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REPORT

For Atlanta BeltLine, Inc

Soil and Groundwater Management Plan
for Interim Corrective Action
Atlanta BeltLine Southside Trail —
Segments 2, 3, and 4/5
STA 146+00.00 to 303+55.12
Atlanta, Fulton County, Georgia

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UNITED CONSULTING

June 24, 2021

Atlanta BeltLine, Inc.
c/o
Mr. Sean Johnston, P.E.
Vice President
Kimley-Horn
817 West Peachtree Street NW
The Biltmore Suite 601
Atlanta, Georgia 30308

Via Email: Sean.Johnston@kimley-horn.com

RE: Report of Soil and Groundwater Management Plan for Interim Corrective Action
Atlanta BeltLine Southside Trail – Segments 2, 3, and 4/5
(STA 146+00.00 to 303+55.12)
Atlanta, Fulton County, Georgia
Project No.: KMHRN-17-GA-01192-14

Dear Mr. Johnston,

United Consulting is pleased to submit this report of our Soil and Groundwater Management Plan (SGMP) for the above-referenced site. This SGMP is associated with the interim corrective actions needed for this project, and not for the overall final Atlanta BeltLine trail construction or the Type 5 risk reduction standard (RRS) approach. This document describes the known impacted areas and outlines the criteria for management or removal of the impacted soils/groundwater during the interim corrective action (remediation) activities. This SGMP can be updated (or an addendum issued) based on future data collected, if needed, and/or if unforeseen conditions are encountered during the site work activities. Should you have any questions regarding this project, we invite you to call at your convenience. Thank you for the opportunity to provide our services.

Sincerely,

UNITED CONSULTING

Brandon W. Sharp
Staff Environmental Engineer

Spencer C. Cox
Project Environmental Specialist

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Executive Vice President/Chief Consultant

BWS/SCC/RCG/rgw
SharePoint: 01192-14.SGMP

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1.0 EXECUTIVE SUMMARY[1]

This Soil and Groundwater Management Plan (SGMP) is intended to provide guidance on how the Remediation Contractor (RC) and their sub-contractors, if any, are to handle soils and groundwater from the Subject Property (as well as from offsite sources for import, as needed) during the needed interim remedial actions. Also, it provides a general framework for addressing potential health and safety concerns associated with the needed corrective action activities. A brief summary of this information is provided below. The text of the report must be reviewed for additional details.

- The Owner was awarded an Environmental Protection Agency (EPA) Brownfield Cleanup Grant. Guidance provided within this document, including proposed corrective actions, are required to be conducted in accordance with the EPA approved Quality Assurance Project Plan (QAPP). The QAPP outlines the participants involved, their roles in the cleanup, activities to be conducted, data quality objectives, sampling design, analytical sampling methodologies, and quality control/quality assurance (QA/QC) requirements.

- A site meeting shall be established by the RC prior to the on-set of this work to establish an understanding of the approach, field feasibility, and sequencing. Alterations to this plan are possible, as approved by the Owner (Atlanta BeltLine, Inc), their Civil Engineer (Kimley-Horn), and the Environmental Consultant (Consultant; United Consulting). At that meeting should be the Owner, Civil Engineer, Consultant, RC, and appropriate subcontractor(s) representatives, at a minimum.

- A Brownfield application for the Subject Property, via a Prospective Purchaser Corrective Action Plan (PPCAP, as amended) has been submitted to, and approved by, the Environmental Protection Division (EPD) Brownfield Unit. The Owner of the Subject Property has elected to certify the Subject Property to non-residential Type 3/4 Risk Reduction Standards (RRSs) for non-arsenic constituents and a Type 5 RRS approach for arsenic. Remediating arsenic (primarily) to the Type 3 RRS of 38 milligrams per kilogram is the focus of the interim corrective actions under this SGMP.

- Based on the soil sampling performed at the Subject Property to date, soils requiring remediation (i.e. excavation and appropriate landfill disposal) under this SGMP has been identified in 39 areas (referenced in the report as Remediation Areas). Most of these areas have been vertically and horizontally defined through pre-excavation site characterization sampling and delineation activities. A limiting condition of the delineation activities is the known utility conflicts through the corridor. Soil impacts remain undefined into and past the utilities in some instances. In these instances, such areas will require additional confirmatory sampling following utility removal (if such occurs) and/or prior to mass grading during future excavation activities. The delineated limits of the Remediation Areas, as established to the mapped utility conflicts, are shown on attached Figures. Removal of utility conflicts is not being addressed under this SGMP, rather the Remedial Areas will be conducted to within certain distances of the conflicts as outlined herein. The RC is fully responsible for identifying utility locations and potential conflicts relative to the remedial activities.

[1] This Executive Summary is not intended to be used or relied upon without reference to the entire report and cannot otherwise be properly understood and interpreted. It is provided solely for the convenience of the Client and not as a substitute for the report or review of the report.

- The estimated volume of the 39 Remediation Areas is approximately 975 cubic yards (CY). This is only an estimate and volume could be more or less, based on field conditions. For these areas, the RC is responsible for the excavation, transportation, and landfill disposal activities. They are responsible for securing the actual Subtitle D landfill acceptance (as acceptable), and preparing the necessary disposal profiles and manifests for the Owner, or their designees, to sign. The Owner must approve the RC selected landfill prior to actual disposal activities. Disposal manifests are required to be maintained.

- Once the 39 Remediation Areas are remediated by the RC, the remaining soils will be managed by the future General Contractor under a separate construction phase SGMP for each Segment.

- If unusual subsurface environmental conditions, including unusual odors, staining, pooled liquids, buried tank, drums, debris, or burial pits, etc. are discovered during remediation excavation activities, the RC should temporarily stop work, and contact the Consultant, in accordance with the Corrective Action Flow Chart provided within the QAPP, so the conditions can be assessed and incorporated into this plan. The RC is responsible for notifying the Owner and Consultant of such conditions. Based on the observations and associated testing, if conducted, the materials will be managed in accordance with this SGMP.

- No impacted groundwater has been detected at the Subject Property, at this time. If groundwater is encountered by the RC during remediation activities and needs to be managed in order to facilitate remediation, the RC is to contact the Consultant (in accordance with the QAPP) prior to management of such water. Depending on the location, coordination with the Owner in addition to supplemental testing may be required to determine the appropriate management.

- Following the soil removal activities at each of the 39 Remediation Areas, the remedial areas must be backfilled with clean soil or quarry stone such as graded aggregate base. Soil imported to the Subject Property is required to be documented as meeting cleanup standards for this project prior to import. Existing data must be obtained, or sampling is required prior to import. The RC is required to obtain the existing data, or the Consultant should be notified of the borrow source(s) by the RC at least 7 days in advance of importing so that samples can be obtained. The RC is responsible for identifying the borrow source, and having equipment at the source for the Consultant to collect the samples. If stone is used, it must be virgin quarry stone and not a recycled product. The import is to be approved by the Consultant prior to the import activity. Backfill compaction requirements are provided in Section 7.4.

- The RC is responsible for security of the site during the remedial activities, and at each remedial area.

- The soil management at the Subject Property is to be documented for the Owner. The Consultant is required to be onsite during remediation activities. The Consultant will observe and document the required corrective actions. The RC is required to provide the Consultant with the landfill disposal manifests. The RC is responsible for documenting the remaining aspects of this Plan and the QAPP. The RC is to provide weekly updates to the Consultant and Owner throughout the remediation process.

- Work shall be performed in accordance with Occupational Safety and Health Administration (OSHA) requirements. All companies involved are to prepare site-specific Health and Safety Plans (HASPs) for their workers and the tasks they are performing, as required by the regulations, and cleaning protocols for their personnel and equipment. The overall safety at the construction site is the responsibility of the RC.

2.0 PURPOSE

United Consulting has prepared this Soil and Groundwater Management Plan (SGMP) for the Atlanta BeltLine Southside Trail (Segments 2, 3, and 4/5) which is herein referred to as the Subject Property. This SGMP is associated with the interim corrective actions needed for this project, and not for the overall final Atlanta BeltLine trail construction or the Type 5 risk reduction standard (RRS) approach. This document is prepared on behalf of Atlanta BeltLine, Inc. (Owner). Implementation of this SGMP is the responsibility of the RC that is selected by the Owner. The means and methods for implementation are the responsibility of the RC, and their sub-contractors. Although this SGMP includes Segments 2, 3, and 4/5, we understand that the base contract will only include Segments 2 and 3 of the SST and an add alternate contract will be drafted thereafter to include Segments 4/5.

Guidance provided within this document, including proposed corrective actions, will be conducted in accordance with the EPA approved Quality Assurance Project Plan (QAPP). The QAPP outlines the participants involved, their roles in the cleanup, activities to be conducted, data quality objectives, sampling design, analytical sampling methodologies, and quality control/quality assurance (QA/QC) requirements.

Under the EPD approved PPCAP, as amended, soils on the Subject Property will need to meet criteria thresholds as set forth by the Georgia Brownfield Program in order for the Owner to certify compliance once the project is completed. The purpose of this SGMP is to provide guidance on how the Remediation Contractor (RC) is to handle soils at the Subject Property during the interim remediation process (including from off-site sources for import) and management procedures for the potential of encountering unforeseen impacted media. The plan also addresses the proper procedures for the disposal/handling of impacted groundwater should it be encountered during construction. Also, it provides a general framework for addressing potential health and safety concerns associated with the needed remediation activities.

United Consulting understands that the Owner has not selected a RC at this time. This report may be updated to include pertinent information once further information is available. United Consulting is the Owner's Environmental Consultant (Consultant).

3.0 SITE LOCATION, EXISTING & PROPOSED CONDITIONS

The Subject Property consists of an approximate 1.9-mile (for Segments 2 and 3, with an additional approximately 1.1 miles for Segments 4/5, if included) corridor situated on the historical railroad corridor located just west of the former railroad underpass at Interstate I-75/I-85 and extends northeastward along the former rail spur to Glenwood Avenue SE in Atlanta, Fulton County, Georgia. The SST is sub-divided herein as Segment 2 (I-75/I-85 to Milton Avenue SE), Segment 3 (Milton Avenue SE to just east of Boulevard SE), and Segment 4/5 (just east of Boulevard SE to Glenwood Avenue SE, the eastern terminus of the SST). As referenced on design plans, these portions of the SST (Segments 2, 3, and 4/5) extend from STA 146+00.00 to 303+55.12. The general location of the Subject Property and its Segments therein are illustrated on Figures 1 and 2.

Similar to the Eastside Corridor, the SST is designed as a public transportation right-of-way within a “green” setting. Generally, the proposed final trail construction is proposed along the northern and western sides (depending on the historic rail bed orientation) of the corridor, preserving space for future transit on the southern and eastern sides. The proposed final trail is generally being designed to accommodate walking, jogging, biking, roller skating and roller blading, as well as wheelchairs and mobility aids for the disabled. Currently, the Subject Property consists of an interim trail system that has been constructed generally along the current alignment of the former railroad bed. The SST will connect the Westside and Eastside Atlanta BeltLine Trails.

4.0 BACKGROUND

4.1 Atlanta BeltLine History

The Atlanta BeltLine is a comprehensive transportation, economic development and urban redevelopment effort in the COA. The Atlanta BeltLine is envisioned as a combination of greenspace, trails, transit, and new development along 22-miles of historic rail segments that encircle the urban core of the COA. The project is one of the largest efforts underway to remediate and redevelop environmentally impacted properties for the long-term benefit of the community. The Atlanta BeltLine has been separated into various segments, with the Subject Property known as Segments 2, 3, and 4/5 of the SST. The following summarizes environmental investigations and communications between ABI, various consultants, and the Georgia EPD regarding the overall Atlanta BeltLine project.

An initial Brownfield application was submitted to the EPD in December 2004 for the North Avenue BeltLine Tract in the form of a Brownfield Corrective Action Plan (CAP). Since that time, ABI and the Invest Atlanta (IA) has submitted numerous Amendments to the CAP.

In 2010, Atlanta BeltLine, Inc. (ABI) and the Atlanta Development Authority (now known as Invest Atlanta) submitted an Amendment to the Brownfield Corrective Action Plan to consolidate separate CAPs into a single revised CAP under the name Atlanta BeltLine Properties. In addition, parcels were added to incorporate them as part of the Atlanta BeltLine Properties under the approved Brownfield CAP. EPD subsequently provided a letter approving the requested Amendment and acknowledging that additional parcels will be incorporated into the Atlanta BeltLine Properties CAP as property acquisitions and developments proceed.

As described in the approved 2010 CAP Amendment (#1), areas, which warrant corrective action, will require confirmation soil sampling to further define the limits of impacted soil on the Subject Property that exceed the applicable soil Risk Reduction Standards (RRS). Soil areas that exceed the RRS will then be subject to further corrective action in order to bring the site into compliance with the approved CAP. Since future use of the Atlanta BeltLine Properties is as a linear system of trails, transit, and green space the primary intent of the applicants is to comply with non-residential soil RRS (Type 3 or 4). Where feasible, compliance with residential soil RRS (Type 1 or 2) is an optional goal. Where compliance with Type 1-4 soil RRS is technically impracticable, remedial action consistent with a Type 5 RRS approach will be executed.

In late 2010, MACTEC (now known as Wood PLC) completed a Phase I Environmental Site Assessment on the Atlanta BeltLine Corridor from Simpson Road to DeKalb Avenue in Atlanta, Fulton and DeKalb County, Georgia, which includes the Subject Property. MACTEC concluded that, in addition to the general environmental concerns associated with past site use, a number of adjacent properties along the corridor were identified as recognized environmental conditions (RECs) and environmental concerns relative to the subject site. MACTEC recommended subsurface sampling and testing along the corridor in the vicinity of the various identified RECs.

In March 2011, CAP Amendment #2 was submitted, which established a procedure whereby EPD will review and approve a site-specific Appendix to the CAP for each segment of the BeltLine. The document also included a presentation of various soil RRS, which were planned for use during the various corrective actions. On April 14, 2011, EPD approved CAP Amendment #2, which included Appendix B for the

Eastside Trail Project (10th Street and Monroe Drive south to DeKalb Avenue). The approval letter also approved certain RRS, which included those listed in Section A.2 of the Amendment.

In June 2019, Appendix F to PPCAP Amendment #2 was submitted, specifically related to the SST portion of the Atlanta BeltLine. The purpose of the submittal was to provide EPD with soil and groundwater data for the SST section of the Atlanta BeltLine corridor and to propose the corrective action approach for this trail section. On July 11, 2019, EPD approved this submittal. A copy of this report is included in Appendix A.

Arsenic was identified as a non-point source relic from historic pesticide application along the railroad corridor and therefore is exempt as a regulated substance. Although arsenic was considered to be an unregulated substance, ABI chose to give special attention to the arsenic impacts and a Type 5 RRS was developed. Under the developed Type 5 RRS, the use of engineering controls (i.e. exposure barriers) was selected to limit exposure as remediation of the extensive sporadic arsenic impacts was not feasible.

4.2 Phase II/Initial Brownfield Site Characterization Sampling

United Consulting completed a Phase II Environmental Assessment/Initial Brownfield Site Characterization Sampling (Phase II) on the Subject Property and other portions of the Southside Trail, report dated September 19, 2018. The scope of work for this assessment was based on MACTEC's previous findings in 2010. A total of 105 borings were advanced across the Southside Trail, with one shallow soil sample, generally in the top 2 feet (ft.) of the soil column collected from each boring. The soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) 8 Metals, and/or polychlorinated biphenyls (PCBs), depending on boring location.

The RRS for constituents detected to date on other portions of the Atlanta BeltLine Properties were established and approved by the EPD as part of Amendment #2 to the approved master CAP for the BeltLine properties. These RRS, as available, have been used for comparison in this report. For constituents detected in soil at the Subject Property, applicable non-residential RRS for arsenic, barium, cadmium, chromium, lead, mercury, benzene, tetrachloroethene, toluene, trichloroethene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene have been previously approved by the EPD. For constituents detected in soil at the Subject Property, the following do not have applicable non-residential RRS approved for the Subject Property to date: xylenes, acenaphthylene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. For comparison purposes, United Consulting developed non-residential RRS for these constituents following the pre-September 25, 2018 RRS methods.

Various VOCs, SVOCs, and RCRA 8 metals, were detected in some of the soil samples collected from the Subject Property. PCBs were not detected in soil samples collected from the Subject Property.

Benzene was detected above the NC in two of the soil samples collected from the Subject Property (EB-59, and EB-64); however, NCs do not apply to petroleum releases, which benzene is anticipated to be associated with.

Benzo(a)pyrene was detected above it applicable non-residential RRS in various soil samples collected from the Subject Property (EB-44, EB-46, EB-57, EB-64, and EB-102). Benzo(b)fluoranthene was detected above its NC and non-residential RRS in multiple soil samples collected from the Subject Property. (EB-44 and EB-65). Lead was detected above its NC and non-residential RRS in one of the soil samples collected from the Subject Property (EB-103).

Arsenic was detected above its Type 3 non-residential RRS in the soil samples collected from 0 to 2 ft bgs in 42 of the borings, and of these samples, 29 exceeded the site-specific Type 5 Recreational Child RRS (63 mg/kg) for arsenic.

4.3 Non-Arsenic Delineation Sampling and Remediation

United Consulting mobilized to the Subject Property on multiple occasions between March and May 2019 to conduct pre-excavation delineation sampling of each of the areas identified to have various non-arsenic constituents above non-residential RRS, in accordance with the Appendix F to CAP Amendment #2.

These areas were identified as Remediation Areas 2 through 9, which concerned the areas of EB-44, EB-46, EB-57, EB-59, EB-64, EB-65, EB-102, and EB-103. At these eight soil borings, a total of 56 hand auger borings were advanced to obtain soil samples for potential laboratory analysis. This included six borings around each of the original borings with impact concentrations above their applicable RRS (two step outs of three borings each), plus one boring at the original boring location with the exceedance for vertical delineation. These borings were advanced to depths of approximately 2 to 5 feet.

One sample from each of the 56 borings was collected for the potential laboratory analysis of arsenic, lead, benzene, benzo(a)pyrene, and/or benzo(b)fluoranthene, depending on the constituents detected at the respective original boring location. Although this assessment was performed for the purposes of delineating non-arsenic constituents, arsenic was analyzed in the step-out borings if there was an exceedance of arsenic at the original boring location. The samples from each of the horizontal step-out borings were collected from within apparent fill materials. The samples from each of the vertical delineation borings were collected at depth intervals of approximately 2.5-3 feet below ground surface (ft. bgs) and 3.5 to 4 ft. bgs.

Soil samples collected from each set of three inner step-out borings were advanced in three equidistant directions from the original boring, if possible, and analyzed for the respective constituents. Soil samples were collected from a second set of three outer step-out borings, and these samples were submitted to the laboratory on hold, and analyzed only if the inner step-out boring from that direction still exceeded applicable non-residential RRS for the respective constituent(s). A minimum safe buffer distance of 5 feet from utilities was required per the existing master BeltLine CAP. Step-out boring directions were modified accordingly to avoid breaching the approximate 5-foot safe distance buffer, per approximate utility locations presented to United Consulting in CAD files and original GDOT fiber plans. The results of this non-arsenic delineation sampling were presented in a report dated April 2, 2019 and additionally illustrated the proposed Remediation Areas. The contaminated soils from these eight Remediation Areas, approximately 49.7 tons, were subsequently removed and disposed of at the Eagle Point Subtitle D landfill, in Ball Ground, Georgia. The remaining soils, as documented through delineation sampling, were identified to be below non-residential RRS for non-arsenic constituents.

4.4 Additional Delineation Sampling, July 2020

United Consulting mobilized to the Subject Property on several days between July 8th and 20th, 2020 to conduct additional sampling, which generally included advancing delineation borings around the borings where arsenic was detected at concentrations requiring initial remediation (prior to the final Type 5 RRS approach). A total of 249 hand auger borings were advanced across the Segments of the Subject Property to obtain soil samples for potential laboratory analysis. This generally included six borings (two step-outs of three borings) around each of the original borings with impact concentrations above applicable RRS, plus one boring at the original boring location with the exceedance for vertical delineation. The borings were advanced to depths of approximately 2 to 4 feet.

One sample from the 210 horizontal step-out borings as well as two samples from the 39 vertical delineation borings were collected for potential laboratory analysis of arsenic. The samples from each of the horizontal step-out borings were collected from within apparent fill materials, from a depth interval of approximately 0 to 2 feet. The samples from each of the vertical delineation borings were typically collected at depth intervals of approximately 2.5-3 feet below ground surface (ft. bgs) and/or 3.5 to 4 ft. bgs.

Following the methodology of previous delineation sampling, soil samples collected from the set of three inner step-out borings were advanced in equidistant directions from the original boring, as possible, and analyzed for arsenic. Soil samples collected from the second set of three outer step-out borings, were submitted to the laboratory on hold, and analyzed only if the inner step-out boring from that direction still exceeded applicable non-residential RRS for arsenic. A minimum safe buffer distance of 5 feet from utilities is required per the existing master BeltLine CAP. Step-out boring directions were modified accordingly to avoid breaching the approximate 5-foot safe distance buffer, per approximate utility locations presented to United Consulting in CAD files, original GDOT fiber plans, and/or field utility locating, as available. This sampling was conducted in the event that utility removal would be conducted at a later point. Remediation area shapes were generated based on the analytical results from the step out borings. The shapes of the remediation areas were generally oval-shaped, based on the three-direction step-out boring approach, and consistent with remediation performed on other portions of the BeltLine. The shapes and sizes of the remediation area will be determined during the remediation activities in the field, based on field conditions (i.e. utility locations determined by the remediation contractor). Consistent with previous delineation sampling activities, fill soils were observed predominantly from the surface up to depths of approximately four feet. The fill materials generally consisted of black to dark brown silty sands and railroad ballast.

Additionally, 19 soil samples were also collected, and subsequently composited, from the remediation areas for the analysis of RCRA metals via the toxicity characteristic leaching procedure (TCLP) to assess potential landfill disposal options. These samples included those collected from borings EB-34, EB-35, EB-37, EB-39, EB-40, and EB-46 from Segment 2; EB-51, EB-53, EB-59, EB-65, EB-73, and EB-74 from Segment 3; and EB-87, EB-91, EB-93, EB-98, and EB-101 from Segment 4/5. Based on this disposal sampling, soils are anticipated to be characteristically non-hazardous.

5.0 DISTRIBUTION OF SOIL IMPACTS

Based on the distribution of impacts across the Subject Property, the Owner under the approved CAP has elected to certify the Subject Property to non-residential Type 3/4 RRSs for non-arsenic constituents and a Type 5 RRS approach for arsenic. Soils with known non-arsenic constituent concentrations above the EPD approved non-residential RRS require removal and landfill disposal. For arsenic, the previous sample locations with concentrations above 38 mg/Kg require removal to established limits with concentrations less than this standard (at delineation borings), or a distance of approximately 10 feet beyond the second delineation sample location with a concentration above 38 mg/Kg.

Based on the soil sampling performed to date, soil impacts that will require remediation under the EPD approved PPCAP, as amended, have been delineated to the minimum safe buffer of active utilities, as applicable. In accordance with Appendix F to PPCAP Amendment #2, where utilities are going to be removed to facilitate the construction of the project, additional delineation and remediation will be required. Currently, there are 39 known areas that require remediation. These areas are the focus of this SGMP.

Where previously drilled and sampled, the Subject Property is underlain by fill materials with depths ranging from approximately one to greater than 25 feet. The fill soils generally consisted of track ballast/gravel and silts, clays, and sands. This fill appeared to be black to dark gray with depths ranging from approximately 1 to 4.5 feet bgs. The average thickness of the black to dark gray fill was approximately 2.5 feet. Sampling locations were conducted in accordance with the PPCAP sampling scheme, as amended. After the known non-arsenic constituents impacts with concentrations above the non-residential RRS are remediated, some non-arsenic impacted soils will remain, but their concentrations are below the non-residential RRS and most are below Type 1 residential RRS. At the arsenic Remediation Areas, arsenic impacted concentrations may remain above the non-residential RRS of 38 mg/Kg. However, these impacted soils can remain onsite due to the approved Type 5 RRS approach, which is further discussed below. Special management of the remaining impacted soils on the Subject Property, post removal of the 39 Remediation Areas is required as detailed below in the Impacted Soil Management Procedures section.

5.1 Soil Impacts Requiring Remediation (Segment 2)

A total of 12 areas requiring remediation for arsenic have been identified. At each of the remediation areas, the vertical delineation samples were identified as in compliance with the applicable RRS and varied in depths from approximately 1 ft bgs to 3 ft bgs. At four of the twelve locations, vertical delineation was attempted, but could not be achieved; as such, vertical remediation for arsenic is controlled by the proposed trail elevation and the Type 5 RRS approach under the BeltLine CAP. Figure 3A shows the overall locations of the remediation areas for Segment 2 of the Southside Trail. Figures 3B through 3L show the individual remediation areas, their locations, associated sample points, and estimated remediation limits.

Remediation Area 2 (EB-44)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-44. Additionally, benzo(a)pyrene and benzo(b)fluoranthene was detected at the original boring location at a concentration exceeding non-residential RRS (that remedial area was an approximate 10-foot square, which was

delineated and remediated in May 2019). Arsenic was additionally detected at concentrations exceeding applicable RRS in the inner and outer step-out borings to the northwest and east. Arsenic detections at the outer step-out to the south was identified below non-residential RRS.

In accordance with Appendix F to CAP Amendment #2, the excavation will extend to within the five-foot buffer of the utility to the north. Based on the excavation boundary defined by a ten-foot lateral expansion from the furthest step-out borings in this are to the east, to within the five-foot utility buffer to the north, and to the outer step-out to the south, the review of provided trail plans for cut/fill analysis which supports a 3-foot vertical removal at this area, and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 42.4 cubic yards (CY) of soil is estimated for excavation and offsite disposal.

Remediation Area 3 (EB-46)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-46. Additionally, benzo(a)pyrene was detected at the original boring location at a concentration exceeding non-residential RRS (that remedial area was an approximate 10-foot square, which delineated and remediated in May 2019). Arsenic was additionally detected at concentrations exceeding applicable RRS in the inner and outer step-out borings to the southeast, west, and north of the original boring location. Due to multiple utility conflicts across the central portion of the location, at this time, the arsenic excavation is bifurcated by a ten-foot band buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north inner step-out boring northward to ten feet past the outer step-out boring and then from the second step-out borings (to the west and southeast) to within five feet from the limiting utilities at the center and/or to the property boundary. The required vertical excavation depth is 2.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 34.4 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 29 (EB-33)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-33. Arsenic was additionally detected at concentrations exceeding the applicable RRS in the inner step-out boring to the north; however, the second outer step-out boring was below applicable RRS defining the extent of excavation to the north. Arsenic detections at the inner step-outs to the southwest and southeast were identified below non-residential RRS.

Based on the aforementioned boundary definition and the review of provided trail plans for cut/fill analysis which supports a 3-foot vertical removal at this area, a total of approximately 14.1 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 30 (EB-34)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-34. Arsenic was additionally detected at concentrations exceeding the applicable RRS in both the inner and outer step-out borings to the north and southwest of the original boring location. Arsenic detections at the inner step-

out to the southeast was identified below non-residential RRS. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north and southwest inner step-out boring ten feet past the outer step-out boring.

Based on the aforementioned boundary definition and the review of provided trail plans for cut/fill analysis which supports a 2-foot vertical removal at this area, a total of approximately 36.3 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 31 (EB-35)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-35. Arsenic was additionally detected at concentrations exceeding the applicable RRS in both the inner and outer step-out borings to the north and southwest of the original boring location. Arsenic detections at the outer step-out to the southeast was identified below non-residential RRS. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north and southwest inner step-out boring ten feet past the outer step-out boring.

Based on the aforementioned boundary definition and the review of provided trail plans for cut/fill analysis which supports a 2-foot vertical removal at this area, a total of approximately 45.9 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 32 (EB-36)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-36. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the north, southeast, and southwest of the original boring location. In accordance with the Appendix F to CAP Amendment #2, the excavation at this location will extend ten feet laterally beyond the second step-out iteration, further bound by utilities to the south.

Based on the excavation boundary defined by a ten-foot lateral expansion from the furthest step-out borings in this area, the review of provided trail plans for cut/fill analysis which supports a 2-foot vertical removal at this area, and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 63.3 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 33 (EB-37)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-37. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the northwest and south of the original boring location. Arsenic detections at the outer step-out to the northeast was identified below non-residential RRS. In accordance with the Appendix F to CAP Amendment #2, the excavation at this location will extend ten feet laterally beyond the second step-out iteration, further bound by utilities to the south.

Based on the excavation boundary defined by a ten-foot lateral expansion from the furthest step-out borings in this area, the review of provided trail plans for cut/fill analysis which supports a 3-foot vertical removal at this area, and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 75.1 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 34 (EB-38)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-38. Arsenic was additionally detected at concentrations exceeding the applicable RRS in the inner step-out borings; however, the second outer step-out borings were all below applicable RRS defining the extent of excavation in each direction.

Based on the aforementioned boundary definition and the review of provided trail plans for cut/fill analysis which supports a 2-foot vertical removal at this area, a total of approximately 22.5 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 35 (EB-39)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-39. Arsenic was additionally detected at concentrations exceeding applicable RRS in the inner and outer step-out borings to the southeast of the original boring location. Arsenic concentrations were identified below RRS at the first step-out boring to the north and the second step-out boring to the southwest. Due to multiple utility conflicts across the central portion of the location, at this time, the arsenic excavation is bifurcated by a ten-foot band buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north and south of the utility buffer (five feet) to ten feet past the outer step-out boring southeast (further limited by additional utilities to the south) and then to the defined extents at the southwest and north with samples below RRS. The required vertical excavation depth is 3.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 30.1 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 36 (EB-40)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-40. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the southwest and east of the original boring location. Arsenic detections at the initial step-out to the northwest was identified below non-residential RRS. In accordance with the Appendix F to CAP Amendment #2, the excavation at this location will extend ten feet laterally beyond the second step-out iteration, further bound by utilities to the south.

Based on the excavation boundary defined by a ten-foot lateral expansion from the furthest step-out borings in this area, the review of provided trail plans for cut/fill analysis which supports a 1-foot vertical removal at this area, and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 16.3 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 37 (EB-41)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-41. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the northeast of the original boring location. The outer step-out boring was located in the vicinity

of the GDOT utility which was field-located approximately five feet north of the boring. In accordance with Appendix F to CAP Amendment #2, the excavation will extend to within the five-foot buffer of the utility to the north. Arsenic was detected at concentrations below applicable RRS in both the inner step-out borings to the southwest and east, defining the extents of excavation in these directions.

