERMINE ACCURACY, PRECISION, AND COMPLETENESS OF DATA
HERITAGE ENVIRONMENTAL SERVICES, LLC

ACCURACY

SPIKE RECOVERY IN PERCENT

$[(S_s – S_o)/C_s]$ 100 = percent spike recovery, where

S_s = Concentration of analyte in analyzed spiked sample
S_o = Concentration of analyte in unspiked sample
C_s = Concentration of analyte spike

SURROGATE SPIKE RECOVERY IN PERCENT

(S_{sur}/C_{sur}) 100 = percent surrogate recovery, where

S_{sur} = Concentration of surrogate in analyzed sample
C_{sur} = Concentration of surrogate

PRECISION

RELATIVE PERCENT DIFFERENCE IN PERCENT

$\{(|X_1 - X_2|)/[(X_1 + X_2)/2]\}$ 100 = relative percent difference, where

X_1 = Concentration measured in sample or matrix spike
X_2 = Concentration measured in sample or matrix spike duplicate

Note: For values that are below detection limits or BDL, the practical quantitation limit will be used to calculate relative percent difference if one of the samples reports a value.

COMPLETENESS IN PERCENT

(x/y)100 = percent complete, where

x = the number of valid measurements after data validation
y = the number of possible measurements prior to performing analysis

Note: See section 12.3 for identification of measurements

13. CORRECTIVE ACTION

An important aspect to ensure that the objectives are met will be corrective action. Heritage intends to minimize the amount of corrective action required during closure by utilizing trained professionals during field and laboratory testing; adhering to Closure Plan requirements, this QAPP, and SOPs; continually reviewing data generated in the laboratory and field; and performing independent review of data through internal laboratory procedures and data validation activities.

13.1. Corrective Action during Field and Data Validation Activities

In certain instances, corrective action may be necessary when a sample network requires changes, sampling locations are adjusted, sampling procedures are changed, or analytical procedures are different from those specified in this QAPP. These changes may be in response to unexpected conditions at the facility.

If non-conformance with the established quality control procedures is identified in the field or laboratory, measures will be taken to correct the non-conformance using this QAPP's guidelines, established SOPs, or alternative corrective action procedures.

After identification of a non-conformance or determination that data is not useful, corrective action will be performed, if possible. Corrective action that may be performed includes:

- Use of back-up or replacement equipment;
- Recalibration of field instruments;
- Reanalysis of out-of-control samples;
- Recollection of samples;
- Modification of plans as necessitated by field conditions;
- Corrections to calculations, drawings, tabulations through review and audit process;
- Acceptance of data while acknowledging the non-conformance;
- Revision of project objectives, sampling procedures, or analytical procedures to obtain the desired data quality or meet the project objectives; or
- Additional training for field and laboratory personnel.

Depending on the identified non-conformance, the nature and extent of corrective action will be contingent on the qualitative degree of non-conformance (e.g., corrections for minor calculation errors versus breakage of an entire set of samples), technical issues associated with non-conformance (e.g., did matrix interferences during analysis cause a loss of sensitivity that cannot be corrected?), and the importance of any particular data measurement (e.g., loss of data at a critical sample location or loss of field measurement data where analytical data is collected).

Personnel performing work during closure will be responsible for corrective action. After identification, the group leaders and QA/QC personnel will be responsible for performing corrective action at the testing laboratory. The Project Manager or designee will perform corrective action as warranted when non-conformance is identified. The Project Manager will be responsible for ensuring that corrective action is performed in the field and in the testing laboratory.

13.2. Laboratory Corrective Action

Laboratory corrective action will be as described in the ADHS-licensed laboratory's QAP.