Based on the aforementioned boundary definition and the review of provided trail plans for cut/fill analysis which supports a 1-foot vertical removal at this area, a total of approximately 3.7 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 38 (EB-45)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-45. Arsenic was additionally detected in the inner step-out borings; however, at concentrations below the applicable RRS defining the extent of excavation in each direction.

Based on the aforementioned boundary definition and the review of provided trail plans for cut/fill analysis which supports a 2-foot vertical removal at this area, a total of approximately 5.7 CY of soil is estimated for excavation and offsite disposal.

5.2 Soil Impacts Requiring Remediation (Segment 3)

A total of 13 areas requiring remediation for arsenic have been identified. At each of the remediation areas, the vertical delineation samples were identified as in compliance with the applicable RRS and varied in depths from approximately 1 ft bgs to 3 ft bgs. At five of the thirteen locations, vertical delineation was attempted, but could not be achieved; as such vertical remediation for arsenic is controlled by the proposed trail elevation and the Type 5 RRS approach under the BeltLine CAP. Figure 4A shows the overall locations of the remediation areas for this Segment 3 of the Southside Trail. Figures 4B through 4M show the individual remediation areas, their locations, associated sample points, and estimated remediation limits.

Remediation Area 4 (EB-57)

As previously indicated, Remediation Area 4 was previously remediated for benzo(a)pyrene. Initial soil testing at sample location EB-57 did not identify arsenic at concentrations above non-residential RRS. Therefore, additional delineation at this location was not warranted.

Remediation Area 5 (EB-59)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-59. Additionally, benzene was detected at the original boring location at a concentration exceeding non-residential RRS (that remedial area was limited due to the existing utilities to the north, which was therein conditionally delineated and remediated in May 2019). Arsenic was additionally detected at concentrations exceeding applicable RRS in the inner and outer step-out borings to the west of the original boring location. Delineation was achieved to the south at the first step-out, and east at the second step-out location. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend ten feet past the outer step-out boring to the west, delineated by the inner and outer

step-out borings to the south and east, and then restricted by the utility to the north. The required vertical excavation depth is 2.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 3.1 CY of soil is estimated for excavation and offsite disposal. This excludes volume associated with previous non-arsenic remediation.

Remediation Area 6 (EB-64)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-64. Additionally, benzene was detected at the original boring location at a concentration exceeding non-residential RRS (that remedial area was limited due to the existing utilities to the north, which was therein conditionally delineated and remediated in May 2019). Arsenic was additionally detected at concentrations exceeding applicable RRS in the inner and outer step-out borings to the west of the original boring location. Delineation was achieved to the south and east at the inner step-out location. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend ten feet past the outer step-out boring to the west, delineated by the inner step-out borings to the south and east, and then restricted by utilities to the north. The required vertical excavation depth is 2.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 5.4 CY of soil is estimated for excavation and offsite disposal. This excludes volume associated with previous non-arsenic remediation.

Remediation Area 7 (EB-65)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-65. Additionally, benzo(a)pyrene and benzo(b)fluoranthene were detected at the original boring location at concentrations exceeding non-residential RRSs (that remedial area was an approximate 10-foot square, which was delineated and remediated in May 2019). Arsenic was additionally detected at concentrations exceeding applicable RRS in the inner and outer step-out boring to the southeast of the original boring location. Delineation was achieved to the north and southwest at the inner and outer step-out locations, respectively. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend ten feet past the outer step-out boring to the southeast, and are delineated by the step-out borings to the southwest and north. The required vertical excavation depth is 2.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 21.9 CY of soil is estimated for excavation and offsite disposal. This excludes volume associated with previous non-arsenic remediation.

Remediation Area 39 (EB-51)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-51. Arsenic was additionally detected at concentrations exceeding applicable RRS in the inner and outer step-out boring to the northwest, but below applicable RRS at both the inner step-out borings to the east and southwest. Based on the aforementioned boundary definition and our review of provided trail design plans (for cut/fill analysis), a 1-foot vertical removal is supported at this area and a total of approximately 5.1 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 40 (EB-53)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-53. Arsenic was additionally detected at concentrations below applicable RRS in the outer step-out borings to the north, east, and southwest of the original boring location. Due to utility conflicts across the central portion of the location, at this time, the excavation is bifurcated by a ten-foot band buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north and south of the utility buffer (five feet) and extend to the defined boundaries with samples below RRS at the north, east, and southwest. The required vertical excavation depth is 3 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 19.4 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 41 (EB-54)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-54. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the northeast of the original boring location. Arsenic detections at the inner step-out boring to the south and the outer step-out boring to the northwest were identified below RRS. In accordance with the Appendix F to CAP Amendment #2, the excavation at this location will extend ten feet laterally beyond the outer step-out boring to the northeast.

Based on the excavation boundary defined by a ten-foot lateral expansion from the step-out boring to the northeast, delineation to the northwest/south, and our review of provided trail plans (for cut/fill analysis), a 1-foot vertical removal is supported at this area and a total of approximately 11.9 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 42 (EB-55)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-55. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the north and southwest of the original boring location. Arsenic was detected at the outer step-out boring to the southeast below RRS. Due to utility conflicts nearest the outer step-out boring to the north, at this time, the arsenic excavation is bifurcated by a ten-foot band buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from to outer step-out to the southeast, southwestward to ten feet past the outer step-out boring to the southwest, and then from the within five feet of the limiting utilities near the outer step-out boring to the north; furthermore, based on the location of these utilities, a small portion to the north of the second step-out north will also require remediation. The required vertical excavation depth is 2.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 48.2 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 43 (EB-56)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-56. Arsenic was additionally detected at concentrations below applicable RRS in the outer step-out borings to the north, southeast, and southwest of the original boring location. Due to utility conflicts across the central portion of the location, at this time, the arsenic excavation is bifurcated by a ten-foot band buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north and south of the utility buffer (five feet) and extend to the defined boundaries with samples below RRS at the north, southeast, and southwest. The required vertical excavation depth is 2.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 17.0 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 44 (EB-60)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-60. Arsenic was additionally detected at concentrations below applicable RRS in the inner step-out borings to the northeast, southeast, and west of the original boring location. Due to utility conflicts along the southern extent of the remediation area, at this time and in accordance with the Appendix F to CAP Amendment #2, the limits of the remediation area are limited to within five feet of these utilities and extend to the inner step-out borings to the northeast and west. The required vertical excavation depth is 2.0 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 5.2 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 45 (EB-62)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-62. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the northwest of the original boring location. Arsenic was detected at concentrations below applicable RRS in the inner step-out borings to the south and northeast of the original boring location. Due to utility conflicts along the southern extent of the remediation area, at this time and in accordance with the Appendix F to CAP Amendment #2, the limits of the remediation area are limited to within five feet of these utilities and extend to the inner step-out boring to the northeast, and ten feet past the outer step-out boring to the northwest. The required vertical excavation depth is 6 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 38.9 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 46 (EB-69)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-69. Arsenic was additionally detected at concentrations below applicable RRS in each of the inner step-out borings to the northwest, southwest, and east of the original boring location. Due to utility conflicts along the southern

extent of remediation, at this time, the arsenic excavation is limited to within the safe five-foot utility buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend to within five feet of the utility buffer and to the defined inner step-out boring below RRS to the northwest. The required vertical excavation depth is 1 foot.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 1.1 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 47 (EB-73)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-73. Arsenic was additionally detected at concentrations below applicable RRS in the outer step-out borings to the north, southeast, and southwest of the original boring location. Due to utility conflicts across the central portion of the location, at this time, the arsenic excavation is bifurcated by a ten-foot band buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north and south of the utility buffer (five feet) and to the outer step-out borings below RRS to the north, southwest, and southeast. The required vertical excavation depth is 5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 25.9 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 48 (EB-74)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-74. Arsenic was additionally detected at concentrations exceeding the applicable RRS in both the inner and outer step-out borings to the southwest of the original boring location. Arsenic detections at each of the inner step-out borings to the southeast and north were identified below non-residential RRS. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend to the north and southeast inner step-out borings and ten feet past the outer step-out boring to the southwest.

Based on the aforementioned boundary definition and our review of provided trail plans (for cut/fill analysis), a 3-foot vertical removal is supported at this area and a total of approximately 29.0 CY of soil is estimated for excavation and offsite disposal.

5.3 Soil Impacts Requiring Remediation (Segment 4/5)

A total of 14 areas requiring remediation for arsenic have been identified. At each of the remediation areas, the vertical delineation samples were identified as in compliance with the applicable RRS and varied in depths from approximately one foot bgs to 3.5 ft bgs. At five of the fourteen locations, vertical delineation was attempted, but could not be achieved; as such, vertical remediation for arsenic is controlled by the proposed trail elevation and the Type 5 RRS approach under the BeltLine CAP. Figure 5A shows the overall locations of the remediation areas for Segment 4/5 of the Southside Trail. Figures 5B through 5O show the individual remediation areas, their locations, associated sample points, and estimated remediation limits.

Remediation Area 49 (EB-80)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-80. Arsenic was additionally detected at concentrations below applicable RRS in the outer step-out borings to the north, southeast, and southwest of the original boring location. The required vertical excavation depth is 3.0 feet. Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 25.6 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 50 (EB-81)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-81. Although shallow delineation sampling was conducted, the entire remediation area is in conflict with known existing utilities. Therefore, in accordance with the Appendix F to CAP Amendment #2, remediation is not required for this area unless the utility is to be removed. If grading plans in this area change, United Consulting should be contacted to evaluate the required management procedures and update this plan, as needed.

Remediation Area 51 (EB-82)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-82. Arsenic was additionally detected at concentrations below applicable RRS in the inner step-out borings to the north, southwest, and southeast of the original boring location. Due to utility conflicts along the southern extent of remediation, at this time, the excavation is limited to within the safe five-foot utility buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend to within five feet of utilities and to the defined step-out boring below RRS to the north. The required vertical excavation depth is 2 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 2.4 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 52 (EB-87)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-87. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the southwest and north of the original boring location. Arsenic detections at the inner step-out to the southeast were identified below non-residential RRS. In accordance with the Appendix F to CAP Amendment #2, the excavation at this location will extend ten feet laterally beyond the second step-out iteration to the north and southwest; however, due to utility conflicts along the northwest of remediation area, at this time, the excavation is limited to within the safe five-foot utility buffer in this direction.

Based on the excavation boundary defined by a ten-foot lateral expansion from the furthest step-out borings in this area, the review of provided trail plans (for cut/fill analysis), a 3.5-foot vertical removal is supported at this area and a total of approximately 42.8 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 53 (EB-88)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-88. Arsenic was additionally detected at concentrations below applicable RRS in the inner step-out borings to the north, southeast, and southwest of the original boring location. Due to utility conflicts across the central portion of the location, at this time, the excavation is bifurcated by a ten-foot band buffer. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend from the north and south of the utility buffer (five feet) to the defined boundaries with samples below RRS. The required vertical excavation depth is 2 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 1.2 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 54 (EB-90)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-90. Although shallow delineation sampling was conducted, the entire remediation area is in conflict with known existing utilities. Therefore, in accordance with the Appendix F to CAP Amendment #2, remediation is not required for this area unless the utility is being removed. If grading plans in this area change, United Consulting should be contacted to evaluate the required management procedures and update this plan, as needed.

Remediation Area 55 (EB-91)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-91. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the north of the original boring location. Arsenic detections at the outer step-out to the southeast and southwest were identified below non-residential RRS. In accordance with the Appendix F to CAP Amendment #2, the excavation at this location will extend ten feet laterally beyond the outer step-out boring to the north, to the outer step-out boring to the southwest, and to within five feet of the utility buffer along the southwest extents of remediation area.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 12.8 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 56 (EB-92)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-92. Arsenic was additionally detected at concentrations below applicable RRS in the inner step-out borings to the north, southeast, and southwest of the original boring location. The required vertical excavation depth is 1.0 foot.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 2.5 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 57 (EB-93)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-93. Arsenic was additionally detected at concentrations below the applicable RRS in the inner step-out borings to the north, southeast, and southwest. However, in accordance with the Appendix F to CAP Amendment #2 and following our review of provided trail plans, at least one foot of fill is anticipated to be placed across this area to establish final grades. Therefore, no further delineation and/or excavation at EB-93 is required at this time. If grading plans in this area change, United Consulting should be contacted to evaluate the required management procedures and update this plan, as needed.

Remediation Area 58 (EB-96)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-96. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the north of the original boring location. Arsenic was detected at the inner step-out to the southeast and southwest at concentrations below RRS. Due to utility conflicts nearest the initial boring (EB-96), at this time, the excavation is limited to within the five-foot safe buffer distance. Therefore, in accordance with the Appendix F to CAP Amendment #2, the excavation will extend ten feet laterally beyond the outer step-out boring to the north and southward to within the safe five-foot utility buffer. The required vertical excavation depth is 2 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 7.9 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 59 (EB-97)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-97. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the southwest and southeast of the original boring location. Delineation was achieved to the north at the outer step-out boring location, below RRS. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend ten feet past the outer step-out borings to the southeast and southwest, and are delineated by the step-out boring to the north. The required vertical excavation depth is 2.5 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 59.1 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 60 (EB-98)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-98. Arsenic was additionally detected at concentrations below applicable RRS at the inner step-out borings to the north and outer step-out borings to the southeast and southwest of the original boring location. The required vertical excavation depth is 1 foot.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 6.2 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 61 (EB-101)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-101. Arsenic was additionally detected at concentrations exceeding applicable RRS in both the inner and outer step-out borings to the southeast of the original boring location. Delineation was achieved to the north at the outer step-out boring and to the southwest at the inner step-out boring. Based on these conditions, in accordance with the Appendix F to CAP Amendment #2, the excavation boundaries extend ten feet past the outer step-out boring to the southeast, and are delineated by step-out borings to the north and southwest. The required vertical excavation depth is 2 feet.

Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 24.3 CY of soil is estimated for excavation and offsite disposal.

Remediation Area 62 (EB-104)

Arsenic was detected at a concentration exceeding non-residential RRS at EB-104. Arsenic was additionally detected at concentrations below applicable RRS in the inner step-out borings to the north, southeast, and southwest. The required vertical excavation depth is 2.0 feet. Based on the aforementioned boundary definition and maintaining a safe buffer distance to utilities as shown on the CAD drawings, a total of approximately 5.5 CY of soil is estimated for excavation and offsite disposal.

5.4 Estimated Soil Remediation Volumes Per Remediation Area

Tables 3A through 3C of this report summarize the estimate volumes of impacted soils, per Segment, requiring interim remediation to meet the conditions or the PPCAP, as amended. This only applies to the 39 Remediation Areas identified for remediation in accordance with the PPCAP, as amended. It does not include additional volumes that may require landfill disposal if soils require removal from the limits of the existing railroad corridor to facilitate construction (which would be addressed under the future SGMPs). These volumes are based on freestanding vertical excavations with no benching, shoring, or setbacks. Based on the above, with a 20% contingency, there is an estimated 975 CY of impacted soils that need to be excavated and disposed of in an appropriately licensed landfill. This is only an estimate and volume could be more or less, based on field conditions. The estimated cubic yardage is an estimated in situ volume, which equates to approximately 1,462 tons.

6.0 GROUNDWATER IMPACTS AND MANAGEMENT

A total of twenty-two (22) groundwater samples have been collected across the Subject Property from temporary monitoring by United Consulting. To date, VOC, SVOC, and/or PCB groundwater impacts were not detected in the samples obtained. Dissolved concentrations of barium were detected in various groundwater samples below its MCL and Type 1 GC. No other RCRA metals have been detected in the dissolved samples. Limited detections of total metals (including barium, chromium, and lead) were detected in totals analysis which is likely indicative of suspected solids. United Consulting's groundwater analytical testing results are summarized in Table 2. Based on the data collected, groundwater impacts have not been detected at the Subject Property.

In June 2018, stabilized groundwater depths at the Subject Property ranged from approximately 18 ft bgs to 26 ft bgs. Groundwater below the Subject Property has been estimated to be generally flowing to the northeast along this portion of the corridor.

If groundwater is encountered by the RC or its sub-contractors during remediation activities and needs to be managed to facilitate remediation, the RC is to contact the Consultant prior to management of such water. Depending on the location, testing may be required to determine the appropriate management. If impacted, such groundwater will likely either need to be pumped into a frac tank for analysis and subsequent appropriate offsite disposal, or pumped directly into the public sanitary sewer under an approved discharge permit. The RC is responsible for coordinating, permitting, and disposing of such groundwater.

7.0 IMPACTED SOIL MANAGEMENT PROCEDURES

A site meeting shall be established by the RC prior to the on-set of this work to establish an understanding of the approach, field feasibility, and sequencing. Alterations to this plan are possible, as approved by the Owner (Atlanta BeltLine, Inc), their Civil Engineer (Kimley-Horn), and the Environmental Consultant (Consultant; United Consulting). At that meeting should be the Owner, Civil Engineer, Consultant, RC, and their subcontractor(s) representative, at a minimum.

7.1 Surveying Control

Impacted soils requiring corrective actions have been identified and delineated, as applicable. The limits of the areas requiring remediation are illustrated on the included Figures. The Consultant at the request of the RC will mark the established removal areas and maintain survey control so that appropriate actions can be taken and documented during the remediation process. However, the RC is fully responsible for identifying utility locations and potential conflicts relative to the remedial activities.

7.2 Soil Grading

Should additional potentially impacted material be identified during remediation, (see Section 8.0) the Contractor must notify the Consultant within 24-hours and prior to further disturbing the suspect materials. The Consultant will observe and document the location of the suspect materials, and determine the appropriate actions that must be taken and documented during the development process. Soils removed for landfill (or other) disposal and other impacted soils (as discussed below) re-used on site should have their placement documented.

All excavation and disposal shall be conducted according to applicable City, County, State and Federal regulations. Impacted soil shall be managed in accordance with the QAPP and PPCAP, as amended, and this SGMP. These are the responsibility of the RC.

7.3 Soils Disposal

7.3.1 Impacted Soils Requiring Corrective Action

As indicated above, based on the soil sampling performed at the Subject Property to date, there are 39 removal areas that will require remediation for various SVOCs and metals, primarily arsenic. Initial landfill characterization analysis was conducted via the Toxicity Characteristic Leaching Procedure (TCLP). That testing supported its likely disposal at a Subtitle D landfill.

Soils requiring remediation can be placed directly into trucks for off-site hauling to the appropriate landfill. Alternatively, they can be stockpiled and/or containerized (roll-off boxes) prior to hauling to the landfill. The RC is responsible for the excavation, transportation, and landfill disposal activities. The RC is responsible for securing the actual Subtitle D landfill acceptance (as applicable), and preparing the necessary disposal profiles and manifests for the Owner, or their designated representative, to sign. The Owner must approve the RC selected landfill prior to actual disposal activities. Disposal manifests are required to be maintained by the RC, who will provide final manifests to the Consultant.

Should additional soils requiring remediation be discovered, the Consultant is required to be onsite during the remediation activities for documentation purposes, and to collect confirmation samples, if needed, as required under the PPCAP.

7.3.2 Remaining Soils

Once the above areas are remediated by the RC, the remaining soils will be managed by the future GC in accordance with a forthcoming construction SGMP for each Segment.

7.4 Import Fill

Following the soil removal activities at each of the 39 Remediation Areas, the remedial areas must be backfilled with clean soil or quarry stone such as graded aggregate base. Backfilling of the remediation excavations is to be accomplished using clean off-site soil or quarry stone. For import, the RC must obtain environmental documentation regarding the import. This is to include either a Phase I or II Environmental Assessment for the borrow source with documentation of no environmental concerns associated with the export area. The RC must provide the available reports to the Consultant for review and approval prior to importing. Otherwise, soil sampling will be required for analytical testing. The Consultant should be notified of the borrow source(s) by the RC at least 7 days in advance of importing so that samples can be obtained. The RC is responsible for identifying the borrow source, and having equipment at the source for the Consultant to collect the samples. A testing frequency will be conducted at a rate of one sample for every approximate 1,000 yards of import fill soil and a minimum of one sample per source. The Consultant would provide the RC notification of the testing results, and environmental suitability of the proposed borrow source. Other testing may also be required relative to engineering requirements of import. If stone is used, it must be virgin quarry stone and not a recycled product.

Soil backfill is to be placed in thin lifts (not to exceed 8-inch loose thickness) and compacted. The soil fill shall be compacted to at least 98 percent of Standard Proctor (ASTM D 698) maximum dry density within the top two (2) feet and at least 95 percent of Standard Proctor maximum dry density elsewhere on the site, as applicable. If graded aggregate base stone is used, it is to be placed in thin lifts (not to exceed 8-inch loose thickness) and compacted. The stone fill shall be compacted to at least 98 percent of the materials Modified Proctor (ASTM D 1557) maximum dry density. Soil or stone is to be at a moisture content that allows for proper compaction.

7.5 Dust Control

The RC is to use best management practices to reduce surface activities and/or air movement that can cause dust to be generated from disturbance of soil surfaces. The RC will have to determine which practices accommodate site-specific conditions. Control measures and design criteria could include: sprinkling/irrigation, mulch, and wind breaks. Controls conducted should be documented and adjusted as site conditions change.

If requested by the Owner, the Consultant could implement a dust-monitoring program during the removal of the Remediation Areas.

8.0 UNFORESEEN CONDITIONS

If unusual subsurface environmental conditions, including unusual odors, staining, pooled liquids, buried tank, drums, debris, or burial pits, etc. are discovered during site work activities, the RC should temporarily stop work, and contact the Consultant so the conditions can be assessed and incorporated into this plan. The RC is responsible for notifying the Owner and Consultant of such conditions. Based on the observations and associated testing, if conducted, the materials will be managed in accordance with this Soil and Groundwater Management Plan.

9.0 HEALTH AND SAFETY

The plan does not cover all worker health and safety issues. The overall health and safety of all employees is the individual responsibility of each employer working on the Subject Property. All employers working on this project are responsible for meeting Occupational Safety and Health Administration (OSHA) requirements.

All companies involved with this project are to prepare Health and Safety Plans (HASPs) for their workers and the tasks they are performing, as required by the regulations, and cleaning protocols for their personnel and equipment. The purpose of the HASPs is to provide personnel required to work onsite with the information, guidelines, and procedures necessary to complete their assignment in a safe manner. The HASP should describe the site, scope of work, potential chemical and physical hazards, personal protective equipment (PPE), atmospheric monitoring requirements, decontamination procedures, emergency response procedures, medical surveillance program, personnel training requirements, and site control practices, as appropriate. Each firm working on this project shall perform their work in accordance with this SGMP, the EPD approved PPCAP, as amended, and their HASP. The overall safety at the construction site is the responsibility of the RC.

Specifically, these training documents will be kept on site by the following key personnel:

- Remediation Contractor Project Manager will ensure training certifications are kept for personnel on-site in the field trailer (or an on-site location), with copies made available to the United Consulting Project Manager and ABI and their representatives;
- ABI and their representatives will keep records of all their employees and contractors training certifications at their offices with digital copies available for review, as needed; and,
- United Consulting will keep records of all their employees' training certification on their person and at their Atlanta office located at 625 Holcomb Bridge Road, Norcross, Georgia 30071.

In addition, the RC's remediation equipment is to be cleaned prior to it leaving the Subject Property, in accordance with RC prepared decontamination protocols and the QAPP. Wash-water utilized for decontamination procedures must be captured and treated/disposed in accordance with federal, state and local regulations.

9.1 Personnel Requirements

Personnel at the Subject Property shall be informed of the hazards, relevant symptoms, and effects of overexposure to impacted media, and the precautions to be observed for safe handling of soil. Personnel exposed to the existing media at the Subject Property are required to follow the procedures in this SGMP and their HASPs.

Investigation results by United Consulting and others identified multiple areas of soil exceedances above RRS. On-site personnel involved with soil handling activities shall wear the appropriate level of PPE and the HASP shall identify the proper level of PPE and monitoring, if necessary, to be implemented to minimize potential exposure.

The responsibilities of the onsite personnel involved with safety and monitoring shall be addressed in each employers HASP. At a minimum, workers should:

- Be briefed on the minimum environmental work precautions upon beginning work within the boundaries of the Subject Property;
- Minimize contact with excavated materials and groundwater and control dust;
- Not eat, drink, smoke or put hands in mouth while working on the Subject Property (without decontaminating hands before such);
- Wash all exposed skin areas with soap and water before departing from the site;
- Remove and change any non-impervious clothing that becomes excessively soiled while on the site, and clean any such material from work shoes or boots before departing the site;
- Be observant of the immediate surroundings; and
- Report to senior site personnel any unusual ground conditions such as pungent odors, staining, pooled liquids other than water, buried tanks, drums or debris, burial pits, etc. Temporarily cease work in any such area until further instruction from senior site personnel.

9.2 Hazardous Waste Operation and Emergency Response (HAZWOPER)

The respective project managers (including the RC) will ensure that all on-site personnel have current certificates of training for the forty-hour OSHA "Hazardous Waste Operations and Emergency Response" (HAZWOPER) with annual eight-hour refresher courses completed per 40 CFR Part 311 and 29 CFR 1910.120. All personnel mobilizing to the site shall carry a Certificate of Training identification card.

Field personnel performing invasive investigations will have evidence of certification of respirator fit-test and cleaner to wear a respirator (if required). Additionally, all field personnel working on site will participate in corporate medical monitoring programs, as appropriate.

Any other personnel (County, EPA, EPD, contractors, etc.) visiting the subject site during cleanup activities must ensure their personnel have at a minimum an OSHA 40-Hr HAZWOPER training certification. All training certifications will need to be verified as a pre-requisite for site visit(s).

All training records will be made available upon request. Deficiencies and the need for new training are identified during annual personnel evaluations. Personnel deficient in any of the following requirements will not be allowed to conduct project activities.

9.3 Personal Protective Equipment Requirements

Workers that may encounter impacted media must wear protective equipment. Based on the current knowledge of site conditions, Level D PPE is likely appropriate for the Subject Property. The level of PPE protection shall be increased should additional information or site conditions indicate that increased protection is necessary to reduce worker exposure to impacted substances. This is to be outlined in the employers HASP.

At a minimum, Level D protection generally consists of the following equipment:

- Safety glasses
- Work boots or shoes with a steel toe and shank
- Hard Hat
- Work uniform or coverall
- Hearing protection

9.4 Site Security

The RC is responsible for site security. The public is not permitted to be on the Subject Property during the remediation and site work activities. The remedial excavations are to be secured from the time of excavation until they are backfilled, as needed relative to job site safety. The following measures may be utilized:

- Warning signs should be posted at the entrance to the site;
- Work zones should be established and demarcated; and
- Fencing the remedial areas between excavation and backfilling.

10.0 REGULATORY COMPLIANCE

Permits may be required for various activities. The RC is to obtain all necessary remediation, storage, access, disturbance, treatment, disposal, and hauling, etc. related permits for their activities. The Consultant may assist the RC, if requested and approved by the Owner.

Soil removal is to be performed in accordance with this SGMP, and the PPCAP, as amended. Remediation activities are to be performed by contractors experienced, trained, and licensed for waste activities, as applicable. The materials removed from the Subject Property are to be transported by experienced, trained, and licensed waste haulers. Soils requiring remediation are to have manifests prepared to document the removal and disposal of the materials. All excavation, handling, containerization, transport, storage, and disposal activities are to be performed by methods that:

- Prevent contamination of the surrounding environment (soil, water, air);
- Are in accordance with applicable federal, state and local regulation and laws; and
- Protect personnel in the work area and adjacent to the work area.

The work is to be performed in compliance with applicable OSHA regulations, as discussed above. The RC and its sub-contractors are required to meet all of the above.

11.0 DOCUMENTATION

The soil management at the Subject Property is to be documented for the Owner. The Consultant is required to be onsite during remediation activities. The Consultant will observe and document the required corrective actions. The RC is required to provide the Consultant with the landfill disposal manifests. The RC is to provide weekly updates to the Consultant and Owner throughout the remediation process.

The RC is responsible for documenting the remaining aspects of this Plan. This includes, but is not necessarily limited to, documentation of:

- Disposal locations of soils exported from the site;
- Groundwater disposal/discharge;
- Disposal manifests; and
- Import soils.

The documentation shall be provided following completion of the grading operations, within 15 working days of conclusion of the RC's field activities, or sooner if requested by the Owner. Disposal manifests shall be included in this documentation package. The project file will be kept for a minimum period of five years.

It is the RC's responsibility to notify the Owner and their Consultant if conditions are encountered during site work which differ from those discussed herein.

12.0 CONTACTS

Atlanta BeltLine, Inc. has retained an Environmental Consultant to perform various environmental consulting services associated with this project. The Remediation Contractor is to coordinate and cooperate with United Consulting during the period of their active involvement on the Subject Property.

Primary Owner Contact:	Atlanta BeltLine Inc. Kristen Mansfield Senior Landscape Architect KMansfield@atlbeltline.org; 404-477-3639
Primary Consultant Contact:	United Consulting Russell Griebel Program Manager rgriebel@unitedconsulting.com; 678-898-6445
Consultant Contact:	United Consulting Spencer Cox Project Manager scox@unitedconsulting.com; 770-842-8956
Consultant Contact:	United Consulting Brandon Sharp Field Team Leader bsharp@unitedconsulting.com; 912-996-3116
Civil Engineer:	Kimley-Horn Sean Johnston Sean.Johnston@kimley-horn.com; 404-419-8716

This SGMP may be updated to include other appropriate contacts, as required, or as the project evolves.

13.0 LIMITATIONS

United Consulting's conclusions, opinions and suggestions have been prepared using generally accepted standards prevailing within the relevant disciplines as practiced within the southeastern United States. The data analysis and recommendations stated herein are professional opinions; no warranty is expressed or implied. United Consulting is not responsible for the conclusions, opinions or recommendations of others. Nothing contained within this report is intended to supersede or replace the judgment of the Client. All decisions relating to the aforementioned project or site are the sole responsibility of said users.

This report has been prepared for the Atlanta BeltLine, Inc., Kimley-Horn, and the future remediation contractor. Should any other person, partnership, or corporation desire to rely upon this report, it will be necessary for United Consulting to update it for the new user. The right to rely upon this report and the data herein may not be assigned without the express written permission of United Consulting. As a prerequisite for the granting of, such permission, the third-party users, (including, but not limited to, the Client's successors and assigns) must agree to be bound by the terms and conditions of the original agreement between United Consulting and the Client. Further, reliance is dependent on similar uses of the property and the document.

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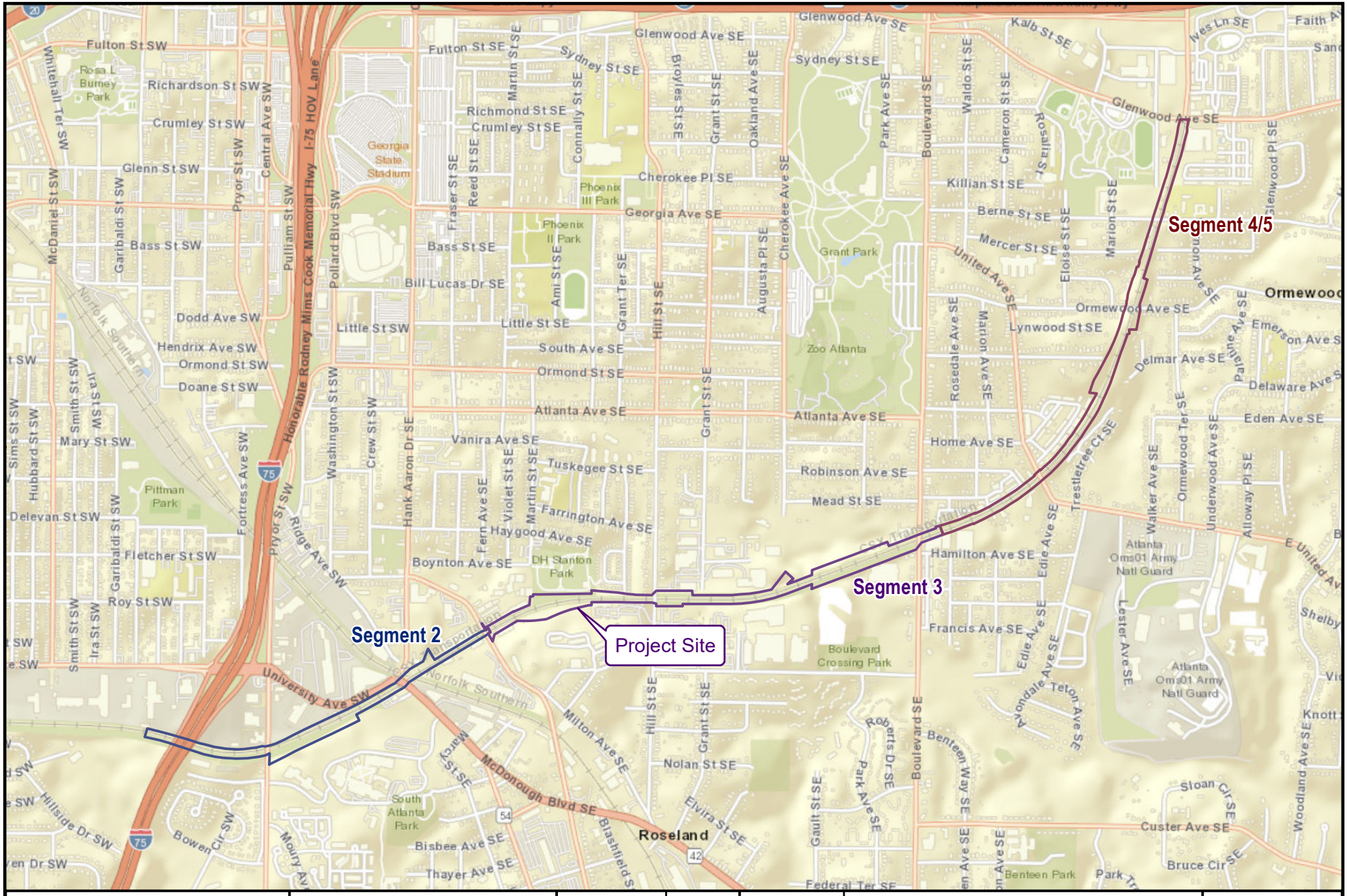
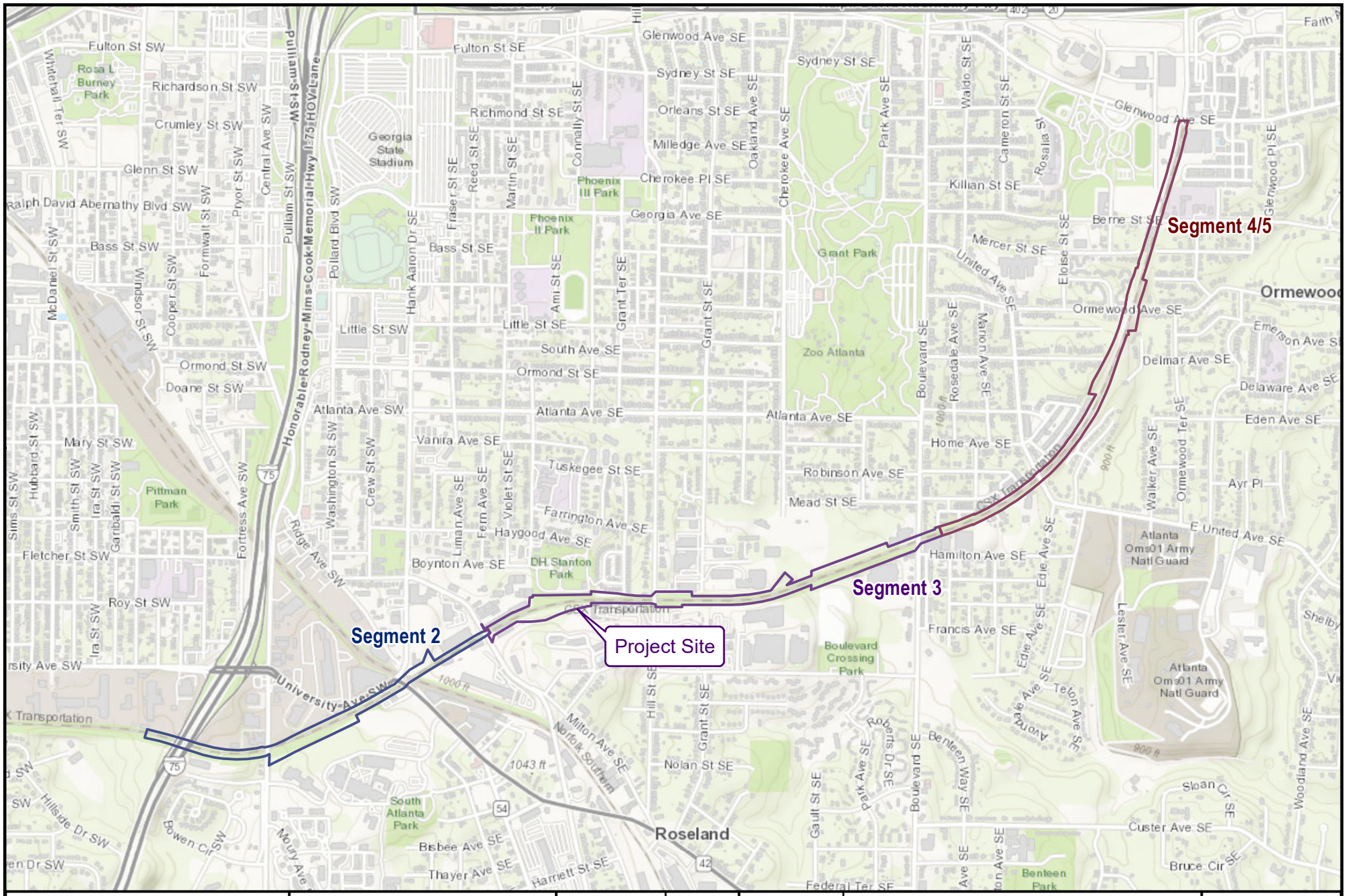
FIGURES



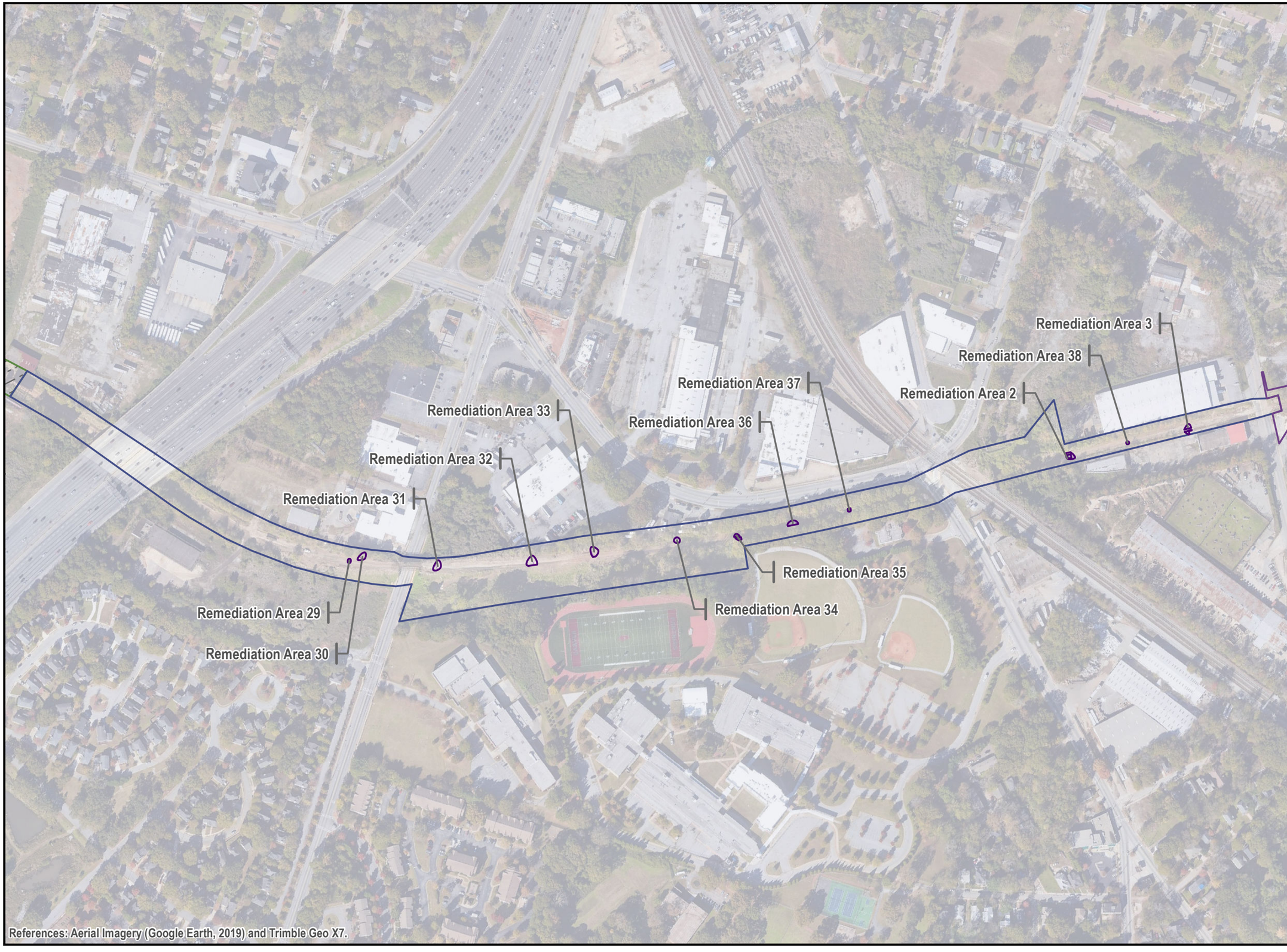
UNITED CONSULTING	**Figure Scale** N 0 1,000 2,000 1 inch = 1,500 feet	**Prepared:**	BWS	**Title:**	Site Location Map
		Checked:	RCG	**Project:**	Atlanta BeltLine — Southside Trail
		Date:	02/15/21	**Project No.**	20-GA-01192-14
				Client:	Kimley-Horn

FIG. 1

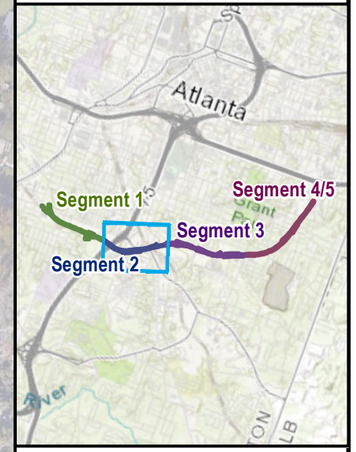


UNITED CONSULTING	**Figure Scale** N 0 1,000 2,000 1 inch = 1,500 feet	**Prepared:**	BWS	**Title:**	USGS Topographic Map
		Checked:	RCG	**Project:**	Atlanta BeltLine — Southside Trail
		Date:	02/15/21	**Project No.**	20-GA-01192-14
				Client:	Kimley-Horn

FIG. 2



Map Index



Legend

- Limits of Remediation Area
- SST Segment 1 Boundary
- SST Segment 2 Boundary
- SST Segment 3 Boundary

Note:
The corresponding SGMP should be reviewed for a complete understanding of the drawings presented herein. Illustrated Southside Trail limits are estimated based on rewiew of site architectural plans (dated 8/7/2019). The original version of this drawing is provided in full-color, black-and-white reproductions may not accurately depict certain information.

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Project:
Atlanta BeltLine – Southside Trail

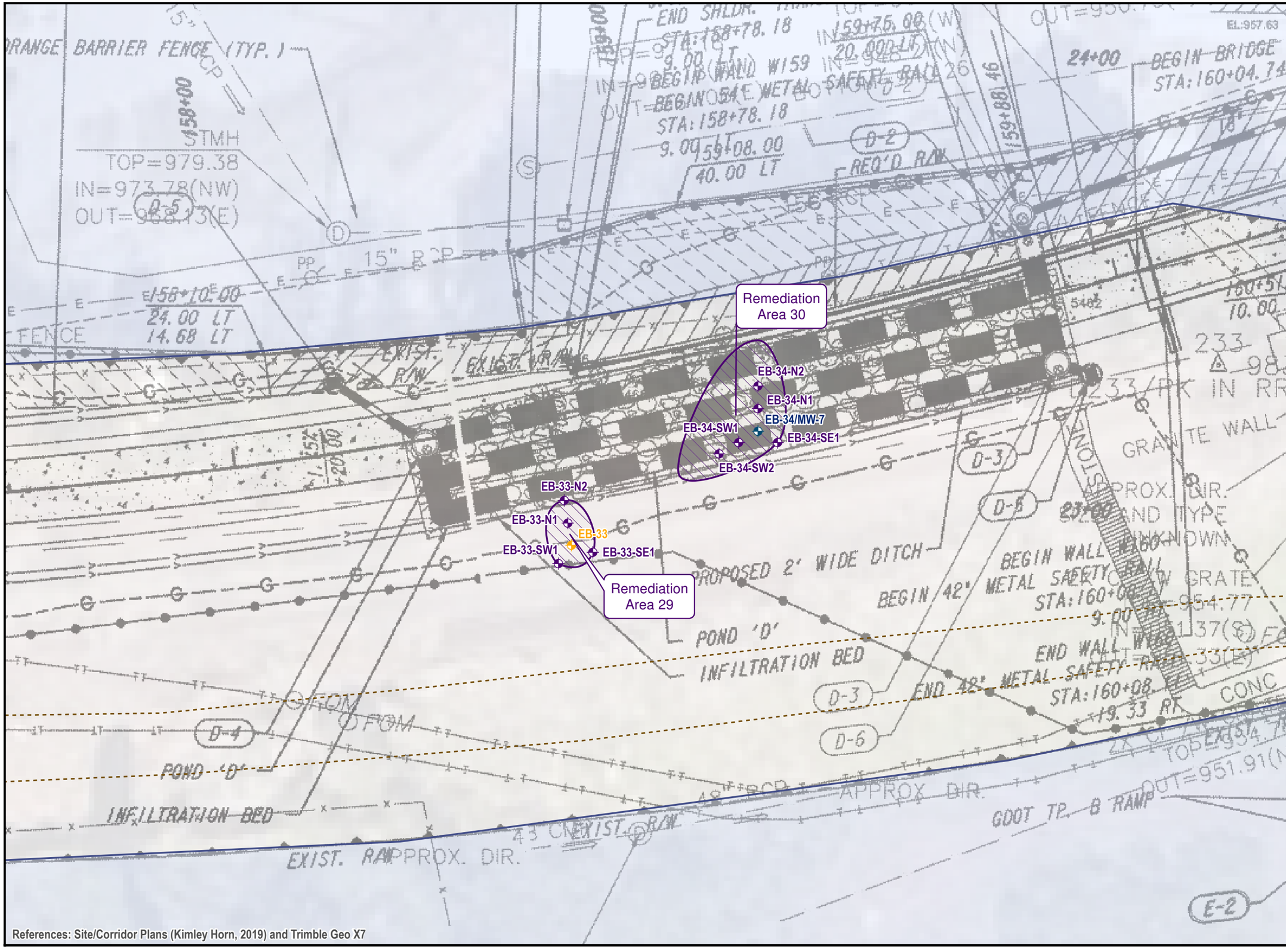
Client:
Kimley-Horn

Sheet Title: Remediation Area Limits (Segment 2 Overview)

Scale: 0 75 150 300
1 inch = 300 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3A



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Temporary Monitoring Well
- Delineation Boring

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Project:
Atlanta BeltLine – Southside Trail

Client:
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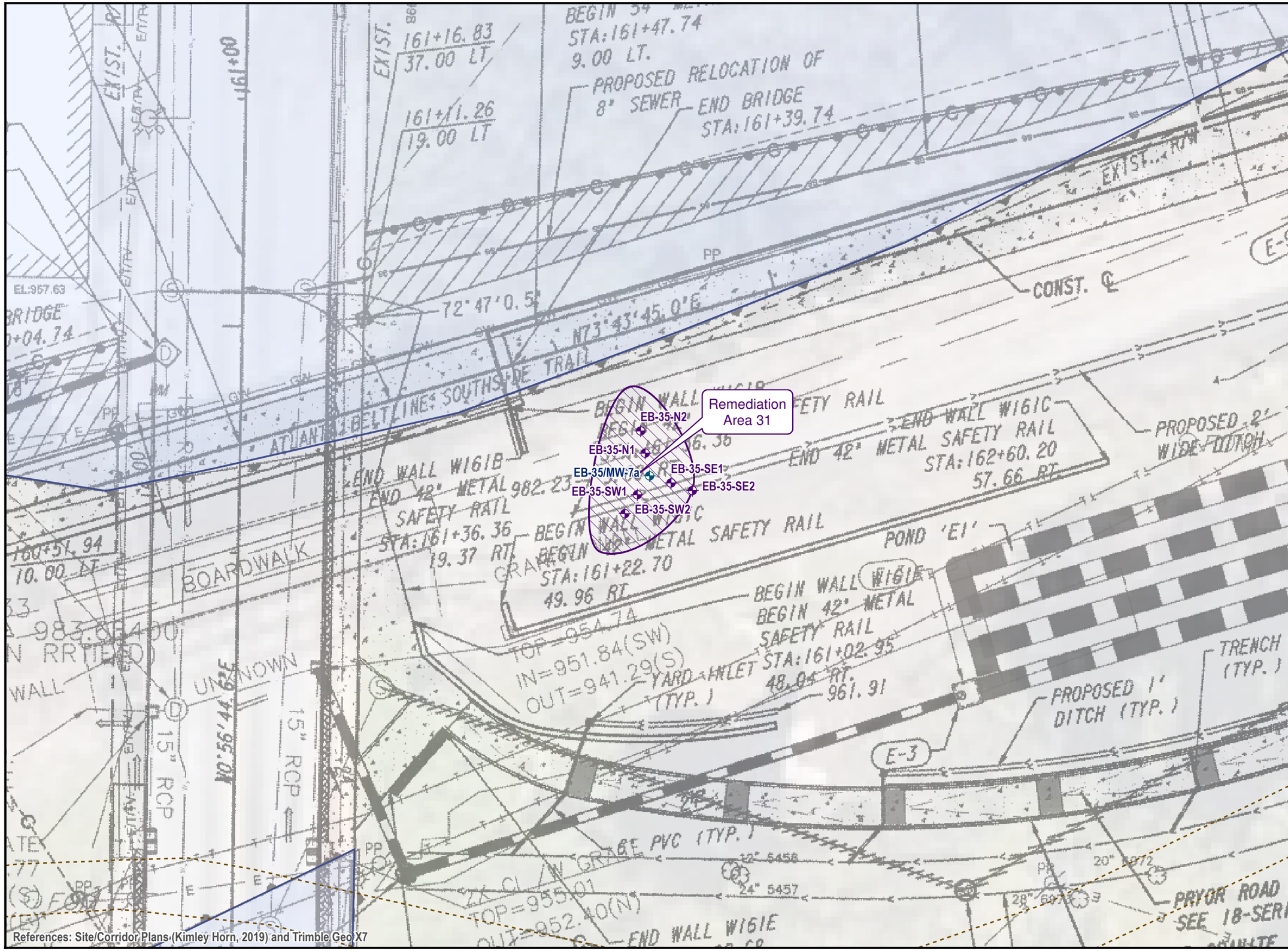
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3B



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Temporary Monitoring Well
- Delineation Boring

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Project:
Atlanta BeltLine – Southside Trail

Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3C

Remediation Area 32

EB-36-N2
EB-36-N1
EB-36/MW-8
EB-36-SE1
EB-36-SE2
EB-36-SW1
EB-36-SW2

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Temporary Monitoring Well
- Delineation Boring

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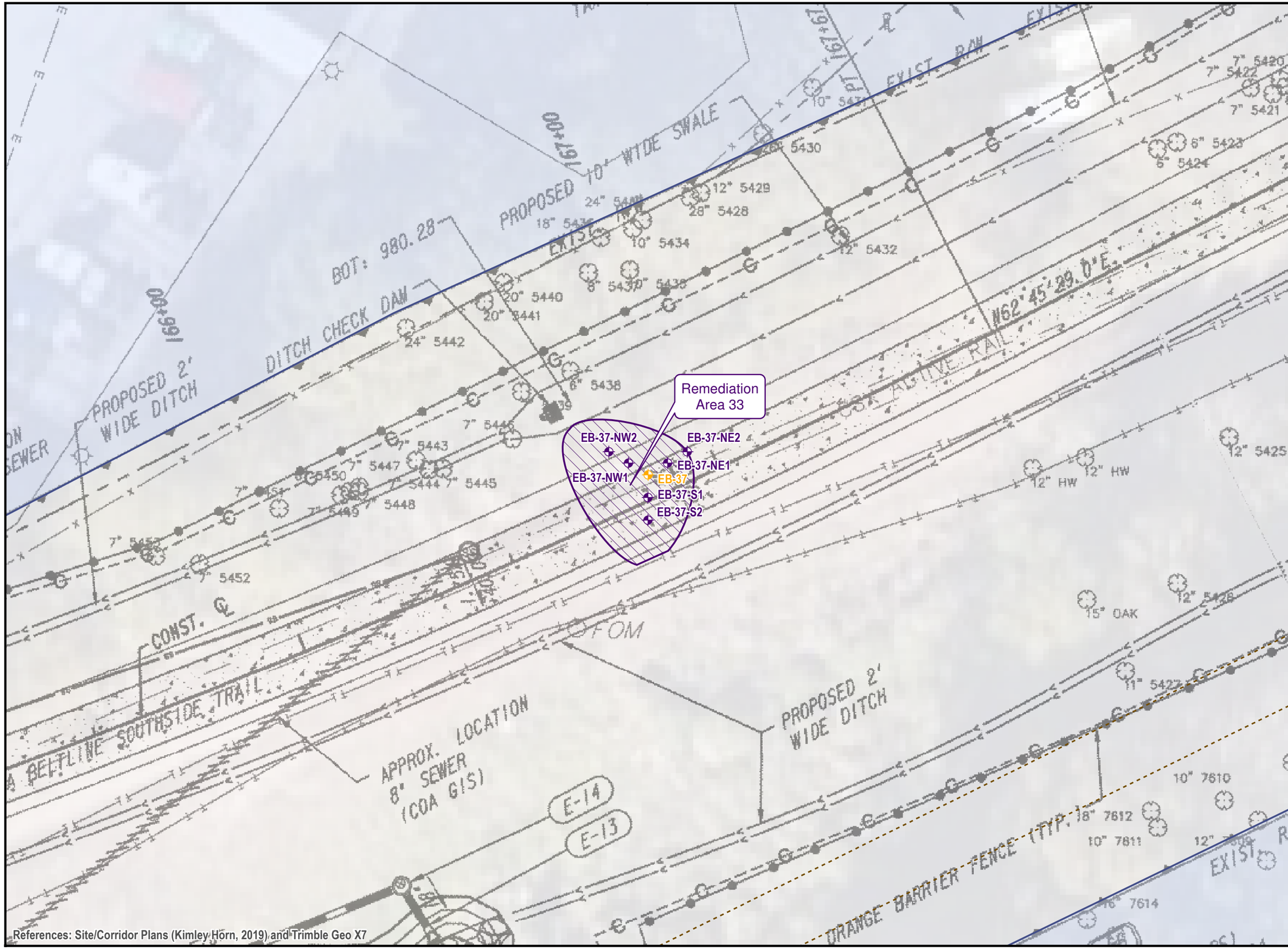
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3D



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N
0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
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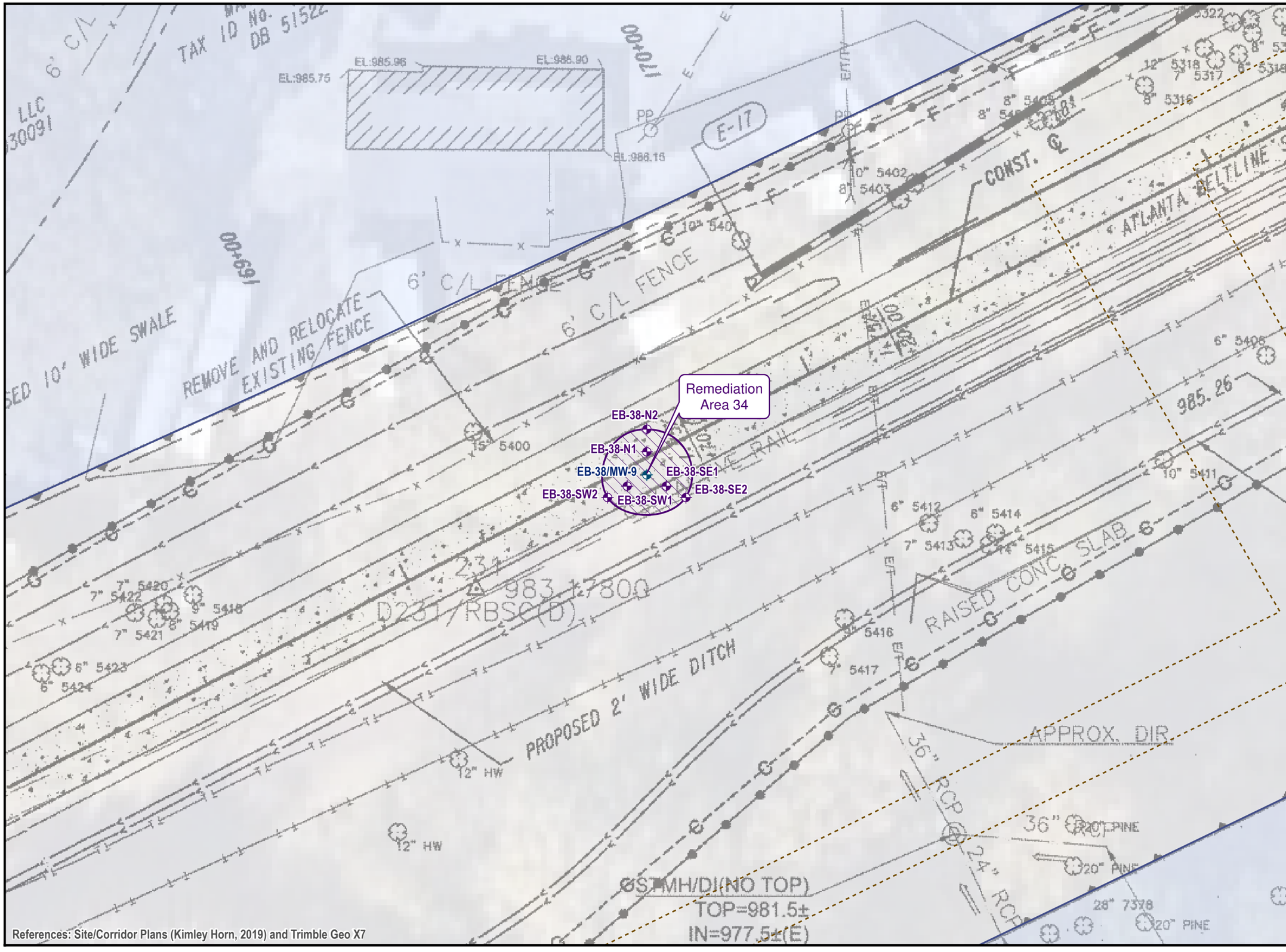
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3E



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Temporary Monitoring Well
- Delineation Boring

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Project:
Atlanta BeltLine – Southside Trail

Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N
0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
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Project No.	20-GA-01192-14

Figure 3F

Remediation Area 35

EB-39-N1

EB-39

EB-39-SW1

EB-39-SW2

EB-39-SE1

Remediation Area 35

EB-39-SE2

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Client:
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Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
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Figure 3G

Remediation Area 36

EB-40-NW1

EB-40

EB-40-E1

EB-40-E2

EB-40-SW1

EB-40-SW2

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Atlanta BeltLine – Southside Trail

Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N

0 5 10 20

1 inch = 20 feet

Prepared:	B. Sharp
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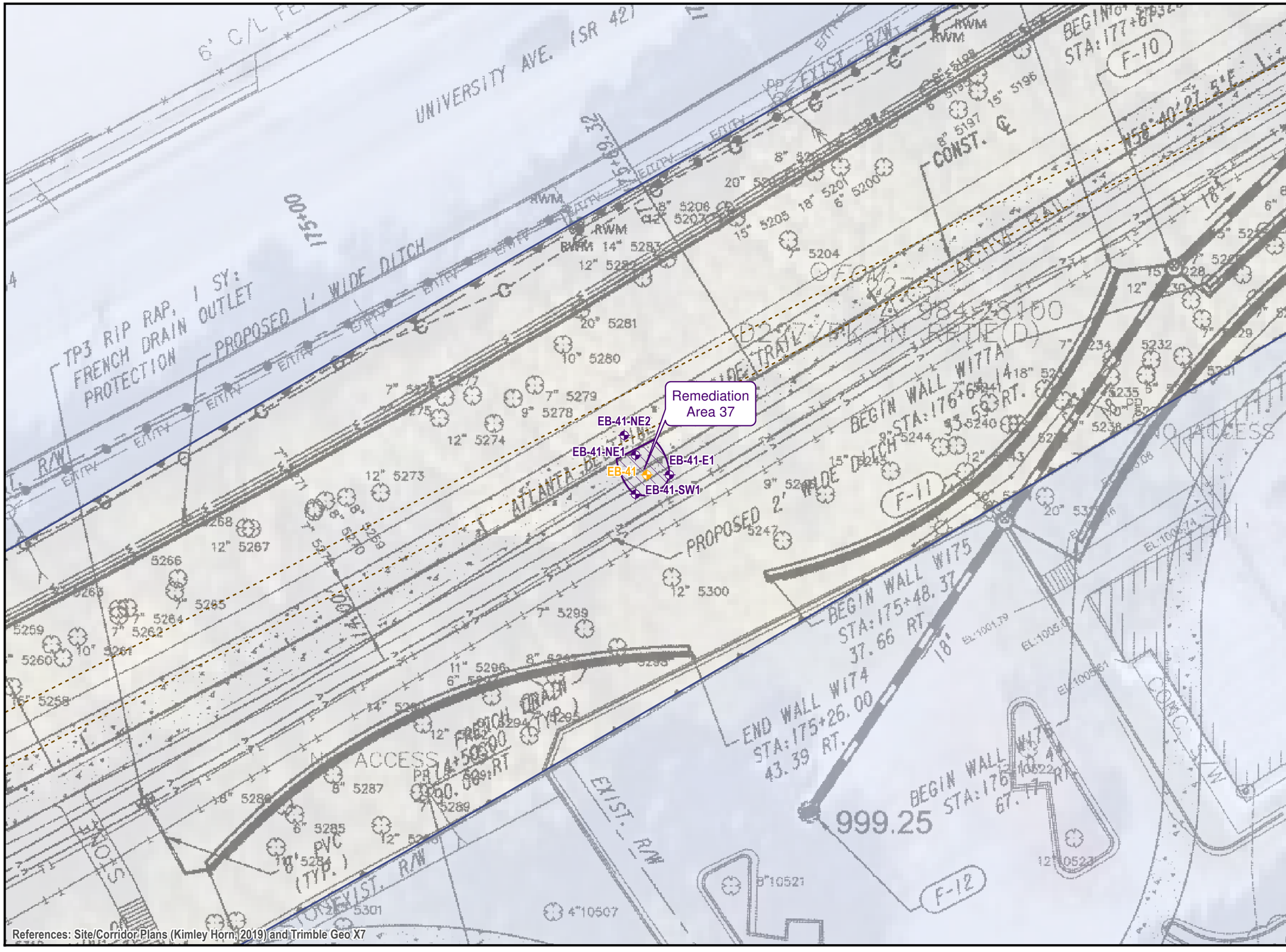
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3H



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Project:
Atlanta BeltLine – Southside Trail

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Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
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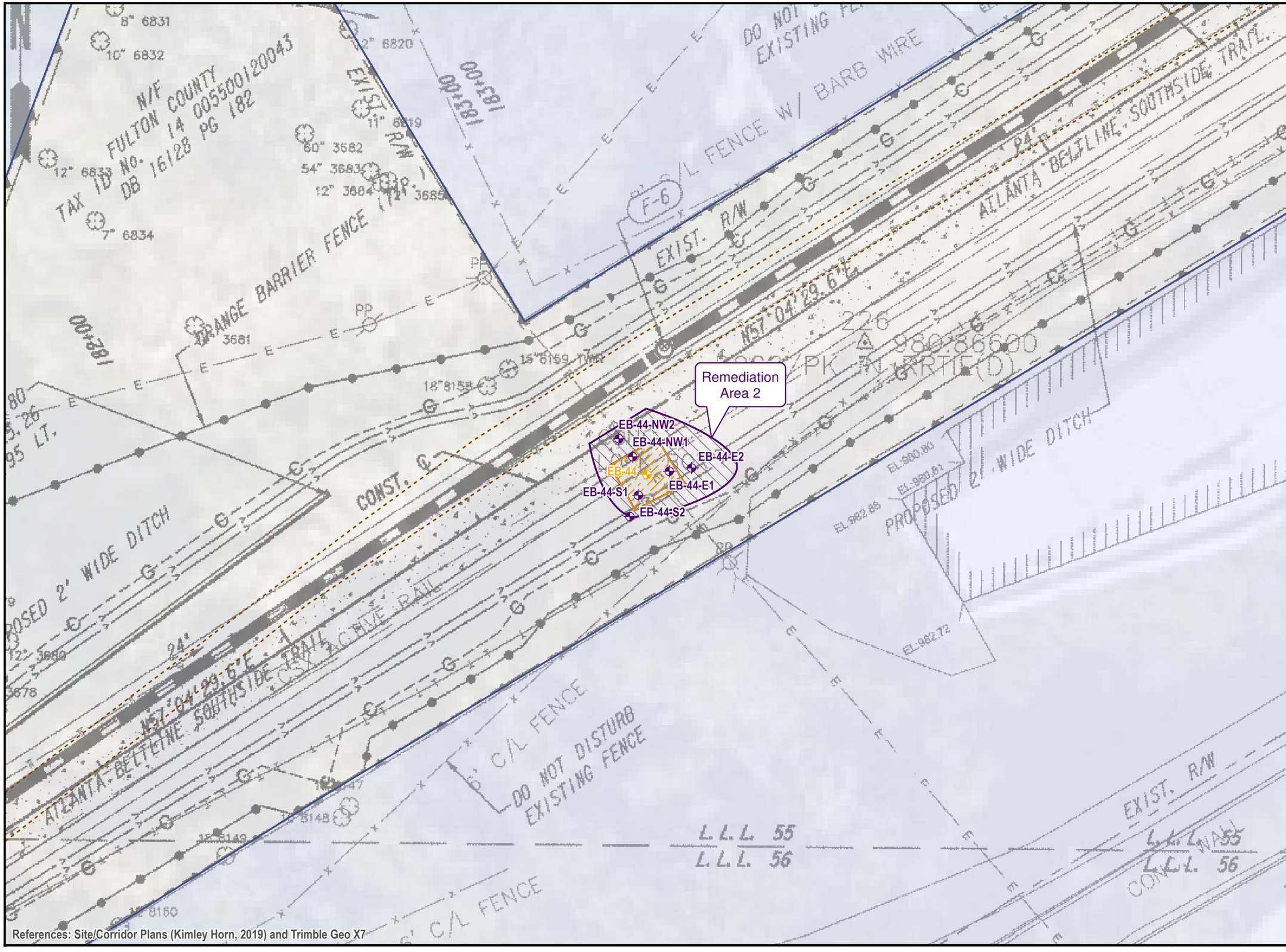
Project No.	20-GA-01192-14

Figure 3I



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Previous Remedial Limits
- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
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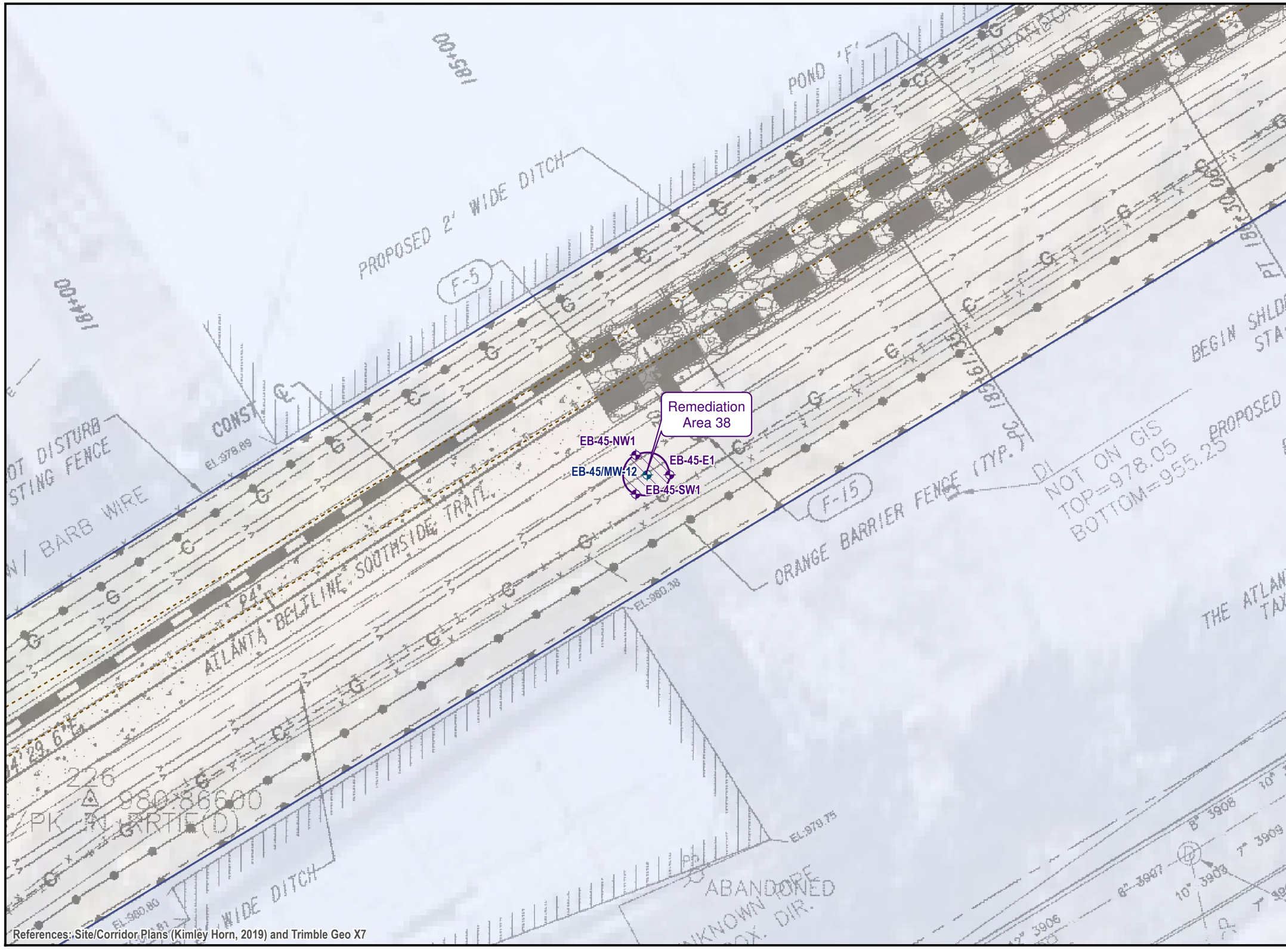
Project No.	20-GA-01192-14

Figure 3J



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Temporary Monitoring Well
- Delineation Boring

Note:
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770-209-0029 Fax 582-2900 www.unitedconsulting.com

Project:
Atlanta BeltLine – Southside Trail

Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3K

Remediation Area 3

EB-46-N2
EB-46-N1
EB-46-E1
EB-46-W1
EB-46
EB-46-W2
EB-46-SE1
EB-46-SE2

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Previous Remedial Limits
- Limits of Remediation Area
- SST Segment 2 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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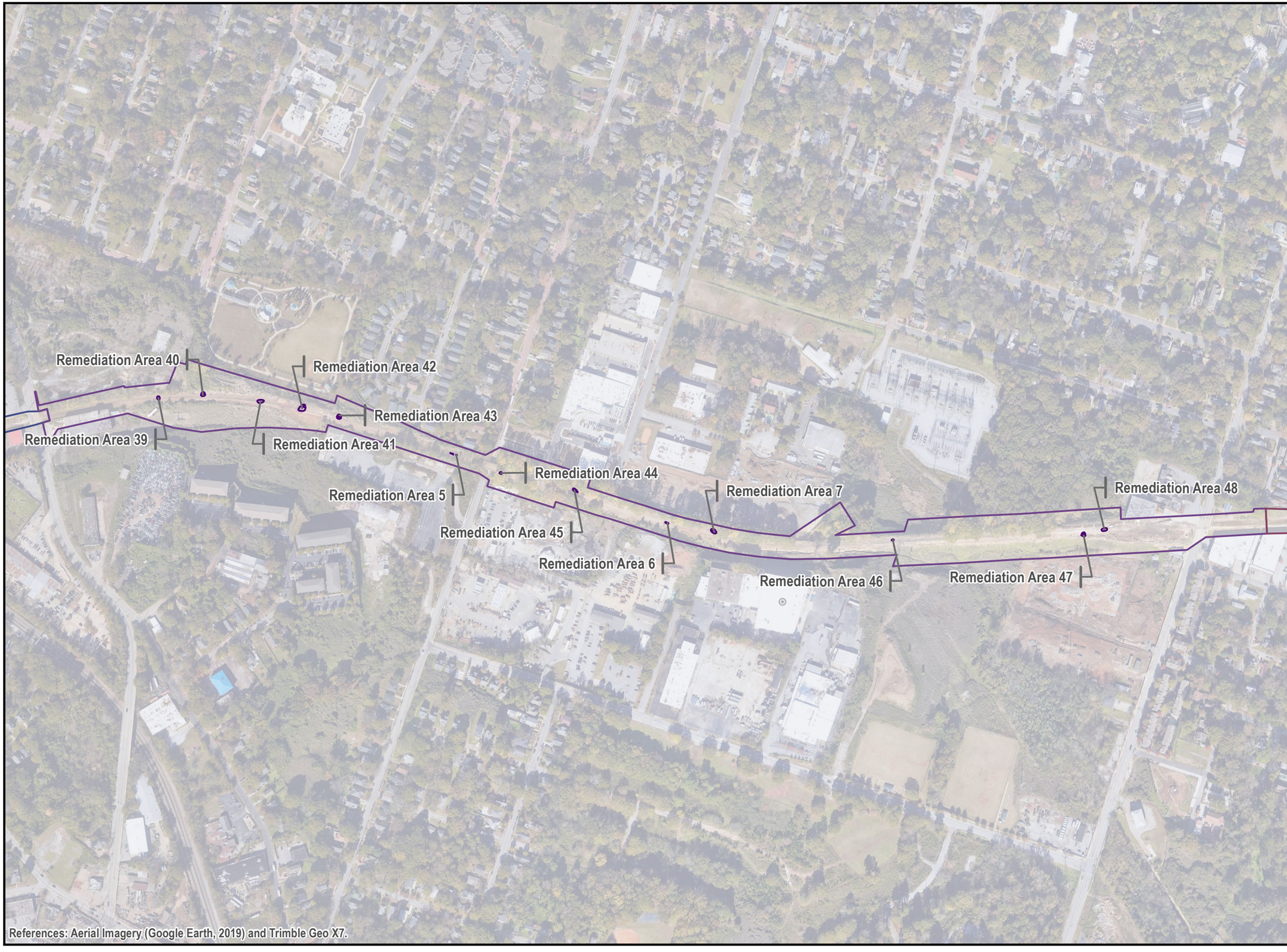
Sheet Title: Remediation Area Limits

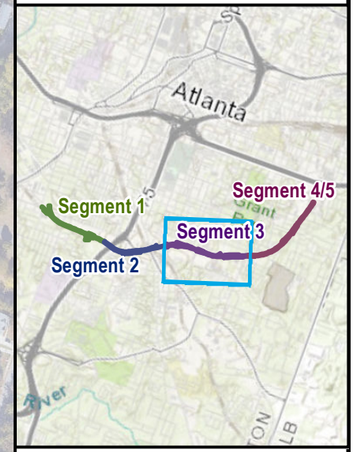
Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 3L



Map Index



Legend

- Limits of Remediation Area
- SST Segment 2 Boundary
- SST Segment 3 Boundary
- SST Segment 4/5 Boundary

Note:
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Project:
Atlanta BeltLine – Southside Trail

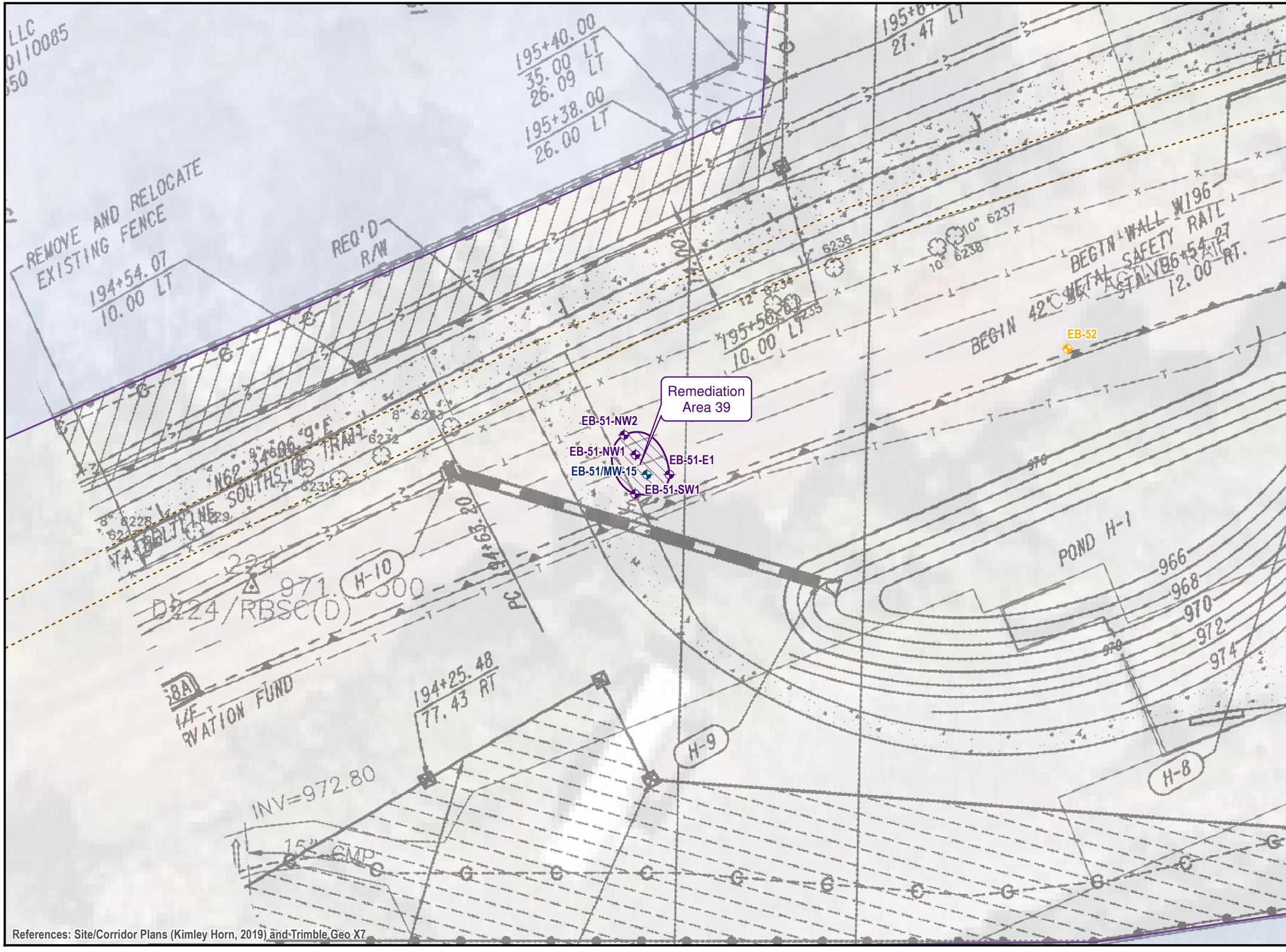
Client:
Kimley-Horn

Sheet Title: Remediation Area Limits (Segment 3 Overview)

Scale: 0 100 200 400
1 inch = 400 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4A



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Temporary Monitoring Well
- Delineation Boring

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Atlanta BeltLine – Southside Trail

Client:
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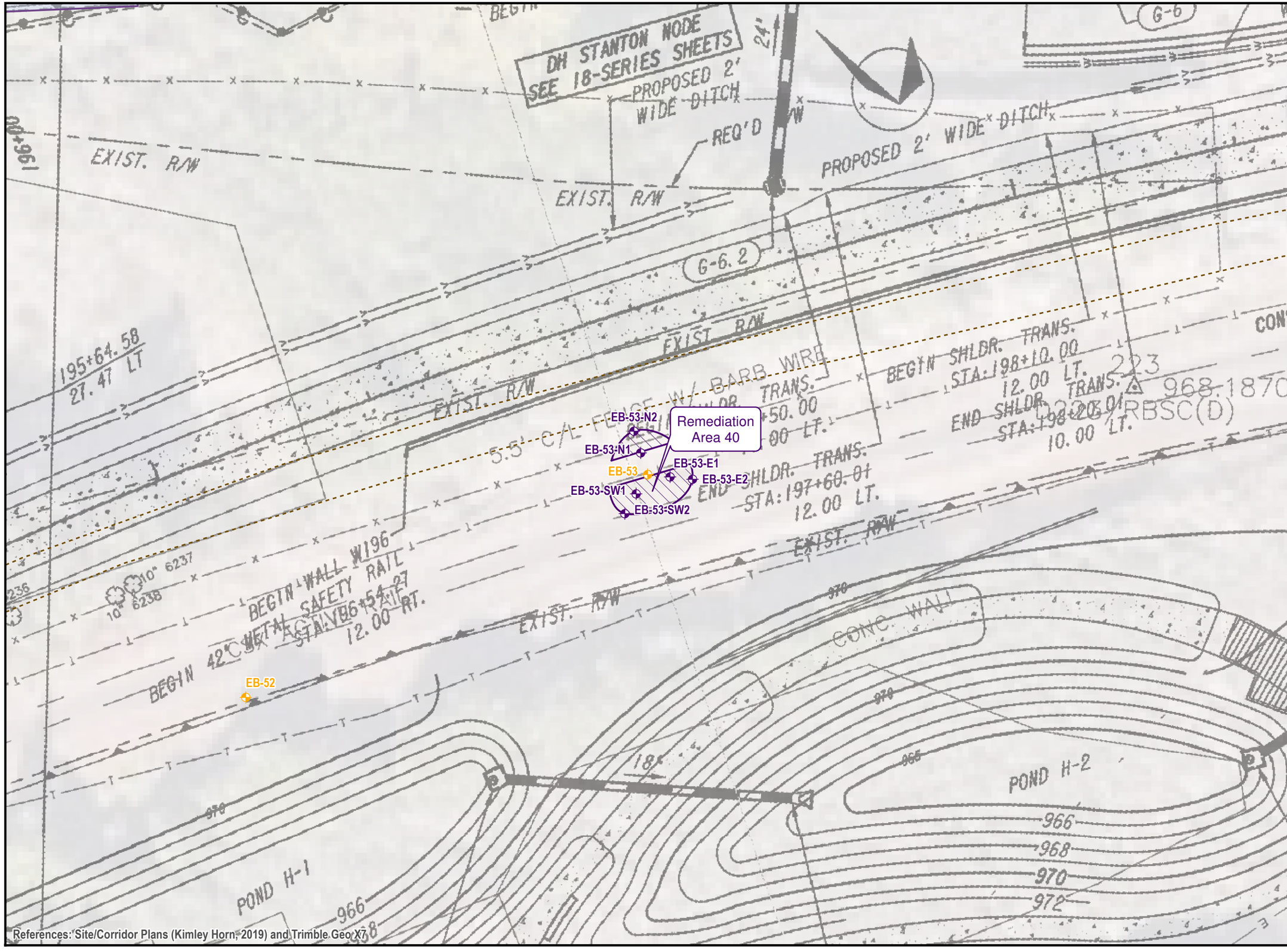
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4B



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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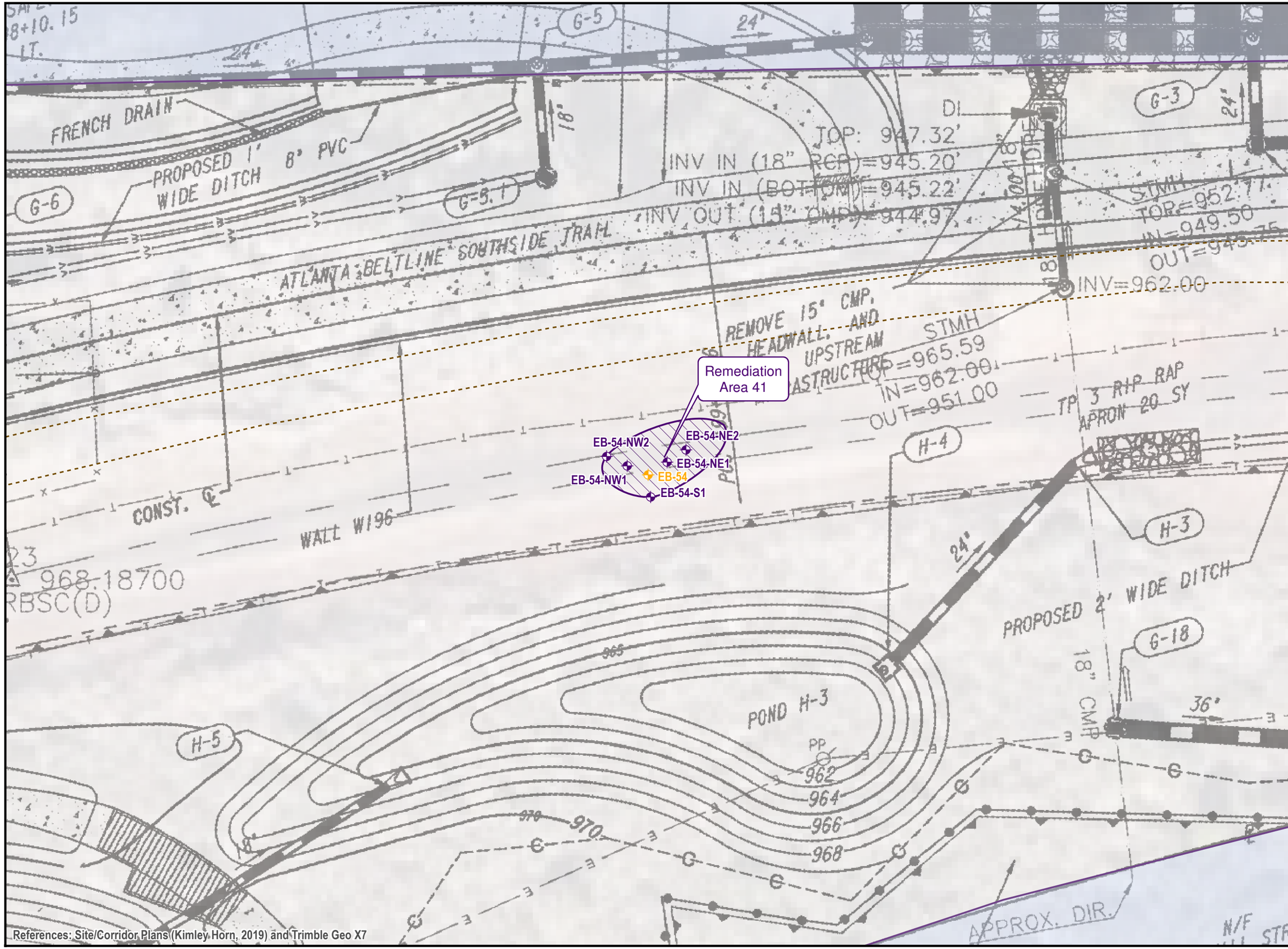
Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4C



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4D

Remediation Area 42

EB-55-N2
EB-55-N1
EB-55
EB-55-SW1
EB-55-SE1
EB-55-SE2
EB-55-SW2

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
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- Delineation Boring

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Atlanta BeltLine – Southside Trail

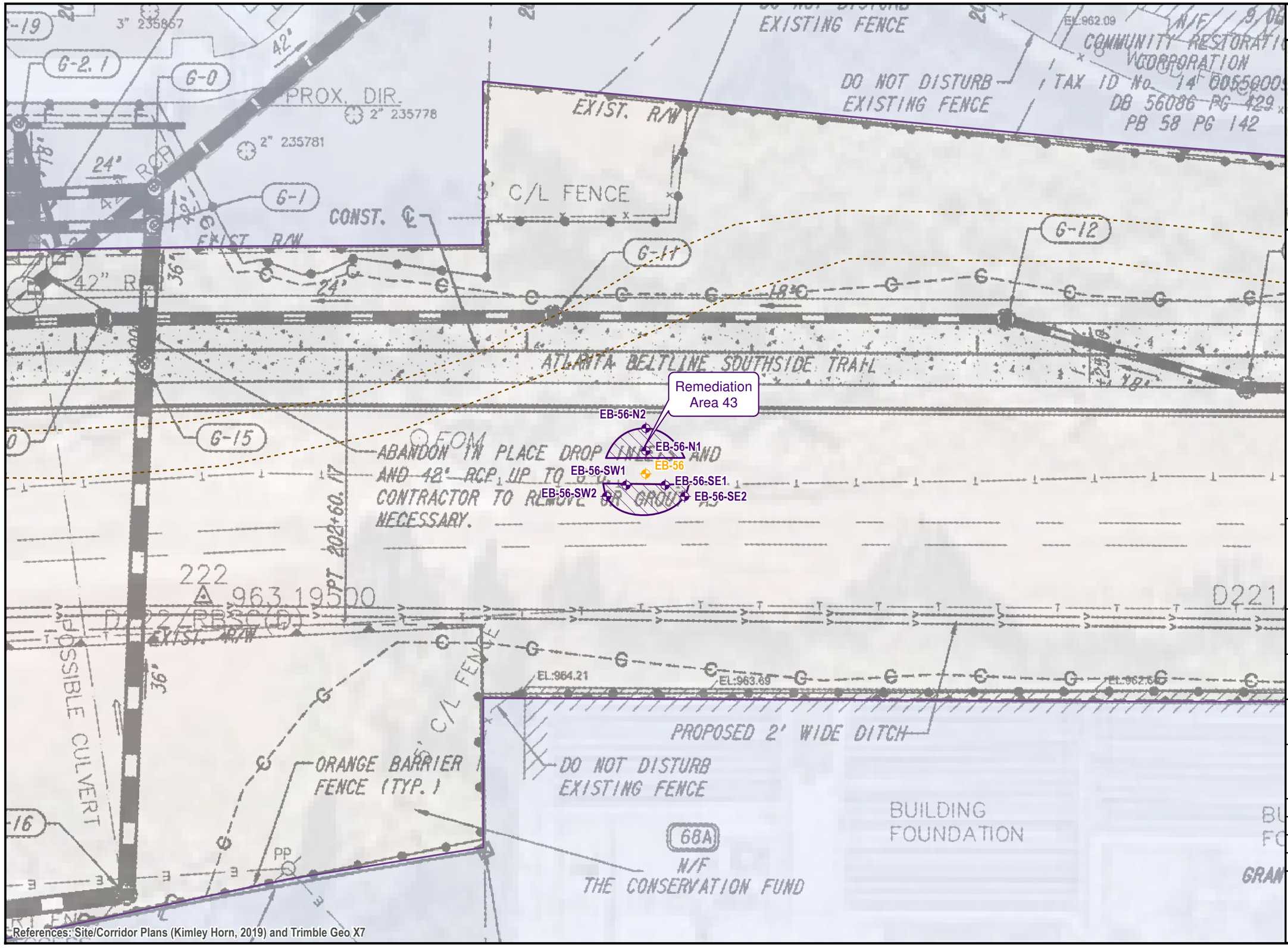
Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4E



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
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Atlanta BeltLine – Southside Trail

Client:
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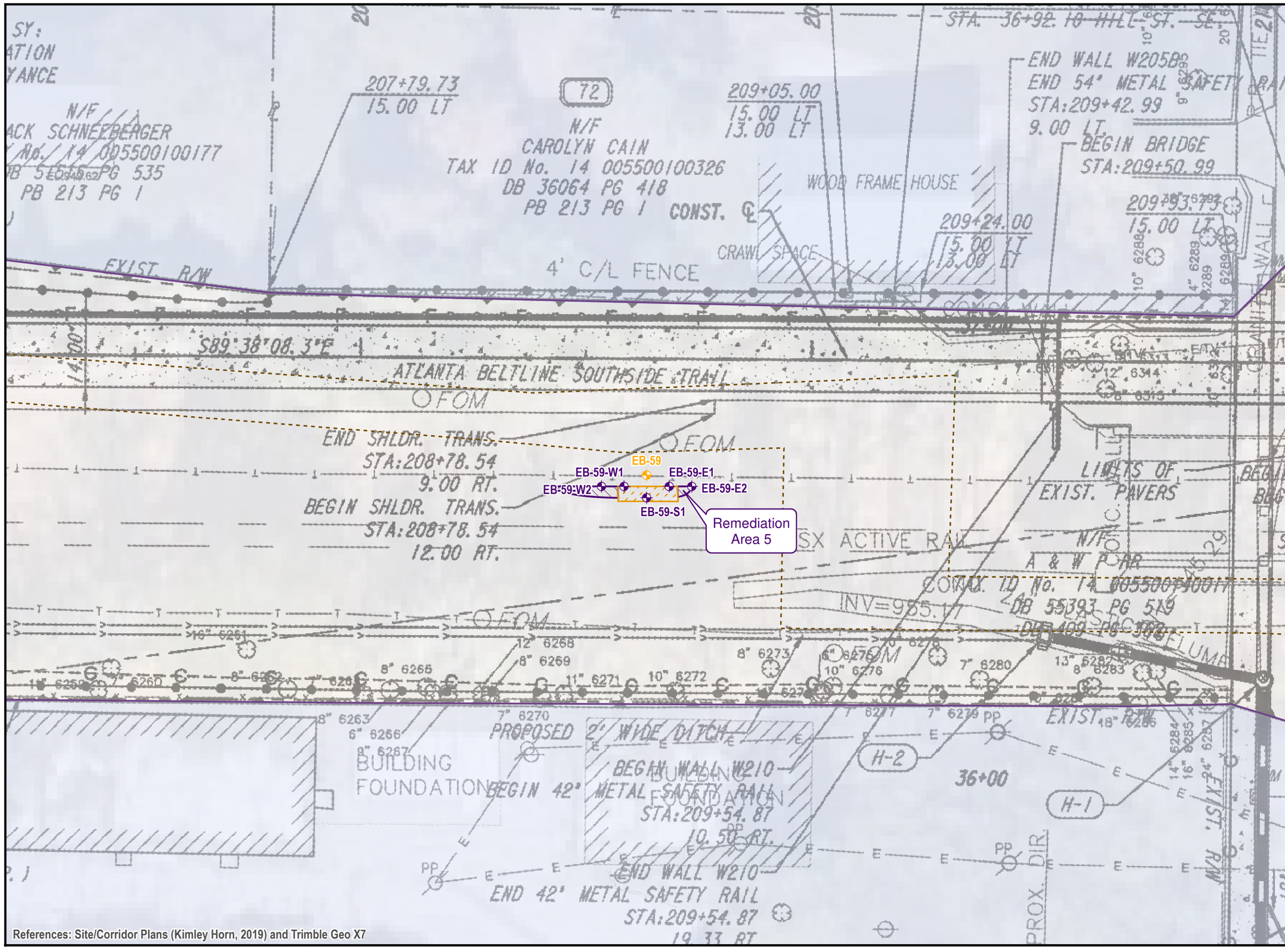
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4F



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Previous Remedial Limits
- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Client:
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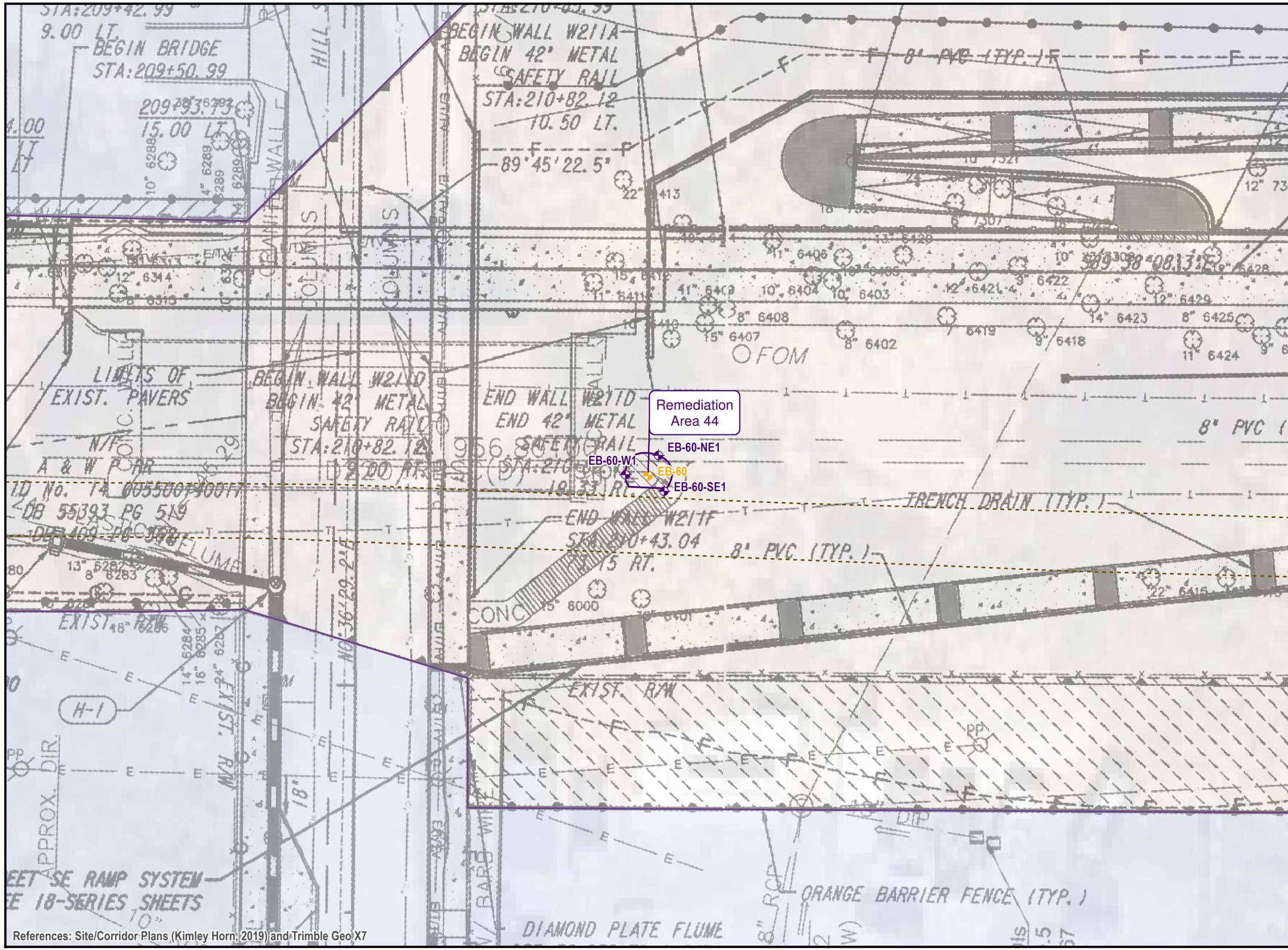
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4G



Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Atlanta BeltLine – Southside Trail

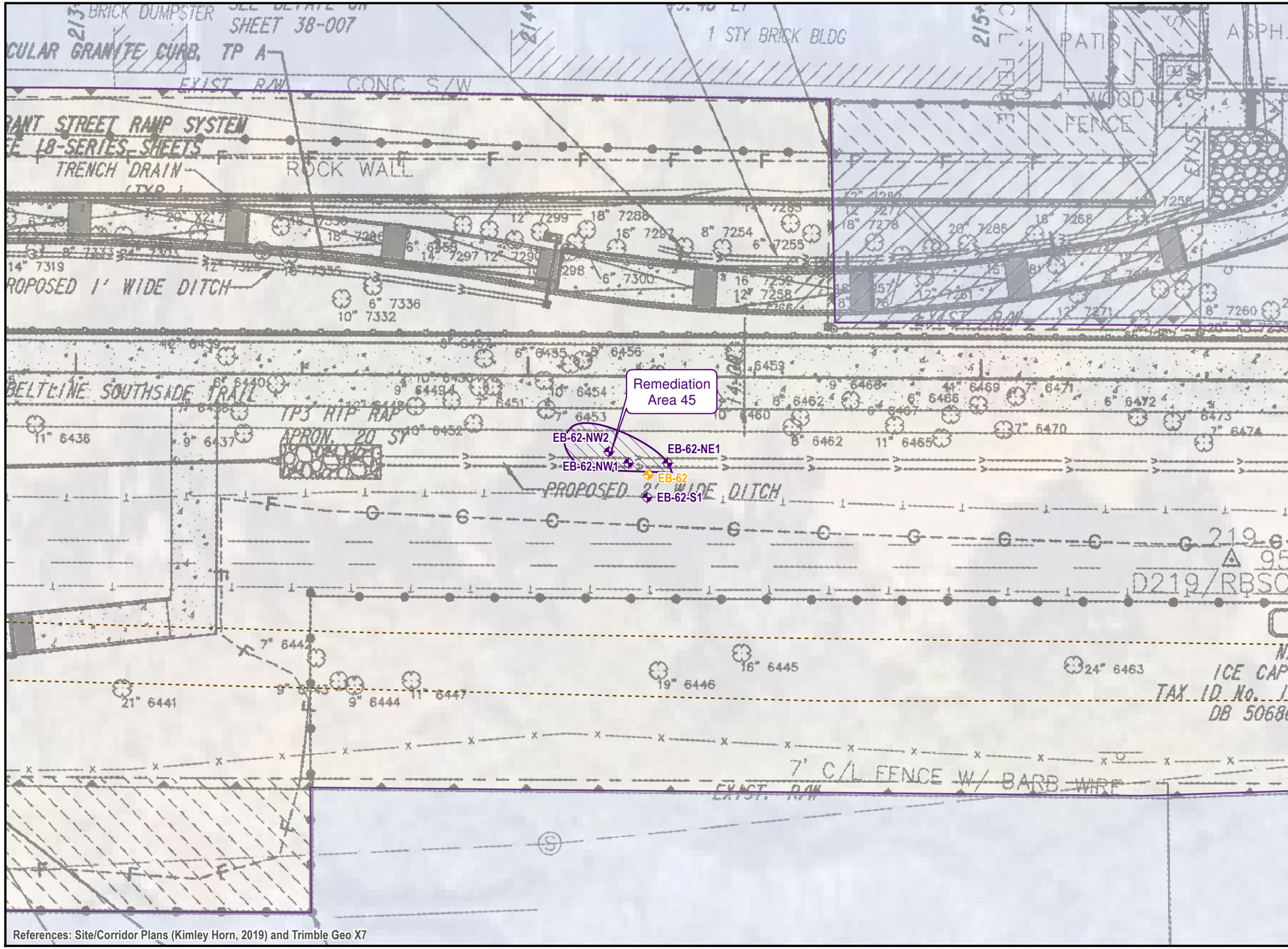
Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4H



Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Client:
Kimley-Horn

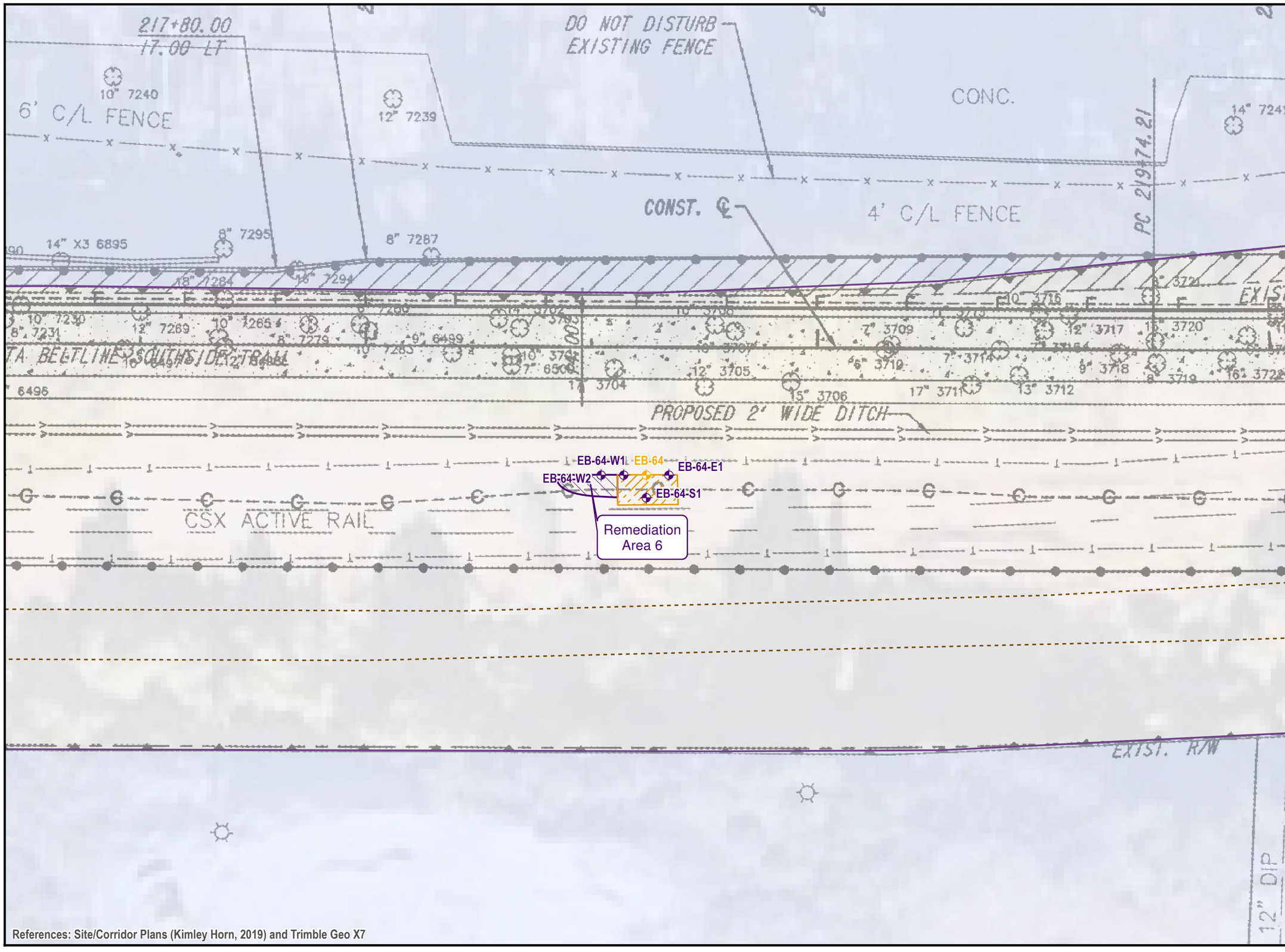
Sheet Title: Remediation Area Limits

Scale: N — 0 5 10 20 — 1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4I

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Previous Remedial Limits
- Limits of Remediation Area
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- Approx. GDOT Fiber
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1 inch = 20 feet

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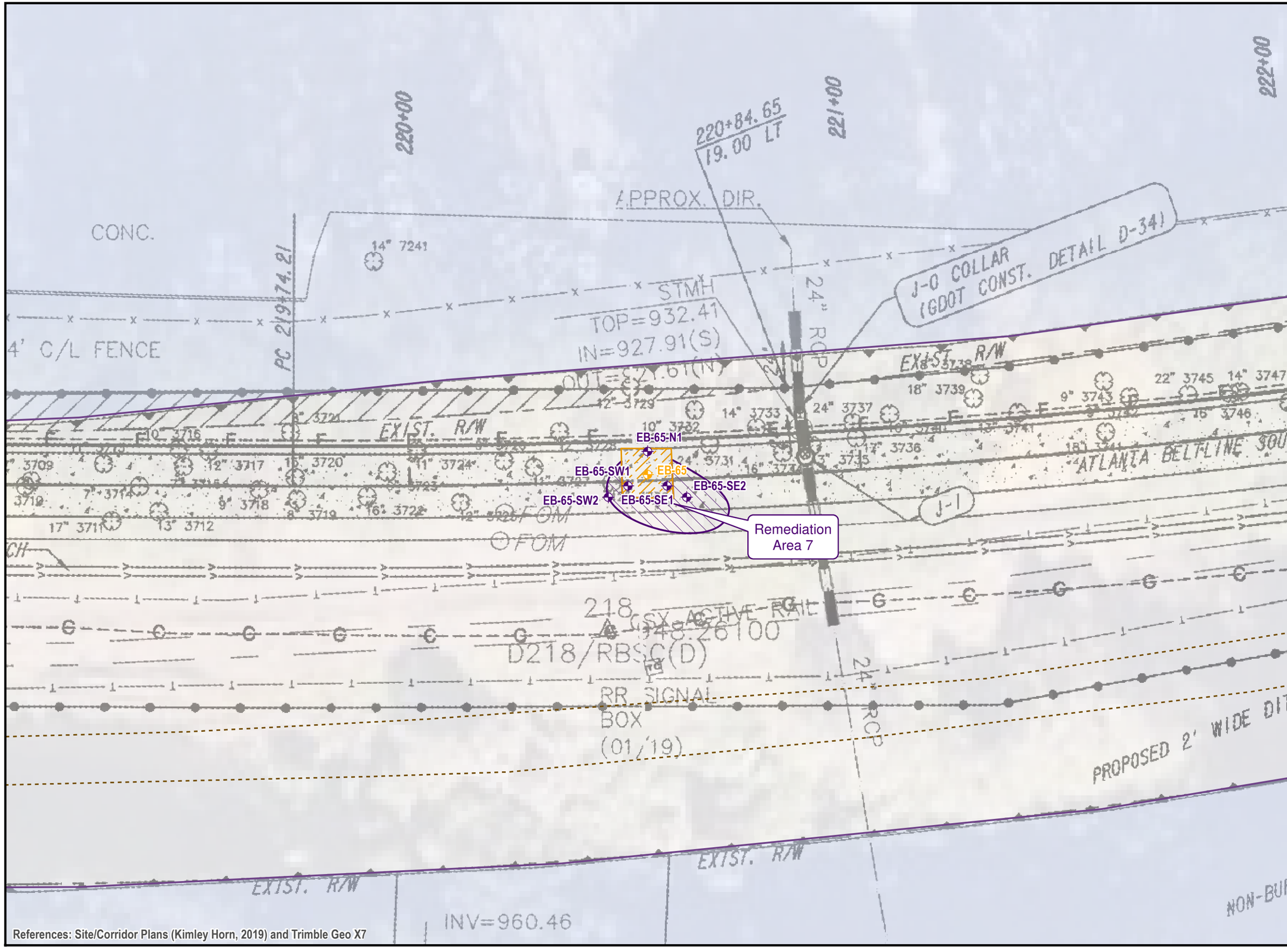
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4J



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Previous Remedial Limits
- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
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Project:
Atlanta BeltLine – Southside Trail

Client:
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Sheet Title: Remediation Area Limits

Scale: N
0 5 10 20
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Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 4K

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

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Legend

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Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
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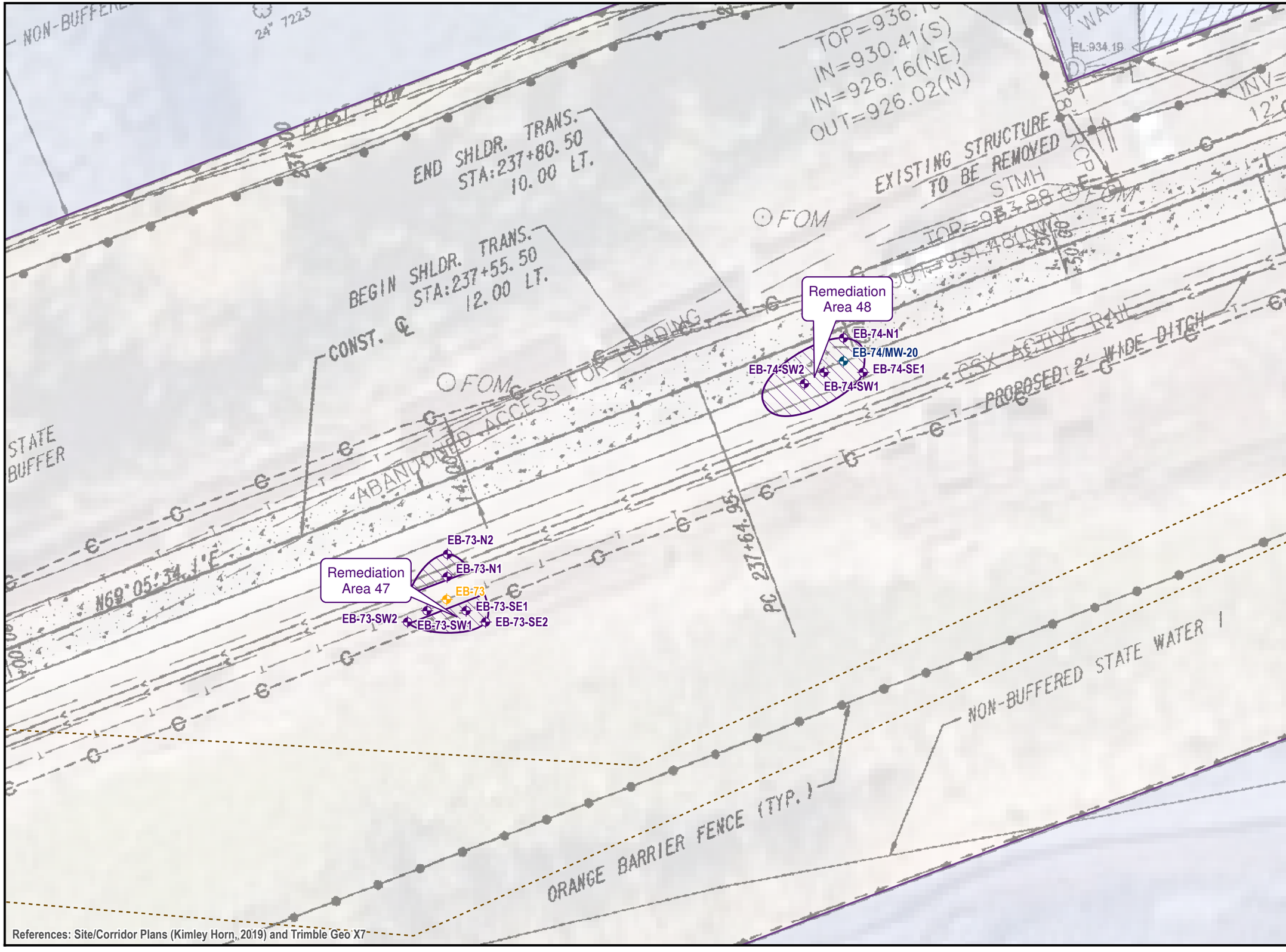
Figure 4L



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
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- Delineation Boring

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Sheet Title: Remediation Area Limits

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0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
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Date:	Feb 15, 2021
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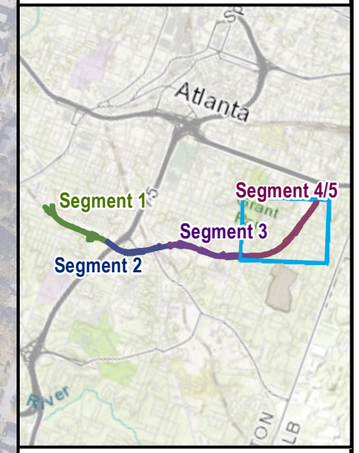
Figure 4M

Remediation Area 62
Remediation Area 61
Remediation Area 60
Remediation Area 59
Remediation Area 58
Remediation Area 57
Remediation Area 56
Remediation Area 55
Remediation Area 54
Remediation Area 53
Remediation Area 52
Remediation Area 50
Remediation Area 51
Remediation Area 49

References: Aerial Imagery (Google Earth, 2019) and Trimble Geo X7.

Map Index



Legend

- Limits of Remediation Area
- SST Segment 3 Boundary
- SST Segment 4/5 Boundary

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Client:
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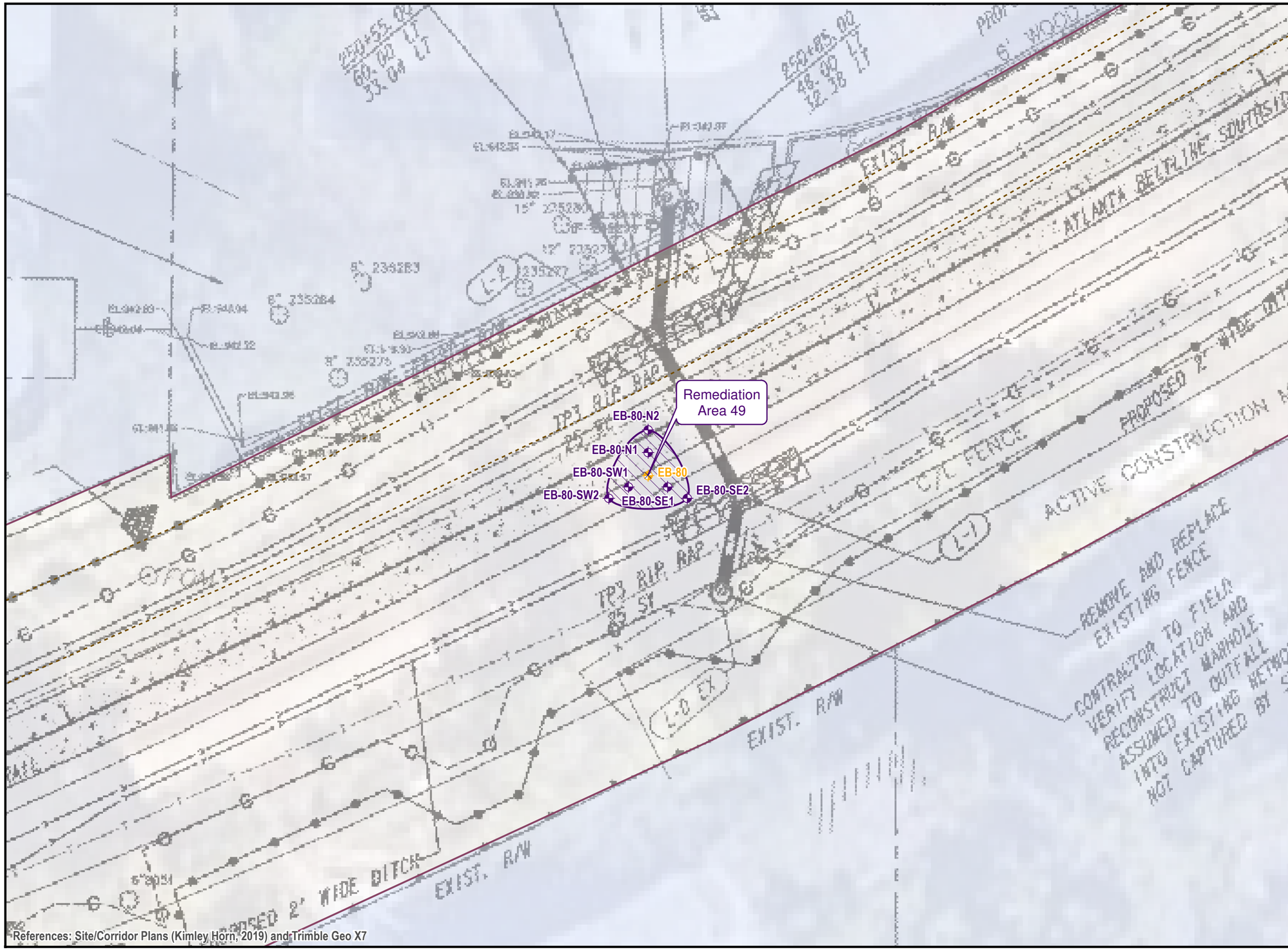
Sheet Title: Remediation Area Limits (Segment 4/5 Overview)

Scale: 0 100 200 400
1 inch = 400 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5A



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
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Atlanta BeltLine – Southside Trail

Client:
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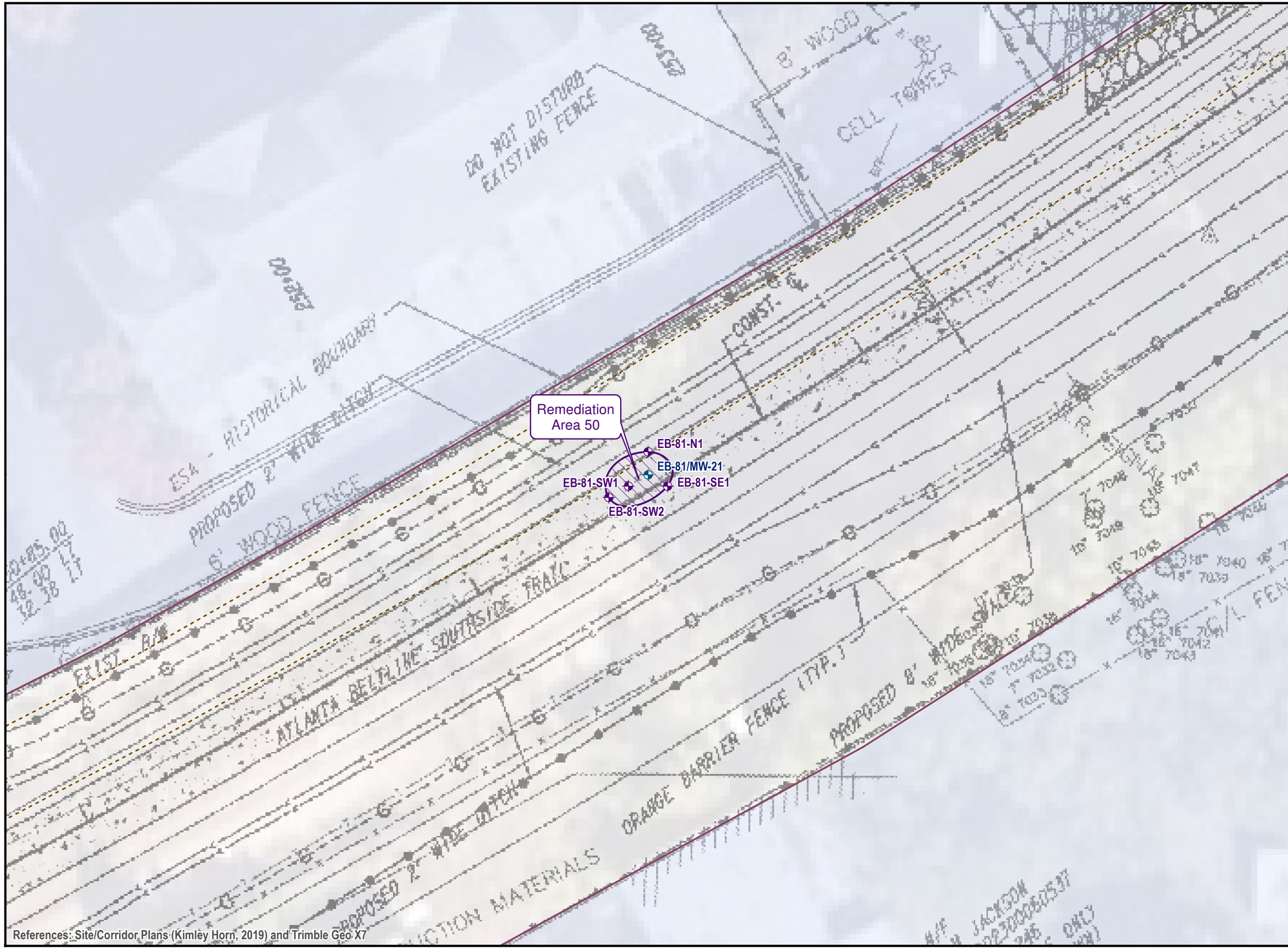
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5B



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
- Temporary Monitoring Well
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Sheet Title: Remediation Area Limits

Scale: N
0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5C

EB-83

EB-82-N1

Remediation Area 51

EB-82

EB-82-SW1

EB-82-SE1

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

Note:
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625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

Project:
Atlanta BeltLine – Southside Trail

Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

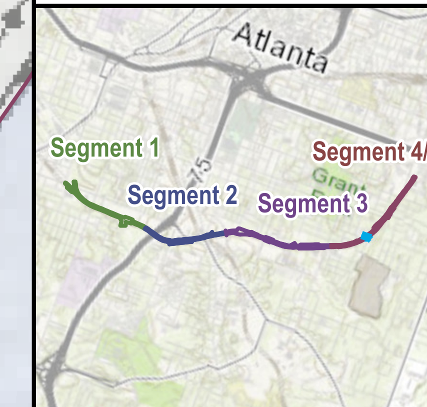
Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5D

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index



Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
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Client: Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20 — 1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5E

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Project:
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Client:
Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5F

Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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Atlanta BeltLine – Southside Trail

Client:
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Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

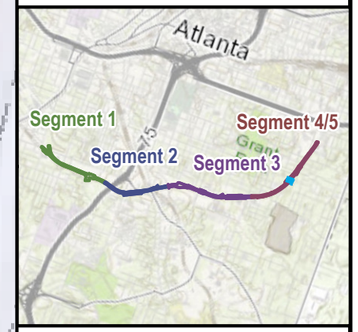
Figure 5G

Remediation Area 55

EB-91-N2
EB-91-N1
EB-91
EB-91-SW1
EB-91-SE1
EB-91-SW2
EB-91-SE2

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index



Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

Note:
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Client:
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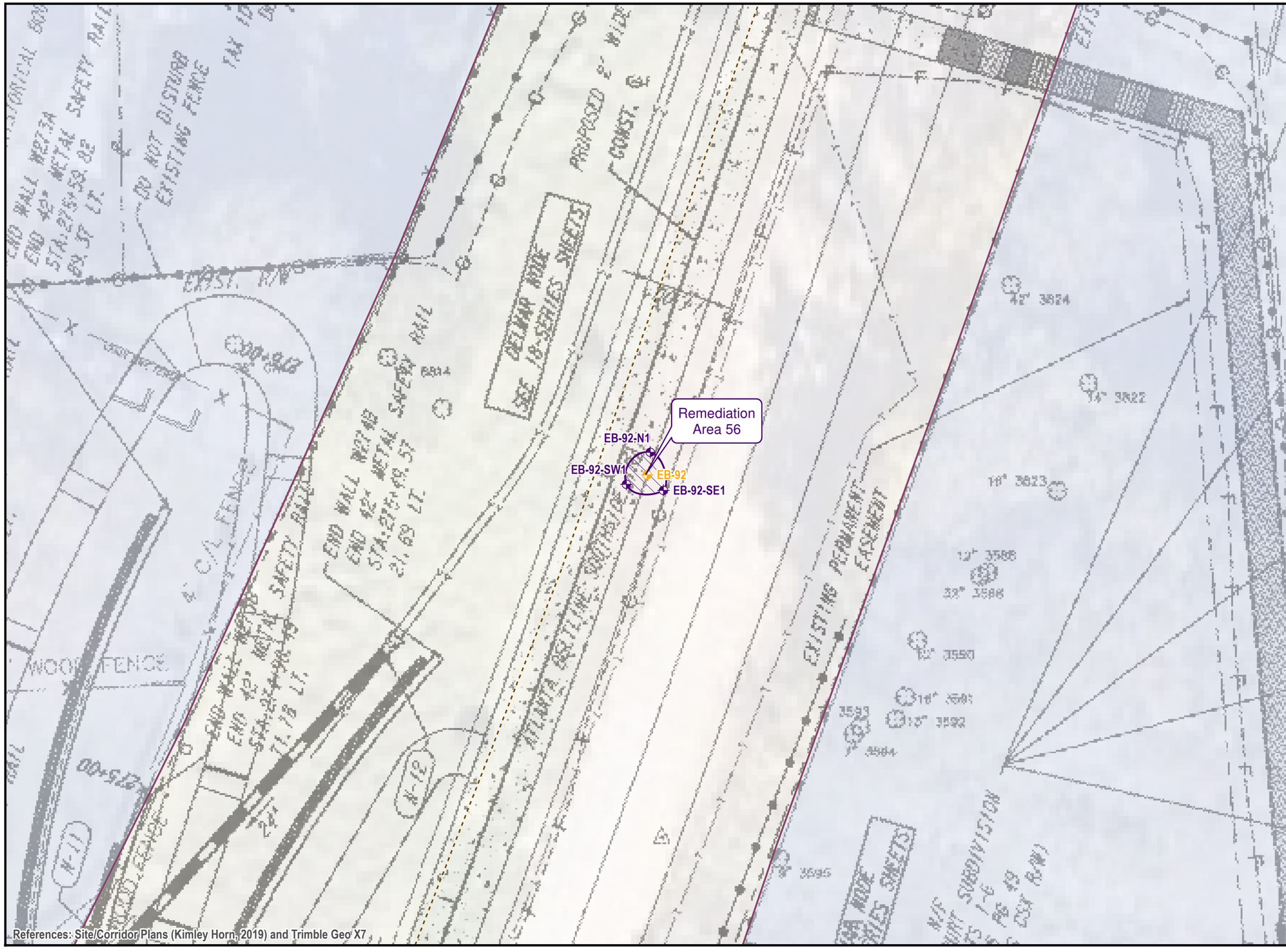
Sheet Title: Remediation Area Limits

Scale: N
0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5H



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
- Approx. GDOT Fiber
- Initial Soil Boring
- Delineation Boring

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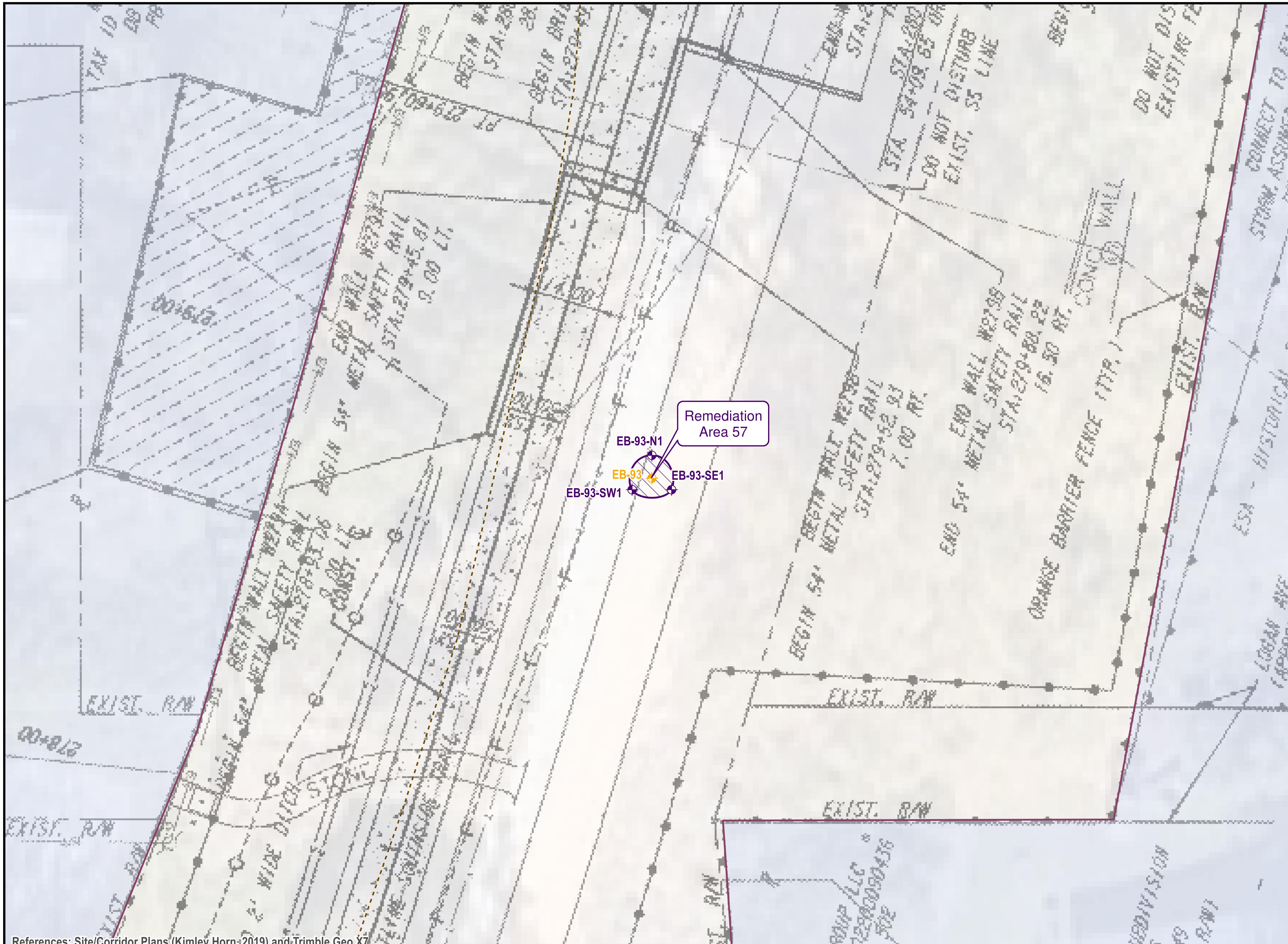
Sheet Title: Remediation Area Limits

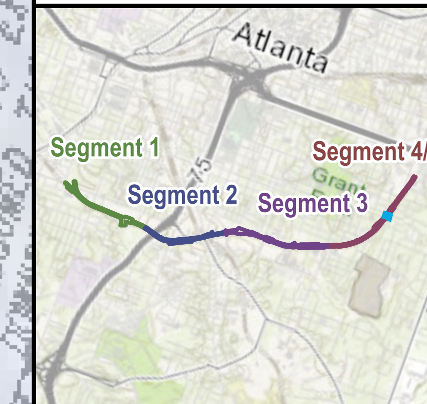
Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5I



Map Index



Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
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Client: Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20 — 1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5J

Remediation Area 58

EB-96-N2

EB-96-N1

EB-96-SE1

EB-96

EB-96-SW1

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
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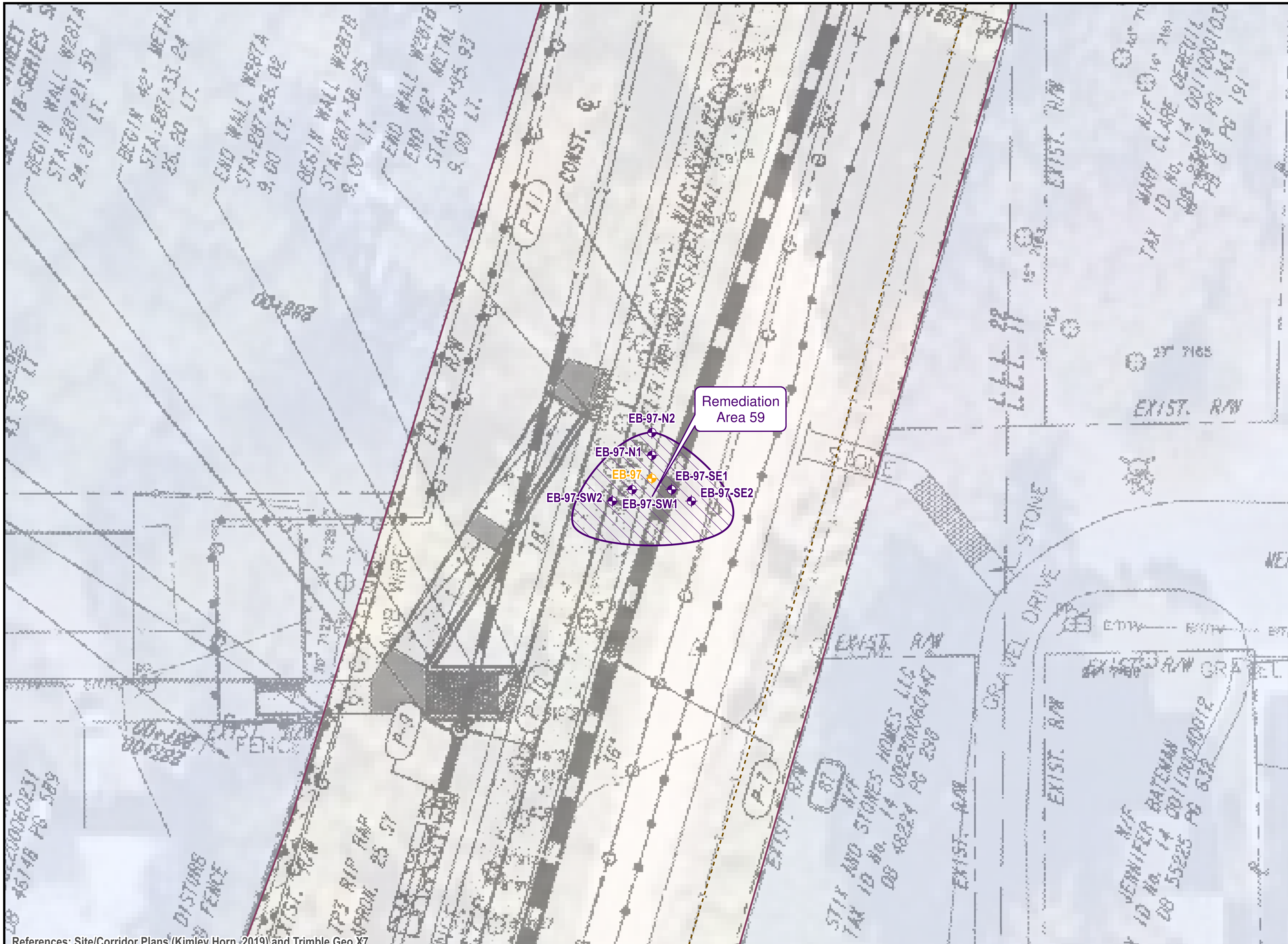
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

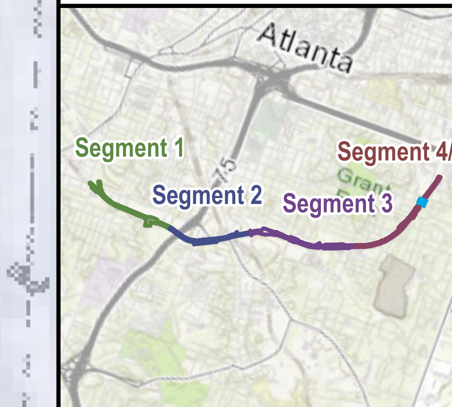
Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5K



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index



Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
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Project: Atlanta BeltLine – Southside Trail

Client: Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20 — 1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5L

References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index

Legend

- Limits of Remediation Area
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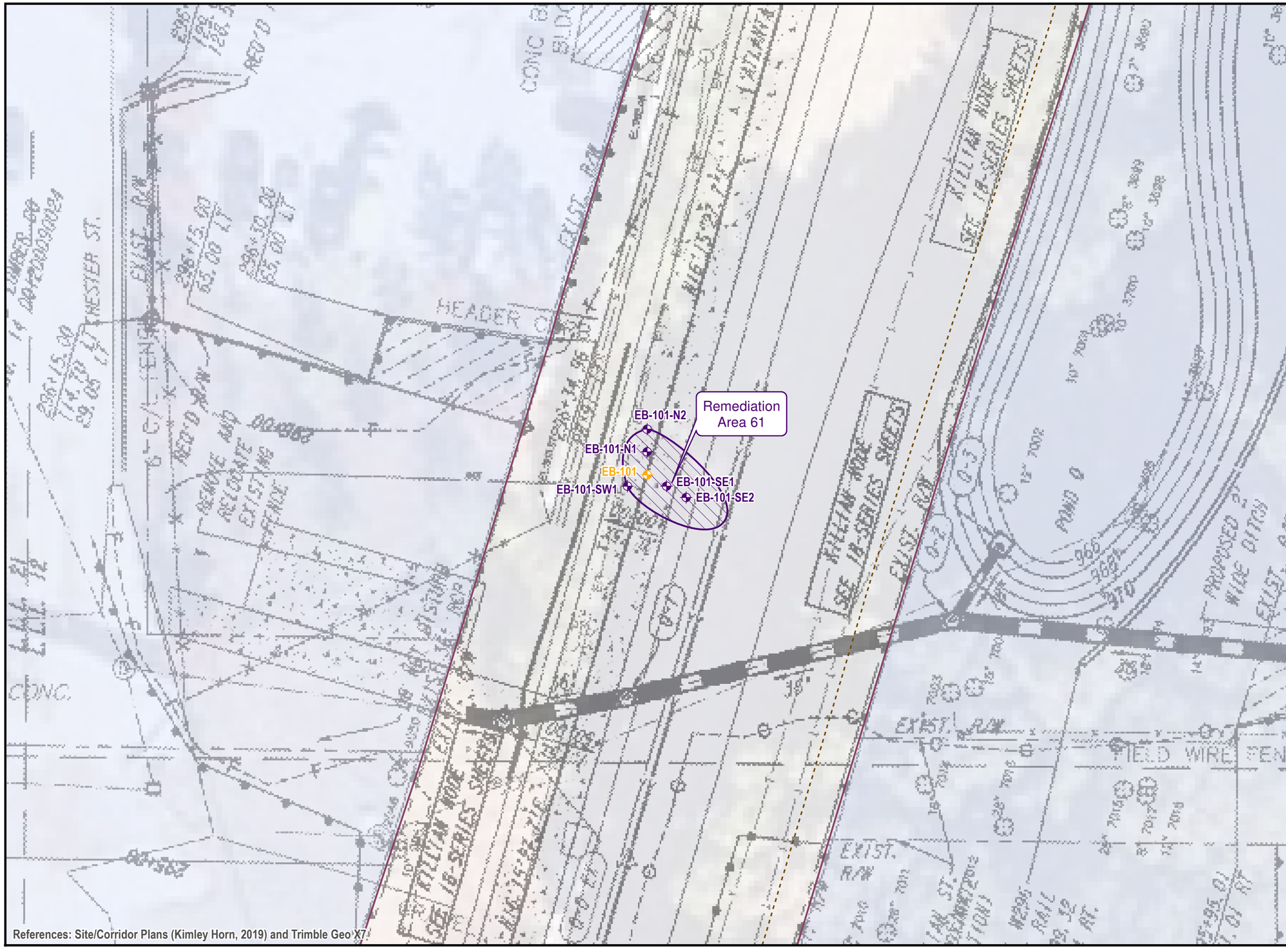
Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5M



Map Index

Legend

- Limits of Remediation Area
- SST Segment 4/5 Boundary
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Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
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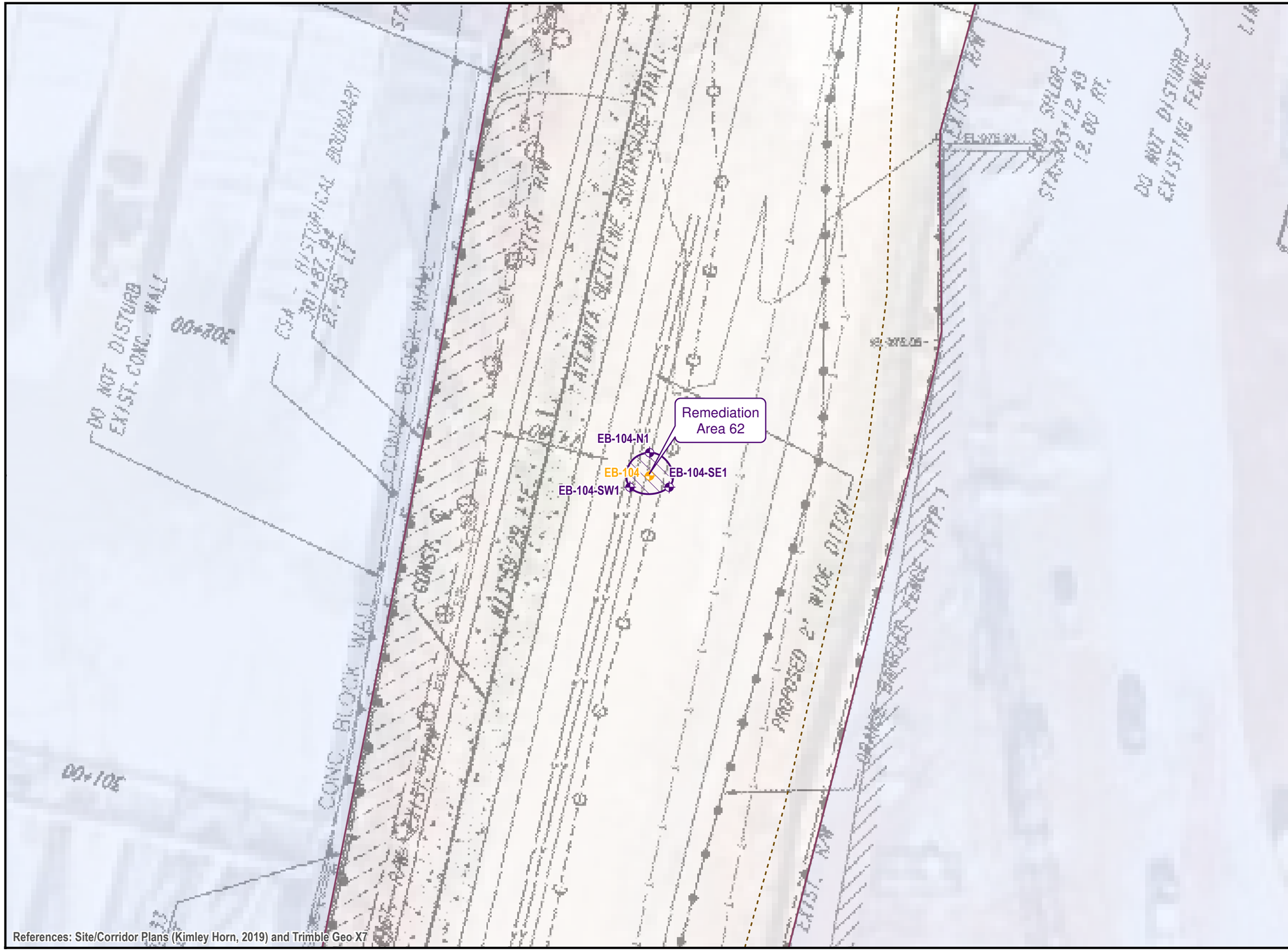
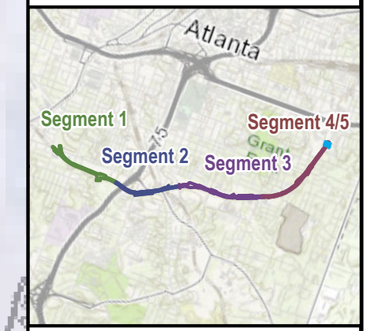
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5N



References: Site/Corridor Plans (Kimley Horn, 2019) and Trimble Geo X7

Map Index



Legend

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- SST Segment 4/5 Boundary
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Kimley-Horn

Sheet Title: Remediation Area Limits

Scale: N 0 5 10 20
1 inch = 20 feet

Prepared:	B. Sharp
Checked:	S. Cox / R. Griebel
Date:	Feb 15, 2021
Project No.	20-GA-01192-14

Figure 5O

TABLES

TABLE 1A: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 1

Notes:

- — Initial Sample with Exceedance
- — Water Table
- < ##.## — Reporting Limit for Constituent
- **NR** — Not Required (Analysis or Remediation)
- **CSNR** — Confirmation Sample Not Required due to utility conflict
- **XX-#-NW#** — Represents Sample Id, direction, and iteration
- **(VALUE)** — Value in parathesis is a duplicate sample
- **Proposed Elev.** — Red - Cut / Yellow - Balance / Green - Fill

					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
Highlighted indicates value greater than RRS				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 2	App. Station ID: 182+95	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-44	0-2	6/1/2018	144	108	<220	8400	18000
		EB-44A	3-4	7/15/2020 & 9/4/2020	8.93	—	—	< 450	< 450
		DUP-26	3-4		8.02	—	—	—	—
		EB-44-NW1	0-1	3/8/2019	107	—	—	<420	<420
		EB-44-NW2	0-1		109	—	—	—	—
		EB-44-S1	0-1		91	—	—	<370	510
		EB-44-S2	0-1		24.3	—	—	—	—
		EB-44-E1	0-1		213	—	—	<390	<390
		EB-44-E2	0-1		71.3	—	—	—	—
		Soil Remediation Dates:	5/10/2019 & TBD		Existing Elevation:	982.00'	Proposed Elevation:		978.77'
Remediation Area 3	App. Station ID: 187+00	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-46	0-2	6/1/2018	158	132	<250	1900	2900
		EB-46R	2-3	7/15/2020	<2.91	—	—	<460	—
		EB-46-N1	0-2		71.7	—	—	3800	—
		EB-46-N2	0-2		394	—	—	830	—
		EB-46-SE1	0-2	3/11/2019	55.1	—	—	2500	—
		EB-46-SE2	0-1		40.7	—	—	12000	—
		SE3	—		Excavate to Property Boundary				
		EB-46-W1	0-1		51.1	—	—	<410	—
		EB-46-W2	0-1		54.8	—	—	—	—
		EB-46-E1	0-1		19.5	—	—	<390	—
		Soil Remediation Dates:	5/10/2019 & TBD		Existing Elevation:	976.50'	Proposed Elevation:		975.46'
Remediation Area 29	App. Station ID: 158+77	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-33	0-2	6/5/2018	262	64	<7.0	430	1400
		EB-33A	2-3	7/20/2020	40.8	—	—	—	—
		EB-33-N1	0-2		38.6	—	—	—	—
		EB-33-N2	0-2		22.6	—	—	—	—
		EB-33-SE1	0-2		11.5	—	—	—	—
		EB-33-SW1	0-2		7.7	—	—	—	—
		Soil Remediation Dates:	TBD		Existing Elevation:	983.50'	Proposed Elevation:		981.50'
Remediation Area 30	App. Station ID: 159+14	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-34	0-2	6/6/2018	41.7	47	< 330	< 400	<400
		DUP-6	0-2	6/6/2018	31.8	46.9	< 340	< 400	< 400
		EB-34	23-25	6/7/2018	< 4.25	9.01	< 5.2	< 350	< 350
		EB-34A	2-3	7/20/2020	6.43	—	—	—	—
		EB-34-N1	0-2		91	—	—	—	—
		EB-34-N2	0-2		46.4	—	—	—	—
		EB-34-SE1	0-2		10.5	—	—	—	—
		DUP-30	0-2		13.1	—	—	—	—
		EB-34-SW1	0-2		306	—	—	—	—
		EB-34-SW2	0-2		200	—	—	—	—
		Soil Remediation Dates:	TBD		Existing Elevation:	982.36'	Proposed Elevation:		980.14'

TABLE 1A: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 1

Notes:

- — Initial Sample with Exceedance
- — Water Table
- < ##.## — Reporting Limit for Constituent
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- **CSNR** — Confirmation Sample Not Required due to utility conflict
- **XX-#-NW#** — Represents Sample Id, direction, and iteration
- **(VALUE)** — Value in parathesis is a duplicate sample
- **Proposed Elev.** — Red - Cut / Yellow - Balance / Green - Fill

Highlighted indicates value greater than RRS

					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 31	App. Station ID: 161+69	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-35	0-2	6/5/2020	70.8	67.4	<7.0	<380	520
		EB-35A	2-3	7/17/2020	10.8	—	—	—	—
		EB-35-N1	0-2		146	—	—	—	—
		EB-35-N2	0-2		558	—	—	—	—
		EB-35-SE1	0-2		169	—	—	—	—
		EB-35-SE2	0-2		15.2	—	—	—	—
		EB-35-SW1	0-2		430	—	—	—	—
		EB-35-SW2	0-2		89.5	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		982.10'	Proposed Elevation:		981.25'
Remediation Area 32	App. Station ID: 164+80	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-36	0-2	6/5/2018	120	127	<8.3	720	1800
		EB-36A	2-3	7/17/2020	13.9	—	—	—	—
		EB-36-N1	0-2		176	—	—	—	—
		DUP-29	0-2		186	—	—	—	—
		EB-36-N2	0-2		153	—	—	—	—
		EB-36-SE1	0-2		232	—	—	—	—
		EB-36-SE2	0-2		128	—	—	—	—
		EB-36-SW1	0-2		123	—	—	—	—
		EB-36-SW2	0-2		130	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		982.30'	Proposed Elevation:		980.55'
Remediation Area 33	App. Station ID: 166+94	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-37	0-2	6/5/2018	418	112	<6.1	520	1500
		EB-37A	3-4	7/17/2020	106	—	—	—	—
		EB-37-NE1	0-2		154	—	—	—	—
		EB-37-NE2	0-2		37.5	—	—	—	—
		EB-37-S1	0-2		306	—	—	—	—
		EB-37-S2	0-2		304	—	—	—	—
		EB-37-NW1	0-2		257	—	—	—	—
		EB-37-NW2	0-2		70.6	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		982.04'	Proposed Elevation:		980.27'
Remediation Area 34	App. Station ID: 169+63	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-38	0-2	6/14/2018	183	65.9	<5.2	<410	700
		EB-38A	2-3	7/16/2020	183	—	—	—	—
		EB-38-N1	0-2		233	—	—	—	—
		EB-38-N2	0-2		22.8	—	—	—	—
		EB-38-SE1	0-2		61.2	—	—	—	—
		EB-38-SE2	0-2		20.6	—	—	—	—
		EB-38-SW1	0-2		114	—	—	—	—
		DUP-28	0-2		98.2	—	—	—	—
		EB-38-SW2	0-2		18.4	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		983.99'	Proposed Elevation:		983.00'

TABLE 1A: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 1

Notes:

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					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
Highlighted indicates value greater than RRS				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 35	App. Station ID: 171+65	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-39	0-2	6/5/2018	81	73.7	<300	<410	410
		DUP-2	0-2		118	58.6	<300	<400	<400
		EB-39A	2-3	7/16/2020	379	—	—	—	—
		EB-39-N1	0-2		32.3	—	—	—	—
		EB-39-SE1	0-2		167	—	—	—	—
		EB-39-SE2	0-2		144	—	—	—	—
		EB-39-SW1	0-2		451	—	—	—	—
		EB-39-SW2	0-2		<2.05	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		984.00'	Proposed Elevation:		981.94'
Remediation Area 36	App. Station ID: 173+48	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-40	0-2	6/5/2018	226	115	<300	660	1500
		EB-40A	2-3	7/16/2020	<2.12	—	—	—	—
		EB-40-NW1	0-2		2.94	—	—	—	—
		DUP-27	0-2		<2.07	—	—	—	—
		EB-40-E1	0-2		134	—	—	—	—
		EB-40-E2	0-2		225	—	—	—	—
		EB-40-SW1	0-2		162	—	—	—	—
		EB-40-SW2	0-2		330	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		984.00'	Proposed Elevation:		984.00'
Remediation Area 37	App. Station ID: 175+42	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-41	0-2	6/5/2018	72.3	54.4	<5.2	<410	1000
		EB-41A	2-3	7/15/2020	<2.26	—	—	—	—
		EB-41-NE1	0-2		59.6	—	—	—	—
		EB-41-NE2	0-2		35.2	—	—	—	—
		EB-41-E1	0-2		<2.37	—	—	—	—
		EB-41-SW1	0-2		<2.11	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		984.00'	Proposed Elevation:		984.90'
Remediation Area 38	App. Station ID: 184+94	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 2				
		EB-45	0-2	6/1/2018	46.4	24.1	<5.5	<400	<400
		EB-45A	2-3	7/15/2020	22.2	—	—	—	—
		EB-45-NW1	0-2		<2.24	—	—	—	—
		EB-45-E1	0-2		37.7	—	—	—	—
		DUP-25	0-2		34.7	—	—	—	—
		EB-45-SW1	0-2		13.9	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		978.50'	Proposed Elevation:		977.12'

General Notes:

Station Numbers, distances, and elevations are approximate

Elevations were determined using nearest schematic shown on plans relative to Station Numbers

Elevations of proposed fill, insufficient fill (for the required soil cap), and cut are respectively highlighted in green, yellow, and red

TABLE 1B: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 2

Notes:

- Initial Sample with Exceedance
- Water Table
- < ##.## — Reporting Limit for Constituent
- **NR** — Not Required (Analysis or Remediation)
- **CSNR** — Confirmation Sample Not Required due to utility conflict
- **XX-#-NW#** — Represents Sample Id, direction, and iteration
- **(VALUE)** — Value in parathesis is a duplicate sample
- **Proposed Elev.** — Red - Cut / Yellow - Balance / Green - Fill

Highlighted indicates value greater than RRS

					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 4	App. Station ID: 206+25	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-57	0-2	6/4/2018	27.8	315	<260	1900	2300
		EB-57R	2.5-3	3/7/2019	—	—	—	<440	—
		EB-57-S1	0-1		—	—	—	3600	—
		EB-57-S2	0-1		—	—	—	860	—
		EB-57-W1	0-1		—	—	—	<380	—
		EB-57-E1	0-1		—	—	—	2000	—
		EB-57-E2	0-1		—	—	—	930	—
		Soil Remediation Dates:	5/10/2019	Existing Elevation:		961.00'	Proposed Elevation:		956.85'
Remediation Area 5	App. Station ID: 208+70	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-59	0-2	6/7/2018	297	132	730	<520	600
		EB-59R	2.5-3	3/6/2019	<2.37	—	<0.80	—	—
		EB-59-S1	0-2		2.73	—	<1.1	—	—
		EB-59-W1	0-0.5		304	—	<1.1	—	—
		EB-59-W2	0-2		98.5	—	—	—	—
		EB-59-E1	0-2		142	—	<1.5	—	—
		DUP-4-NONAS	0-2		<2.3	—	<1.4	—	—
		EB-59-E2	0-2		<2.45	—	—	—	—
		Soil Remediation Dates:	5/10/2019 & TBD	Existing Elevation:		958.00'	Proposed Elevation:		956.00'
Remediation Area 6	App. Station ID: 218+65	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-64	0-2	5/31/2018	108	73.5	610	<390	<390
		EB-64R	2.5-3	3/6/2019	<2.45	—	<0.86	—	—
		DUP-3-NONAS	2.5-3		<2.15	—	—	—	—
		EB-64-E1	0-1		34.9	—	<1.1	—	—
		EB-64-W1	0-1		199	—	<1.1	—	—
		EB-64-W2	0-1		69.2	—	—	—	—
		EB-64-S1	0-1		14	—	<0.72	—	—
		Soil Remediation Dates:	5/10/2019 & TBD	Existing Elevation:		948.00'	Proposed Elevation:		946.00'
Remediation Area 7	App. Station ID: 220+55	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-65	0-2	5/31/2018	246	131	< 11	3200	8800
		EB-65R	2.5-3	3/6/2019	<2.13	—	—	<380	<380
		EB-65-N1	0-2		21.9	—	—	<400	460
		DUP-2-NONAS	0-2		25.7	—	—	<400	470
		EB-65-SE1	0-2		246	—	—	<410	730
		EB-65-SE2	0-2		41.6	—	—	—	—
		EB-65-SW1	0-2		198	—	—	<400	610
		EB-65-SW2	0-2		10.3	—	—	—	—
		Soil Remediation Dates:	5/10/2019 & TBD	Existing Elevation:		946.00'	Proposed Elevation:		945.00'
Remediation Area 39	App. Station ID: 194+05	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-51	0-2	5/31/2018	115	158	<320	<440	<440
		EB-51A	3-4	7/13/2020	360	—	—	—	—
		EB-51-NW1	0-2		81.1	—	—	—	—
		EB-51-NW2	0-2		22.6				
		EB-51-E1	0-2		17.6	—	—	—	—
		EB-51-SW1	0-2		2.15	—	—	—	—
		DUP-24	0-2		5.61	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		971.50'	Proposed Elevation:		971.50'

TABLE 1B: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 2

Notes:

- Initial Sample with Exceedance
- Water Table
- < ##.## — Reporting Limit for Constituent
- **NR** — Not Required (Analysis or Remediation)
- **CSNR** — Confirmation Sample Not Required due to utility conflict
- **XX-#-NW#** — Represents Sample Id, direction, and iteration
- **(VALUE)** — Value in parathesis is a duplicate sample
- **Proposed Elev.** — Red - Cut / Yellow - Balance / Green - Fill

Highlighted indicates value greater than RRS

				RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
				Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
			Type 3/4	38	400	500	1,640	5,000
			Type 5	63	—	—	—	—
Remediation Area 40	App. Station ID: 197+05	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-53	0-2	6/7/2018	67.8	93.1	<380	<410	570
		EB-53A	3-4	7/13/2020	57	—	—	—	—
		EB-53-N1	0-2		51	—	—	—	—
		EB-53-N2	0-2		31.7	—	—	—	—
		EB-53-SW1	0-2	7/10/2020	246	—	—	—	—
		EB-53-SW2	0-2		10.1	—	—	—	—
		EB-53-SE1	0-2		160	—	—	—	—
		EB-53-SE2	0-2		12.4	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		971.25'	Proposed Elevation:		969.50'
Remediation Area 41	App. Station ID: 199+70	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-54	0-2	6/4/2018	80.4	114	<310	510	1300
		EB-54A	3-4	7/10/2020	<2.65	—	—	—	—
		EB-54-NW1	0-2		222	—	—	—	—
		EB-54-NW2	0-2		19.7	—	—	—	—
		EB-54-NE1	0-2		55.1	—	—	—	—
		EB-54-NE2	0-2		88.1	—	—	—	—
		EB-54-S1	0-2		<2.87	—	—	—	—
		DUP-23	0-2		<2.9	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		966.00'	Proposed Elevation:		966.56
Remediation Area 42	App. Station ID: 201+65	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-55	0-2	6/4/2018	197	150	<310	<400	760
		EB-55A	3-4	7/10/2020	18	—	—	—	—
		EB-55-N1	0-2		96.8	—	—	—	—
		EB-55-N2	0-2		282	—	—	—	—
		EB-55-SE1	0-2		142	—	—	—	—
		EB-55-SE2	0-2		20.5	—	—	—	—
		EB-55-SW1	0-2		74.3	—	—	—	—
		EB-55-SW2	0-2		85.5	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		964.00'	Proposed Elevation:		962.82'
Remediation Area 43	App. Station ID: 203+30	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-56	0-2	6/4/2018	68.7	59.7	<320	<430	480
		EB-56A	3-4	7/13/2020	69.6	—	—	—	—
		EB-56-N1	0-2		50.9	—	—	—	—
		DUP-22	0-2		58.5	—	—	—	—
		EB-56-N2	0-2		9.05	—	—	—	—
		EB-56-SW1	0-2		73	—	—	—	—
		EB-56-SW2	0-2		14.2	—	—	—	—
		EB-56-SE1	0-2		95	—	—	—	—
		EB-56-SE2	0-2		8.96	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		962.50'	Proposed Elevation:		961.00'
Remediation Area 44	App. Station ID: 211+80	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-60	0-2	6/4/2018	145	112	<210	1400	2100
		EB-60A	2-3	7/10/2020	<2.62	—	—	—	—
		EB-60-NE1	0-2		12.4	—	—	—	—
		EB-60-SE1	0-2		15.6	—	—	—	—
		EB-60-W1	0-2		12.7	—	—	—	—
		DUP-21	0-2		14.4	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		948.00'	Proposed Elevation:		946.00'

TABLE 1B: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 2

Notes:

— Initial Sample with Exceedance
— Water Table
< ##.## — Reporting Limit for Constituent
NR — Not Required (Analysis or Remediation)
CSNR — Confirmation Sample Not Required due to utility conflict
XX-#-NW# — Represents Sample Id, direction, and iteration
(VALUE) — Value in parathesis is a duplicate sample
Proposed Elev. — Red - Cut / Yellow - Balance / Green - Fill

					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
Highlighted indicates value greater than RRS				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 45	App. Station ID: 214+30	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-62	0-2	5/30/2018	41.6	31.8	<5.7	<440	<440
		DUP-1	0-2	5/31/2018	57.2	41.1	<5.3	<390	490
		EB-62A	2-3	7/10/2020	121	—	—	—	—
		EB-62-NW1	0-2		107	—	—	—	—
		EB-62-NW2	0-2		274	—	—	—	—
		EB-62-NE1	0-2		3.21	—	—	—	—
		EB-62-S1	0-2		23.5	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		952.00'	Proposed Elevation:		947.43'
Remediation Area 46	App. Station ID: 228+55	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-69	0-2	5/30/2018	57.2	33.2	<6.7	<410	580
		EB-69A	2-3	7/10/2020	2.63	—	—	—	—
		EB-69-NW1	0-2		11.8	—	—	—	—
		EB-69-SW1	0-2		< 2.5	—	—	—	—
		EB-69-E1	0-2		< 2.38	—	—	—	—
		DUP-19	0-2		4.04	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		939.59'	Proposed Elevation:		939.59'
Remediation Area 47	App. Station ID: 236+95	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-73	0-2	5/30/2018	515	86.5	<5.8	1100	3400
		EB-73A	3-4	7/9/2020	556	—	—	—	—
		EB-73-N1	0-2		188	—	—	—	—
		EB-73-N2	0-2		35.4	—	—	—	—
		EB-73-SE1	0-2		405	—	—	—	—
		EB-73-SE2	0-2		48.9	—	—	—	—
		EB-73-SW1	0-2		140	—	—	—	—
		EB-73-SW2	0-2		13.4	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		936.00'	Proposed Elevation:		932.38'
Remediation Area 48	App. Station ID: 237+95	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 3				
		EB-74	0-2	6/14/2018	91.7	112	< 7.8	< 420	1200
		DUP-10	0-2		54.6	145	< 8.2	< 410	520
		EB-74A	3-4	7/9/2020	12.9	—	—	—	—
		EB-74-N1	0-2		13.8	—	—	—	—
		EB-74-SE1	0-2		28	—	—	—	—
		EB-74-SW1	0-2		61.7	—	—	—	—
		DUP-18	0-2		281	—	—	—	—
		EB-74-SW2	0-2		295	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		936.00'	Proposed Elevation:		933.22

General Notes:

Station Numbers, distances, and elevations are approximate

Elevations were determined using nearest schematic shown on plans relative to Station Numbers

Elevations of proposed fill, insufficient fill (for the required soil cap), and cut are respectively highlighted in **green**, **yellow**, and **red**

TABLE 1C: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 4/5

Notes:

- — Initial Sample with Exceedance
- — Water Table
- < ##.## — Reporting Limit for Constituent
- **NR** — Not Required (Analysis or Remediation)
- **CSNR** — Confirmation Sample Not Required due to utility conflict
- **XX-#-NW#** — Represents Sample Id, direction, and iteration
- **(VALUE)** — Value in parathesis is a duplicate sample
- **Proposed Elev.** — Red - Cut / Yellow - Balance / Green - Fill

Highlighted indicates value greater than RRS

					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 8	App. Station ID: 298+30	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-102	0-2	6/13/2018	< 4.26	11.6	< 4.1	2100	4500
		EB-102R	2.5-3	3/6/2019	—	—	—	<380	—
		EB-102S1	0-1		—	—	—	650	—
		EB-102-N1	0-1		—	—	—	410	—
		EB-102-E1	0-1		—	—	—	1200	—
		Soil Remediation Dates:	5/6/2019	Existing Elevation:		972.50'	Proposed Elevation:		972.70'
Remediation Area 9	App. Station ID: 300+20	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-103	0-2	6/14/2018	26.4	733	< 8.4	770	1900
		EB-103R	2.5-3	3/6/2019	—	12.5	—	—	—
		EB-103-N1	0-2		—	129	—	—	—
		EB-103-S1	0-2		—	77.4	—	—	—
		DUP-1-NONAS	0-2		—	63.1	—	—	—
		EB-103-W1	0-2		—	45	—	—	—
		Soil Remediation Dates:	5/6/2019	Existing Elevation:		973.68'	Proposed Elevation:		973.70'
Remediation Area 49	App. Station ID: 250+50	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-80	1-1.5	6/7/2018	185	316	<6	<450	920
		EB-80A	3-4	7/9/2020	<2.74	—	—	—	—
		EB-80-N1	0-2		126	—	—	—	—
		EB-80-N2	0-2		<2.36	—	—	—	—
		EB-80-SE1	0-2		113	—	—	—	—
		EB-80-SE2	0-2		19.1	—	—	—	—
		EB-80-SW1	0-2		41.4	—	—	—	—
		EB-80-SW2	0-2		34	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		938.00'	Proposed Elevation:		935.00'
Remediation Area 50	App. Station ID: 252+50	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-81	0-2	6/14/2018	100	123	<7.7	510	1200
		EB-81A	2-3	7/9/2020	176	—	—	—	—
		EB-81-N1	0-2		5.81	—	—	—	—
		DUP-17	0-2		32.4	—	—	—	—
		EB-81-SE1	0-2		2.7	—	—	—	—
		EB-81-SW1	0-2		53.6	—	—	—	—
		EB-81-SW2	0-2		30.9	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		937.95'	Proposed Elevation:		937.27'
Remediation Area 51	App. Station ID: 254+50	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-82	0-1	6/7/2018	110	48.2	<5	<460	<460
		EB-82A	2-3	7/9/2020	43.5	—	—	—	—
		EB-82-N1	0-2		4.53	—	—	—	—
		EB-82-SW1	0-2		6.06	—	—	—	—
		EB-82-SE1	0-2		6.59	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		938.00'	Proposed Elevation:		937.00'

TABLE 1C: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 4/5

Notes:

- Initial Sample with Exceedance
- Water Table
- < ##.## — Reporting Limit for Constituent
- **NR** — Not Required (Analysis or Remediation)
- **CSNR** — Confirmation Sample Not Required due to utility conflict
- **XX-#-NW#** — Represents Sample Id, direction, and iteration
- **(VALUE)** — Value in parathesis is a duplicate sample
- **Proposed Elev.** — Red - Cut / Yellow - Balance / Green - Fill

					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
Highlighted indicates value greater than RRS				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 52	App. Station ID: 263+95	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-87	1.5-2	6/6/2018	207	138	<250	<390	890
		EB-87A	3-4	7/8/2020	46.7	—	—	—	—
		EB-87-N1	0-2		301	—	—	—	—
		DUP-16	0-2		372	—	—	—	—
		EB-87-N2	0-2		159	—	—	—	—
		EB-87-SW1	0-2		163	—	—	—	—
		EB-87-SW2	0-2		150	—	—	—	—
		EB-87-SE1	0-2		23	—	—	—	—
		Soil Remediation Dates:	TBD		Existing Elevation:	940.13'	Proposed Elevation:		937.99
Remediation Area 53	App. Station ID: 266+35	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-88	0-1	6/6/2018	84.5	57.5	<270	<490	<490
		EB-88A	3-4	7/8/2020	46.1	—	—	—	—
		EB-88-N1	0-2		25.3	—	—	—	—
		EB-88-SW1	0-2		13.9	—	—	—	—
		EB-88-SE1	0-2		4.29	—	—	—	—
		Soil Remediation Dates:	TBD		Existing Elevation:	941.89'	Proposed Elevation:		941.26'
Remediation Area 54	App. Station ID: 270+10	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-90	0-1	6/6/2018	212	80.1	<300	<420	<420
		EB-90A	3-4	7/8/2020	<3.26	—	—	—	—
		EB-90-S1	0-2		11	—	—	—	—
		DUP-15	0-2		14.9	—	—	—	—
		EB-90-NE1	0-2		6.67	—	—	—	—
		EB-90-NW1	0-2		5.76	—	—	—	—
		Soil Remediation Dates:	TBD		Existing Elevation:	943.70'	Proposed Elevation:		943.17'
Remediation Area 55	App. Station ID: 272+95	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-91	1-1.5	6/6/2018	217	88.2	<260	590	1900
		EB-91A	2-3	7/8/2020	110	—	—	—	—
		EB-91-N1	0-2		85.5	—	—	—	—
		EB-91-N2	0-2		285	—	—	—	—
		EB-91-SE1	0-2		143	—	—	—	—
		EB-91-SE2	0-2		29.6	—	—	—	—
		EB-91-SW1	0-2		115	—	—	—	—
		EB-91-SW2	0-2		6.57	—	—	—	—
		Soil Remediation Dates:	TBD		Existing Elevation:	948.00'	Proposed Elevation:		948.00'
Remediation Area 56	App. Station ID: 276+00	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-92	0.5-1	6/6/2018	268	53.6	<7.3	<410	<410
		EB-92A	2-3	7/8/2020	64.3	—	—	—	—
		EB-92-N1	0-2		10.9	—	—	—	—
		DUP-14	0-2		8.28	—	—	—	—
		EB-92-SE1	0-2		33.1	—	—	—	—
		EB-92-SW1	0-2		28.5	—	—	—	—
		Soil Remediation Dates:	TBD		Existing Elevation:	952.00'	Proposed Elevation:		952.00'

TABLE 1C: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 4/5

Notes:

- — Initial Sample with Exceedance
- — Water Table
- < ##.## — Reporting Limit for Constituent
- **NR** — Not Required (Analysis or Remediation)
- **CSNR** — Confirmation Sample Not Required due to utility conflict
- **XX-#-NW#** — Represents Sample Id, direction, and iteration
- **(VALUE)** — Value in parathesis is a duplicate sample
- **Proposed Elev.** — Red - Cut / Yellow - Balance / Green - Fill

Highlighted indicates value greater than RRS

					RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
					Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
				Type 3/4	38	400	500	1,640	5,000
				Type 5	63	—	—	—	—
Remediation Area 57	App. Station ID: 278+90	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-93	1-1.5	6/6/2018	384	126	< 8.0	< 440	1200
		EB-93A	2-3	7/8/2020	3.74	—	—	—	—
		EB-93-N1	0-2		4.43	—	—	—	—
		EB-93-SW1	0-2		5.6	—	—	—	—
		EB-93-SE1	0-2		26	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		952.00'	Proposed Elevation:		953.79'
Remediation Area 58	App. Station ID: 285+95	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-96	0-1	6/7/2018	49	140	< 190	< 360	390
		EB-96A	2-3	7/8/2020	9.59	—	—	—	—
		EB-96-N1	0-2		99.1	—	—	—	—
		DUP-13	0-2		120	—	—	—	—
		EB-96-N2	0-2		87.7	—	—	—	—
		EB-96-SW1	0-2		10.3	—	—	—	—
		EB-96-SE1	0-2		3.58	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		960.00'	Proposed Elevation:		956.78'
Remediation Area 59	App. Station ID: 287+90	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-97	0-0.5	6/7/2018	169	107	< 340	< 420	500
		EB-97A	2-3	7/8/2020	85.3	—	—	—	—
		EB-97-N1	0-2		102	—	—	—	—
		EB-97-N2	0-2		<2.28	—	—	—	—
		EB-97-SE1	0-2		74.2	—	—	—	—
		EB-97-SE2	0-2		47.5	—	—	—	—
		EB-97-SW1	0-2		81.9	—	—	—	—
		EB-97-SW2	0-2		47	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		962.00'	Proposed Elevation:		960.66'
Remediation Area 60	App. Station ID: 290+15	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-98	0-1	6/7/2018	61.7	38.6	< 310	< 450	770
		EB-98A	3-4	7/8/2020	48.7	—	—	—	—
		EB-98-N1	0-2		34.1	—	—	—	—
		DUP-11	0-2		109	—	—	—	—
		EB-98-SW1	0-2		46.5	—	—	—	—
		EB-98-SW2	0-2		28.6	—	—	—	—
		EB-98-SE1	0-2		79.7	—	—	—	—
		DUP-12	0-2		109	—	—	—	—
		EB-98-SE2	0-2		12.3	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		964.00'	Proposed Elevation:		964.20'

TABLE 1C: SUMMARY OF PRE-EXCAVATION SITE CHARACTERIZATION SAMPLING RESULTS, SEGMENT 4/5

Notes:

— Initial Sample with Exceedance
— Water Table
< ##.## — Reporting Limit for Constituent
NR — Not Required (Analysis or Remediation)
CSNR — Confirmation Sample Not Required due to utility conflict
XX-#-NW# — Represents Sample Id, direction, and iteration
(VALUE) — Value in parathesis is a duplicate sample
Proposed Elev. — Red - Cut / Yellow - Balance / Green - Fill

				RCRA-Metals (mg/Kg)		VOCs (ug/Kg)	SVOCs (ug/Kg)	
				Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthracene
Highlighted indicates value greater than RRS			Type 3/4	38	400	500	1,640	5,000
			Type 5	63	—	—	—	—
Remediation Area 61	App. Station ID: 296+10	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-101	0-2	6/13/2018	59.4	46.2	< 5.0	1100	2900
		DUP-6	0-2		—	—	< 5.4	870	2300
		EB-101A	2-3	7/8/2020	40.7	—	—	—	—
		EB-101-N1	0-2		144	—	—	—	—
		EB-101-N2	0-2		16.9	—	—	—	—
		EB-101-SE1	0-2		122	—	—	—	—
		EB-101-SE2	0-2		97.8	—	—	—	—
		EB-101-SW1	0-2		8.37	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		969.00'	Proposed Elevation:		968.00'
Remediation Area 62	App. Station ID: 301+90	Sample ID	Depth	Date Collected	Atlanta BeltLine Segment 4/5				
		EB-104	0-2	6/13/2018	102	302	< 5.7	610	1600
		EB-104A	2-3	7/8/2020	< 1.73	—	—	—	—
		EB-104-N1	0-2		33.6	—	—	—	—
		EB-104-SE1	0-2		27.3	—	—	—	—
		EB-104-SW1	0-2		31.5	—	—	—	—
		Soil Remediation Dates:	TBD	Existing Elevation:		975.49'	Proposed Elevation:		973.40'

General Notes:

Station Numbers, distances, and elevations are approximate

Elevations were determined using nearest schematic shown on plans relative to Station Numbers

Elevations of proposed fill, insufficient fill (for the required soil cap), and cut are respectively highlighted in **green**, **yellow**, and **red**

TABLE 2 - SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - DETECTIONS ONLY

Constituents	MCL[1]	Type 1 RRS[2]	MW-1		MW-2	Duplicate	MW-3	MW-5	MW-6	Duplicate 2	MW-7A	MW-8	MW-9	MW-10	MW-11
			18-Jun-18	19-Jun-18	13-Jun-18	13-Jun-18	13-Jun-18	13-Jun-18	15-Jun-18	15-Jun-18	12-Jun-18	6-Jun-18	20-Apr-20	6-Jun-18	6-Jun-18
Volatile Organic Compounds (VOCs) (ug/L)															
TCL List	-	-	BRL	-	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Semi Volatile Organic Compounds (SVOCs) (ug/L)															
TCL List	-	-	-	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Polychlorinated Biphenyls (PCBs) (ug/L)															
TCL List	-	-	-	-	-	-	BRL	-	-	-	-	BRL	-	BRL	-
Total Metals (mg/L) (Total/Dissolved)															
Arsenic	0.01	0.01	-	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01	< 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01
Barium	2	2	-	0.0630 / 0.0606	0.0888 / 0.0847	0.0889 / 0.0877	0.158 / 0.0325	0.106 / 0.104	0.0439	0.0632	0.0787 / 0.0335	0.0587 / 0.0624	0.236 / 0.109	0.066 / 0.0702	0.133 / 0.142
Cadmium	0.005	0.005	-	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005	< 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005
Chromium	0.1	0.1	-	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	0.0188 / < 0.01	< 0.01 / < 0.01	< 0.01	< 0.01	0.0113 / < 0.01	< 0.01 / < 0.01	0.0446 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01
Lead	0.015	0.015	-	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	**0.0524** / < 0.01	< 0.01 / < 0.01	< 0.01	< 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	**0.0204** / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01
Silver	-	0.1	-	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01	< 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01
Analytical Report Sample ID:			MW-1-GW	MW-1-GW	613-MW-2-GW	613-MW-2-D	613-MW-3-GW	613-MW-5-GW	MW-6-GW	DUP-2-GW	612-MW-7A-GW	606-MW-8-GW	606-MW-9-GW	606-MW-10-GW	606-MW-11-GW

Notes:

BOLD	- Exceeds Type 1 RRS and/or MCLs
< ##.##	Reporting Limit for Constituent
NA	- Not applicable
NR	- Not regulated
NE / -	- Not established / Not analyzed
[1]	- Federal Maximum Contaminant Levels
[2]	- Georgia Response and Remediation Program Type 1 RRS Appendix III Table 1
ug/L	- VOC and SVOC results are reported in microgram per liter
mg/L	- Metals results are reported in milligram per liter

THIS TABLE SUMMARIZES DETECTED CONSTITUENTS IN THE SAMPLES ANALYZED. REMAINING CONSTITUENTS NOT LISTED INDICATE RESULTS BELOW THE LABORATORY DETECTION LIMITS. (I.E. NOT DETECTED IN THE SAMPLE ABOVE QUANTITATION LIMITS)

TABLE 2 - SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - DETECTIONS ONLY

Constituents	MCL[1]	Type 1 RRS[2]	MW-12	MW-13	MW-14	MW-15	MW-16		MW-19	MW-20	MW-21	MW-23a	EB-106	EB-107	EB-109
			7-Jun-18	7-Jun-18	7-Jun-18	7-Jun-18	12-Jun-18	18-Jun-18	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	12-Apr-19	12-Apr-19	12-Apr-19
Volatile Organic Compounds (VOCs) (ug/L)															
TCL List	-	-	BRL	BRL	BRL	BRL	BRL	-	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Semi Volatile Organic Compounds (SVOCs) (ug/L)															
TCL List	-	-	BRL	BRL	BRL	BRL	-	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Polychlorinated Biphenyls (PCBs) (ug/L)															
TCL List	-	-	-	-	-	-	-	-	-	-	-	-	-	BRL	BRL
Total Metals (mg/L) (Total/Dissolved)															
Arsenic	0.01	0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	-	< 0.01 / < 0.01	**0.786** / < 0.01	< 0.05 / < 0.01	< 0.05 / < 0.01	< 0.05 / < 0.01	0.0110 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01
Barium	2	2	0.0721 / 0.0795	0.0837 / 0.0836	0.0716 / 0.0747	0.0545 / 0.0587	-	0.178 / 0.167	**13** / 0.0691	0.981 / 0.106	0.114 / 0.0454	0.438 / 0.127	0.514 / 0.0332	0.130 / 0.0495	0.0724 / 0.0457
Cadmium	0.005	0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	-	< 0.005 / < 0.005	**0.0440** / < 0.005	< 0.025 / < 0.005	< 0.025 / < 0.005	< 0.025 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005	< 0.005 / < 0.005
Chromium	0.1	0.1	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	-	< 0.01 / < 0.01	**4.16** / < 0.01	0.0503 / < 0.01	0.0129 / < 0.01	0.0388 / < 0.01	**0.182** / < 0.01	0.0268 / < 0.01	< 0.01 / < 0.01
Lead	0.015	0.015	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	-	< 0.01 / < 0.01	**7.18** / < 0.01	**0.0660** / < 0.01	< 0.05 / < 0.01	**0.0622** / < 0.01	**0.0814** / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01
Silver	-	0.1	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01	-	< 0.01 / < 0.01	0.0561 / < 0.01	0.0660 / < 0.02	< 0.05 / < 0.02	0.0622 / < 0.02	< 0.01 / < 0.01	< 0.01 / < 0.01	< 0.01 / < 0.01
Analytical Report Sample ID:			607-MW-12-GW	607-MW-13-GW	607-MW-14-GW	607-MW-15-GW	612-MW-16-GW	MW-16-GW	MW-19	MW-20	MW-21	MW-23A	EB-106-GW	EB-107-GW	EB-109-GW

Analytical Report Sample ID: 607-MW-12-GW | 607-MW-13-GW | 607-MW-14-GW | 607-MW-15-GW | 612-MW-16-GW | MW-16-GW | MW-19 | MW-20 | MW-21 | MW-23A | EB-106-GW | EB-107-GW | EB-109-GW

Notes:

BOLD	- Exceeds Type 1 RRS and/or MCLs
< ##.##	Reporting Limit for Constituent
NA	- Not applicable
NR	- Not regulated
NE / -	- Not established / Not analyzed
[1]	- Federal Maximum Contaminant Levels
[2]	- Georgia Response and Remediation Program Type 1 RRS Appendix III Table 1
ug/L	- VOC and SVOC results are reported in microgram per liter
mg/L	- Metals results are reported in milligram per liter

THIS TABLE SUMMARIZES DETECTED CONSTITUENTS IN THE SAMPLES ANALYZED. REMAINING CONSTITUENTS NOT LISTED INDICATE RESULTS BELOW THE LABORATORY DETECTION LIMITS. (I.E. NOT DETECTED IN THE SAMPLE ABOVE QUANTITATION LIMITS)

Table 3A - Summary of Estimated Soil Remediation Volumes Per Remediation Area, Segment 2

Remediation Area	Segment	Sample ID	Constituents[1]	Delineated Area (sq. ft.)	Added Area Following Removal of Conflicted Utilities (sqft.)*	Remediation Depth (ft)	Actual Remediated Depth (ft)	Cubic Feet (ft^3)	Cubic Yards (yd^3)	Tons ^	w/20% Contingency
2	2	EB-44	As, B[a]P, B[b]F	382	Conflict not being removed / Previously Remediated for non-Arsenic	3.0	3.12, TBD	1146	42.4	64	76
3	2	EB-46	As, B[a]P	371	Conflict not being removed / Previously Remediated for benzo(a)pyrene	2.5	2.64, TBD	928	34.4	52	62
29	2	EB-33	As	127	NA	3.0	TBD	381	14.1	21	25
30	2	EB-34	As	490	NA	2.0	TBD	980	36.3	54	65
31	2	EB-35	As	620	NA	2.0	TBD	1240	45.9	69	83
32	2	EB-36	As	854	Conflict not being removed	2.0	TBD	1708	63.3	95	114
33	2	EB-37	As	676	Conflict not being removed	3.0	TBD	2028	75.1	113	135
34	2	EB-38	As	304	NA	2.0	TBD	608	22.5	34	41
35	2	EB-39	As	232	Conflict not being removed	3.5	TBD	812	30.1	45	54
36	2	EB-40	As	441	Conflict not being removed	1.0	TBD	441	16.3	25	29
37	2	EB-41	As	100	Conflict not being removed	1.0	TBD	100	3.7	6	7
38	2	EB-45	As	77	NA	2.0	TBD	154	5.7	9	10
								Totals:	389.8	585	702

Notes:

^, Using a 1.50 tons/cu.yd. Multiplier

Assumes vertical excavation sidewalls with no setbacks or benching

TBD - To Be Determined; Remediation is pending

1 - Constituents Key:

As — Arsenic
B[a]P — Benzo(a)pyrene
B[b]F — Benzo(b)fluoranthene
Pb — Lead

[2] Utility removal unknown at this time; Entire Remedial Area in conflict with Utility

* Applies to non-arsenic constituents. NA means not applicable, as additional arsenic removal is not required due to the Type 5 RRS approach.

Table 3B - Summary of Estimated Soil Remediation Volumes Per Remediation Area, Segment 3

Remediation Area	Segment	Sample ID	Constituents[1]	Delineated Area (sq. ft.)	Added Area Following Removal of Conflicted Utilities (sqft.)*	Remediation Depth (ft)	Actual Remediated Depth (ft)	Cubic Feet (ft^3)	Cubic Yards (yd^3)	Tons ^	w/20% Contingency
4	3	EB-57	B[a]P	121	Conflict not being removed / Previously Remediated for benzo(a)pyrene	2.5	2.5	303	-[2]	-	-
5	3	EB-59	As, Benzene	33	Conflict not being removed / Previously Remediated for benzene	2.5	2.52, TBD	83	3.1	5	6
6	3	EB-64	As, Benzene	58	Conflict not being removed / Previously Remediated for benzene	2.5	2.8, TBD	145	5.4	8	10
7	3	EB-65	As, B[a]P, B[b]F	236	NA / Previously Remediated for non-Arsenic	2.5	2.82, TBD	590	21.9	33	39
39	3	EB-51	As	138	NA	1.0	TBD	138	5.1	8	9
40	3	EB-53	As	175	Conflict not being removed	3.0	TBD	525	19.4	29	35
41	3	EB-54	As	320	NA	1.0	TBD	320	11.9	18	21
42	3	EB-55	As	521	Conflict not being removed	2.5	TBD	1303	48.2	72	87
43	3	EB-56	As	184	Conflict not being removed	2.5	TBD	460	17.0	26	31
44	3	EB-60	As	70	Conflict not being removed	2.0	TBD	140	5.2	8	9
45	3	EB-62	As	175	Conflict not being removed	6.0	TBD	1050	38.9	58	70
46	3	EB-69	As	31	Conflict not being removed	1.0	TBD	31	1.1	2	2
47	3	EB-73	As	140	Conflict not being removed	5.0	TBD	700	25.9	39	47
48	3	EB-74	As	261	NA	3.0	TBD	783	29.0	44	52
								Totals:	232.1	348	418

Notes:

^, Using a 1.50 tons/cu.yd. Multiplier

Assumes vertical excavation sidewalls with no setbacks or benching

TBD - To Be Determined; Remediation is pending

1 - Constituents Key:

As — Arsenic
B[a]P — Benzo(a)pyrene
B[b]F — Benzo(b)fluoranthene
Pb — Lead

2 - Remediation previously conducted

* Applies to non-arsenic constituents. NA means not applicable, as additional arsenic removal is not required due to the Type 5 RRS approach.

Table 3C - Summary of Estimated Soil Remediation Volumes Per Remediation Area, Segment 4/5

Remediation Area	Segment	Sample ID	Constituents[1]	Delineated Area (sq. ft.)	Added Area Following Removal of Conflicted Utilities (sqft.)*	Remediation Depth (ft)	Actual Remediated Depth (ft)	Cubic Feet (ft^3)	Cubic Yards (yd^3)	Tons ^	w/20% Contingency
8	4	EB-102	B[a]P	34	Conflict not being removed	2.5	2.5	85	-[3]	-	-
9	4	EB-103	Pb	79	NA	1.0	2.25	196	-[3]	-	-
49	4	EB-80	As	230	NA	3.0	TBD	690	25.6	38	46
50	4	EB-81	As	136	Conflict not being removed[2]	2.0	Utility Conflict[2]				
51	4	EB-82	As	32	Conflict not being removed	2.0	TBD	64	2.4	4	4
52	4	EB-87	As	330	Conflict not being removed	3.5	TBD	1155	42.8	64	77
53	4	EB-88	As	16	Conflict not being removed	2.0	TBD	32	1.2	2	2
54	4	EB-90	As	35	Conflict not being removed[2]	2.0	Utility Conflict[2]				
55	4	EB-91	As	345	Conflict not being removed	1.0	TBD	345	12.8	19	23
56	4	EB-92	As	68	NA	1.0	TBD	68	2.5	4	5
57	4	EB-93	As	72	NA	Fill	Fill Reportedly Required - No Planned Remediation				
58	4	EB-96	As	107	Conflict not being removed	2.0	TBD	214	7.9	12	14
59	4	EB-97	As	638	NA	2.5	TBD	1595	59.1	89	106
60	4	EB-98	As	168	NA	1.0	TBD	168	6.2	9	11
61	4	EB-101	As	328	NA	2.0	TBD	656	24.3	36	44
62	4	EB-104	As	74	NA	2.0	TBD	148	5.5	8	10
								Totals:	190.2	285	342

Notes:

^, Using a 1.50 tons/cu.yd. Multiplier

Assumes vertical excavation sidewalls with no setbacks or benching

TBD - To Be Determined; Remediation is pending

1 - Constituents Key:

As — Arsenic
B[a]P — Benzo(a)pyrene
B[b]F — Benzo(b)fluoranthene
Pb — Lead

2 - Utility removal unknown at this time; Entire Remedial Area in conflict with Utility

3 - Remediation previously conducted

* Applies to non-arsenic constituents. NA means not applicable, as additional arsenic removal is not required due to the Type 5 RRS approach.

APPENDIX A

Appendix F to PPCAP Amendment #2, dated June 7, 2019

UNITED CONSULTING

REPORT

For
Environmental
Protection Division

Appendix F to Corrective Action Plan
Amendment #2
Atlanta BeltLine Properties -
Southside Trail
Atlanta, Fulton County, Georgia

625 Holcomb Bridge Road, Norcross, GA 30071 • 770-209-0029 • unitedconsulting.com

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June 7, 2019

Ms. Shannon Ridley
Brownfields Unit Coordinator
Land Protection Branch
Environmental Protection Division
Floyd Towers East, Suite 1154
2 Martin Luther King, Jr. Drive SE
Atlanta, Georgia 30334

RE: Appendix F to Corrective Action Plan Amendment #2
Atlanta BeltLine Properties - Southside Trail
Atlanta, Fulton County, Georgia
Project No. KMHRN-17-GA-01192-06

Dear Ms. Ridley:

On behalf of **Atlanta BeltLine, Inc.**, United Consulting is pleased to submit this Appendix F to the March 25, 2011 Corrective Action Plan (CAP) Amendment #2 of the approved master BeltLine CAP. This Appendix F specifically relates to the portion of the Atlanta BeltLine Properties referenced as the Southside Trail (SST), which is hereinafter reference to as the Subject Property. The purpose of this submittal is to provide EPD with soil and groundwater data for the SST section of the Atlanta BeltLine corridor and to propose the corrective action approach.

On March 25, 2011, CAP Amendment #2 was submitted that established a procedure whereby EPD will review and approve a site-specific Appendix to the CAP for each segment of the BeltLine. To date, there have been five Appendices issued including:

- Appendix A – Soil RRS Calculations;
- Appendix B – Eastside Trail Project Plan;
- Appendix C – Reynoldstown Trail Project Plan;
- Appendix D – Northeast Corridor Project Plan; and
- Appendix E – Eastside Trail Corridor Extension – Aramark Parcel.

United Consulting understands that each of the above Appendices were approved by the EPD. For Appendix A, only Appendix A.2 was approved (Appendix A.3 was not approved). As documented within Appendices B, C, and D, a Type 5 soil Risk Reduction Standard (RRS) was applied to the elevated arsenic detections along those segments. As documented in the attached Appendix F, similar arsenic in soil conditions have been encountered along the SST. Therefore, the same corrective action approach is proposed herein. Based on our meeting with you on May 14, 2019, this Appendix F includes:

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- A summary of United Consulting's September 2018 Phase II Environmental Assessment/Initial Brownfield Site Characterization Sampling and April 2019 Additional Phase II Environmental Assessment, along with supporting figures and summary tables;
- A summary of the non-arsenic remedial efforts already taken across the SST; and
- Planned Corrective Actions for SST.

Appendix B and D to the PPCAP Amendment #2 included a Type 5 arsenic exposure assessment, Type 5 RRS arsenic justification, and arsenic soil to groundwater leaching assessment. Atlanta BeltLine, Inc. confirmed that the SST is similar to previous trail sections relative to potential receptors, which may include construction and utility workers, recreational users, and landscaper/lawn mowers. Further, the hydrogeologic conditions along the SST are similar to the Northeast Corridor and Eastside Trail, and no arsenic groundwater impacts have been detected along these trail segments. Due to the consistent conditions and potential receptors at the SST and the other trail segments, an updated Type 5 arsenic exposure assessment, Type 5 RRS arsenic justification, nor arsenic soil to groundwater leaching assessment appears to be warranted.

At this time, an interim hiking trail is under construction and scheduled to open along the entire SST around July 2019. The final trail is being completed in segments as funding becomes available. The first segment planned for construction, Segment 1, is on the western portion of the SST from near University Avenue, approximately 4,600 feet to the east; approximately from Stations (STA) 100+31 to 146+00. This segment is currently planned for construction starting in late 2019.

A rapid response to this request is greatly appreciated. As approved by you in a meeting on May 14, 2019, arsenic delineation sampling efforts are currently under way at Segment 1. The Prospective Purchaser plans to commence the initial arsenic soil remediation at Segment 1 by mid- to late-2019. Please contact Russell Griebel with United Consulting at 770-582-2788, if you have any questions or if we can be of further assistance.

Sincerely,

UNITED CONSULTING

Maurice James Fagan IV

M. James (Jay) Fagan, P.G.
Staff Geologist

Russell C. Griebel, P.G., C.P.G.
Executive Vice President

Attachments:
F1 – Phase II Environmental Assessment/Initial Brownfield Site Characterization Sampling and Additional Phase II Environmental Assessment Summary
F2 – Figures and Table

Figure 1	Subject Property Location Map (Aerial Photograph)
Figure 2	Subject Property Location Map (Street Map)
Figure 3	USGS Topographic Map
Figure 4a	Soil Sample Location Map Overview
Figure 4b	Allene to Metropolitan Soil Sample Locations

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Figure 4c Metropolitan to Pryor Soil Sample Locations
Figure 4d Pryor to Milton Soil Sample Locations
Figure 4e Milton to Hill Soil Sample Locations
Figure 4f Hill to Boulevard Soil Sample Locations
Figure 4g Boulevard to Ormewood Soil Sample Locations
Figure 4h Ormewood to Glenwood Soil Sample Locations
Figure 5a Inferred Groundwater Potentiometric Surface Map (Aerial Photograph)
Figure 5b Inferred Groundwater Potentiometric Surface Map (USGS Topographic Map)
MACTEC Phase I Summary and Conclusions Table (i.e. REC Summary Table)

F3 – Analytical Summary Tables
Table 1 Well Construction Summary
Table 2 Soil Screening Measurements
Table 3 Groundwater Depth Summary
Table 4 Summary of Soil Analytical Results – Detections Only
Table 5 Summary of Groundwater Analytical Results – Detections Only

F4 – Non-Arsenic Remedial Efforts
F5 – Planned Corrective Actions for SST

MJF/RCG/rgw

SharePoint: 01192-06.PPCAP Amendment No 2 – Appendix F

C: Kevin Burke; Atlanta BeltLine, Inc.; KBurke@atlbeltline.org
Sean Johnston; Kimley-Horn; sean.johnston@kimley-horn.com

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F1 – PHASE II ENVIRONMENTAL ASSESSMENT/INITIAL BROWNFIELD SITE CHARACTERIZATION SAMPLING AND ADDITIONAL PHASE II ENVIRONMENTAL ASSESSMENT SUMMARY

625 Holcomb Bridge Road, Norcross, GA 30071 • 770-209-0029 • unitedconsulting.com

1.0 INTRODUCTION

The Subject Property, **Atlanta BeltLine – Southside Trail (SST),** consisted of the former CSX railroad and associated right-of-way (ROW) that extended approximately 4.5-miles from near University Ave (Station 100+25.00) generally to the east and then to the north to Glenwood Ave (Station 303+55.12), in Atlanta, Fulton County, Georgia. Also part of the Subject Property were limited areas (slivers) of required (new) ROW needed for the future construction of the SST. The general location of the Subject Property is illustrated on Figures 1 and 2 in Attachment F2. Figure 3 in Attachment F2 is a USGS topographic map of the project area.

Like the Eastside Corridor, the SST is being designed as a public transportation right-of-way within a "green" setting. Generally, the proposed final trail construction is proposed along the northern and western sides (depending on the historic rail bed orientation) of the corridor, preserving space for future transit on the southern and eastern sides. The proposed final trail is generally being designed to accommodate walking, jogging, biking, roller skating and roller blading, as well as wheelchairs and mobility aids for the disabled. Prior to the construction of the final trail, ABI is planning to open an interim hiking trail that will be constructed generally along the current alignment of the former railroad bed. The SST will connect the Westside and Eastside Atlanta BeltLine Trails.

At the time of United Consulting's Phase II Environmental Assessment (Phase II)/Initial Brownfield Site Characterization Sampling (BSCS) and Additional Phase II, the railroad tracks, ties, and associated ballast were in place along the majority of the alignment. However, CSX was at the beginning stages of removing the tracks and ties starting at Glenwood Avenue and working to the south and west. Following completion of the report, CSX had completed removing the tracks and ties across the Subject Property. Figures 4a to 4h in Attachment F2 show the boring locations advanced for the Phase II/Initial BSCS and Additional Phase II.

At the time of the issuance of this report, the interim hiking trail was under construction across the approximate 4.5-miles. The final trail is being completed in segments as funding becomes available. The first segment (Segment 1) planned for construction is on its western portion from near University Avenue approximately 4,600 feet to the east; approximately from Stations (STA) 100+31 to 146+00. This segment is planned for construction staring in late 2019.

2.0 BACKGROUND

On November 1, 2010, MACTEC completed a Phase I Environmental Site Assessment on the Atlanta BeltLine Corridor from Simpson Road to DeKalb Avenue in Atlanta, Fulton and DeKalb County, Georgia, which included the Subject Property. MACTEC concluded that, in addition to the general environmental concern associated with past site use, a number of adjacent properties along the corridor were identified as recognized environmental conditions (RECs) and environmental concerns relative to the subject site. MACTEC recommended subsurface sampling a testing along the corridor in the vicinity of the various identified RECs.

31 facilities in the vicinity of the SST corridor were considered RECs. These were identified as Findings Numbers SW-6 to SW-11, SE-1 to SE-21, and E-1 to E-4 in MACTEC's November 2010 Phase I report. The general locations of these RECs are illustrated on Figures 5a and 5b

in Attachment F2. A copy of the Summary and Conclusions table from MACTEC's Phase I are including in Attachment F2, following the figures. MACTEC suggested additional file reviews for select RECs located along the BeltLine corridor. United Consulting performed file reviews for the facilities relevant to the SST.

United Consulting was retained by Kimley Horn to perform a Phase II/Initial BSCS and Additional Phase II of the Subject Property. The purpose of this assessment was to determine if the previously identified on- and off-site recognized environmental conditions (RECs) had impacted the Subject Property. Additionally, to determine if possible corrective actions could be warranted for impacts with concentrations above certain clean-up standards as established under the existing Brownfield documents for the overall Atlanta BeltLine. The scope of work for the assessments was generally based on MACTEC's findings and the file reviews. The scope of the assessments was presented to Brownfield staff at a meeting at EPD offices on May 7th, 2018.

2.0 PHASE II/INITIAL BSCS AND ADDITIONAL PHASE II SUMMARY

United Consulting completed a Phase II/Initial BSCS on the Subject Property in mid-2018. The results from this assessment are briefly summarized below. Supporting figures are included in Attachment F2, along with supporting summary tables in Attachment F3. This is being provided as a summary, complete details will be provided in later Interim and/or Final PPCSR(s).

- A total of 105 borings were advanced on the Subject Property to facilitate soil sampling and/or groundwater sampling. The borings were designated EB-1 to EB-105. Soils were collected during the drilling operations for screening with an organic vapor monitor (OVM). Soils screened with the OVM did not reveal elevated organic vapors above background levels, except one sample (EB-82 from 2-4 feet). Of the 105 borings advanced on the Subject Property, 89 were advanced via hand auger, and 16 were advanced via direct push technology. The boring locations are illustrated on Figures 4a to 4g.

- Soil samples were generally collected from a shallow interval (0 to 2 feet below ground surface (ft bgs)) at each boring location. 105 soil samples were collected during drilling activities at the Subject Property and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and Resource Conservation and Recovery Act (RCRA) 8 metals. 10 of the soil samples were also analyzed for polychlorinated biphenyls (PCBs), depending on the boring location relative to the previously identified RECs and regulatory file reviews.

    - The Hazardous Site Response Act (HSRA) Risk Reduction Standards (RRS) for constituents detected to date on other portions of the Atlanta BeltLine Properties were established and approved by Environmental Protection Division (EPD) as part of Amendment #2 to the approved master CAP for the BeltLine properties. These RRS, as available, were used for comparison in this report. For constituents detected in soil at the Subject Property that did not have non-residential RRS approved, United Consulting calculated non-residential RRS following the pre-September 25, 2018 RRS methods.

    - Various VOCs, SVOCs, and RCRA 8 metals were detected in the soil samples collected from the Subject Property. PCBs were not detected in soil samples collected from the Subject Property.

- Benzene was detected above the HSRA Notification Concentration (NC) in the soil samples collected from 0 to 2 ft bgs in borings EB-12, EB-23, EB-25, EB-26, EB-59, and EB-64, and above its non-residential RRS in the soil samples collected from 0 to 2 ft bgs in borings EB-25, EB-59, and EB-64; however, NCs do not apply to petroleum releases, which this constituent is anticipated to be associated with.
- Tetrachloroethene was detected above its NC in one of the soil samples, EB-12, from a depth of 0 ft bgs to 2 ft bgs, but below its non-residential RRS.
- Benzo(a)pyrene was detected above its NC and non-residential RRS in the soil samples collected from 0 to 2 ft bgs in borings EB-44, EB-46, EB-57, EB-65, and EB-102.
- Benzo(b)fluoranthene was detected above its NC and non-residential RRS in the soil samples collected from 0 to 2 ft bgs in borings EB-44 and EB-65.
- Chrysene was detected at a concentration equal to its NC in boring EB-44, at a sample collection depth of 0 ft bgs to 2 ft bgs, but below its non-residential RRS.
- Indeno(1,2,3-cd)pyrene was detected above its NC in boring EB-44, at a sample collection depth of 0 ft bgs to 2 ft bgs, but below its recently calculated non-residential RRS.
- Lead was detected above its NC and non-residential RRS in one of the borings, SB-103, at a sample collection depth of 0 ft bgs to 2 ft bgs.
- Arsenic was detected above its Type 3 non-residential RRS (38 mg/kg) in the soil samples collected from 0 ft bgs to 2 ft bgs in 54 of the borings, and of these samples, 44 exceeded the site-specific Type 5 Recreational Child RRS (63 mg/kg) for arsenic.
- The location of these borings are illustrated on Figure 4a (overview). On Figure 4a, the borings with constituent concentrations above the non-residential RRS are color coded. Figures 4b to 4h show the boring locations in more detail, along with the constituent and its concentration that exceeded the RRS per location. There were nine boring locations with non-arsenic impact concentrations above the applicable Type 3 non-residential RRS.

  - Two additional soil samples were proposed to be collected (SB-10 and SB-61), but have been delayed due to private property access restrictions. The locations of these planned borings are illustrated on Figure 4a, 4b (EB-10), and 4f (EB-61).

- Sixteen groundwater monitoring wells were installed at the Subject Property, two of which did not produce groundwater. Fourteen groundwater samples were submitted for analysis of VOCs, SVOCs, total and dissolved RCRA 8 metals, and/or PCBs depending on the temporary monitoring well location.

  - Total and dissolved barium, total chromium, total lead, and total mercury were detected below their respective United States Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) and HSRA Type 1 Groundwater Criteria (GC), except for the detection of total lead in the groundwater sample collected from MW-3, which exceeded the MCL and Type 1 GC. VOCs, SVOCs, and PCBs were not detected in the groundwater samples collected from the Subject Property. To account for turbidity in the groundwater samples, both total and dissolved metals analysis were conducted. Dissolved barium was detected below its MCL and Type 1 GC, and dissolved chromium, dissolved lead, and dissolved mercury were not detected in the groundwater samples. Based on the dissolved analysis, the detections of chromium, lead, and mercury in the total metals analyses (including the detection of lead above the MCL and Type 1 GC in

MW-3) are likely attributed to the sample turbidities, and not a groundwater release. The detections of total and dissolved barium are consistent with typical background concentrations.

- Nine additional monitoring wells were proposed to be installed, but have been delayed due to their close proximity to buried Georgia Department of Transportation (GDOT) fiber optic cables (MW-9, MW-18, MW-19, MW-20, MW-21, and MW-22), private property access restrictions (MW-17), or proximity to CSX rail removal activities (MW-23 and MW-23a). Shallow soil samples have already been collected from eight of the nine remaining proposed monitoring well locations (all of the listed wells, minus EB-61/MW-17), and the analytical results are included herin.

- United Consulting utilized a United States Geological Survey (USGS) topographic map of the area to assist in interpreting groundwater flow direction in the vicinity of the wells installed on the Subject Property. Based on the USGS topographic map of the area, groundwater below the Subject Property is generally anticipated to flow to the north and/or east in the vicinity of MW-1 through MW-5, to the southwest in the vicinity of MW-6 through MW-8, and to the northwest and/or northeast in the vicinity of MW-10 through MW-16. The interpreted groundwater flow directions are illustrated on Figures 5a and 5b.

- The Southside Trail has already been entered into the Georgia Brownfield Program via PPCAP Amendment #9. Soil impacts requiring corrective actions to complete the Brownfield process were identified through this assessment.

At the time of the issuance of this Appendix F report, the non-arsenic soil remediation for the aforementioned nine areas has been completed, as summarized in Attachment F4. Additional actions remain for the three additional non-arsenic areas described below. Additional actions remain associated with the arsenic conditions as summarized in Attachment F5. Initially, this will generally include isolated removal and landfill disposal. Remaining impacted media will be managed in accordance with an environmental management plan during the redevelopment process, followed by the application of a Type 5 RRS approach during the final trail construction.

Following the Phase II/Initial BSCS conducted on the Subject Property in mid-2018, United Consulting was asked to conducted additional Phase II sampling associated with the SST between Allene Ave and the Mainline SST. This added Phase II sampling was conducted in April 2019. The sampling performed followed the same methodology of the September 2018 Phase II/Initial BSCS. The results from this assessment are briefly summarized below. Supporting figures are included in Attachment F2, along with supporting summary tables in Attachment F3. This is being provided as a summary, complete details will be provided in later Interim and/or Final PPCSR(s).

- A total of five borings were advanced on the Subject Property to facilitate soil sampling and/or groundwater sampling. The borings were designated EB-106 to EB-110. Soils were collected during the drilling operations for screening with an OVM. Soils screened with the OVM did not reveal elevated organic vapors above background levels, except one sample (EB-82 from 2-4 feet)]. Each of the borings were advanced via direct push technology. The boring locations are illustrated on Figures 4a to 4g.

- Soil samples were generally collected from a shallow interval (0 to 1 feet below ground surface (ft bgs)) at each boring location. Five soil samples were collected during drilling activities and analyzed for VOCs, SVOCs, and RCRA 8 metals, and/or PCBs depending on the boring location.

  - The above referenced RRSs were used for soil concentration comparison in this report, with the values included in Table 4.

  - Various SVOCs, metals, and PCBs were detected in some of the soil samples (the samples were collected from approximately 0-1 foot).

    - The concentrations of two SVOCs (benzo(a)pyrene and benzo(b)fluoranthene) were greater than their applicable RRSs at three of the five tested soil locations (EB-106, EB-108, and EB-109).
    - One of the above boring locations (EB-109) also had lead at a concentration above its applicable RRS.
    - Two of the five tested soil locations (EB-108 and EB-110) have arsenic concentrations above its RRS, one of which coincides (EB-108) with one of the locations with SVOCs with concentrations above their RRSs.
    - PCBs were detected in one soil sample (EB-109). The PCBs concentrations are below their RRSs.
    - The location of these borings are illustrated on Figure 4a (overview). On Figure 4a, the borings with constituent concentrations above the non-residential RRS are color coded. Figure 4b shows the boring locations in more detail, along with the constituent and its concentration that exceeded the RRS per location.

- At borings EB-106, EB-107, and EB-109 groundwater samples were collected via the direct push Screen Point sampling method. Three groundwater samples were submitted for analysis of VOCs, SVOCs, total and dissolved RCRA 8 metals, and/or PCBs depending on the boring location.

  - The groundwater samples showed the presence of some metals in the samples tested for total metals. This included arsenic, barium, chromium, and/or lead. The dissolved metals analysis only showed barium at concentrations ranging from 0.0332 to 0.0495 milligrams per liter (mg/L), with the concentrations below its Federal drinking water Maximum Contaminant Level (MCL). With this, it is unlikely there is a metals release at the Subject Property. No VOCs, SVOCs, or PCBs were detected in the samples, as tested.

- United Consulting was told that the Southside Trail has already been entered into the Georgia Brownfield Program via PPCAP Amendment #9. Soil impacts requiring corrective actions to complete the Brownfield process were identified through this assessment. This included non-arsenic impacts at three locations, and arsenic impacts at two locations.

F2 – FIGURES

Legend

Approximate Project Site Boundary

UNITED CONSULTING

Figure Scale

N

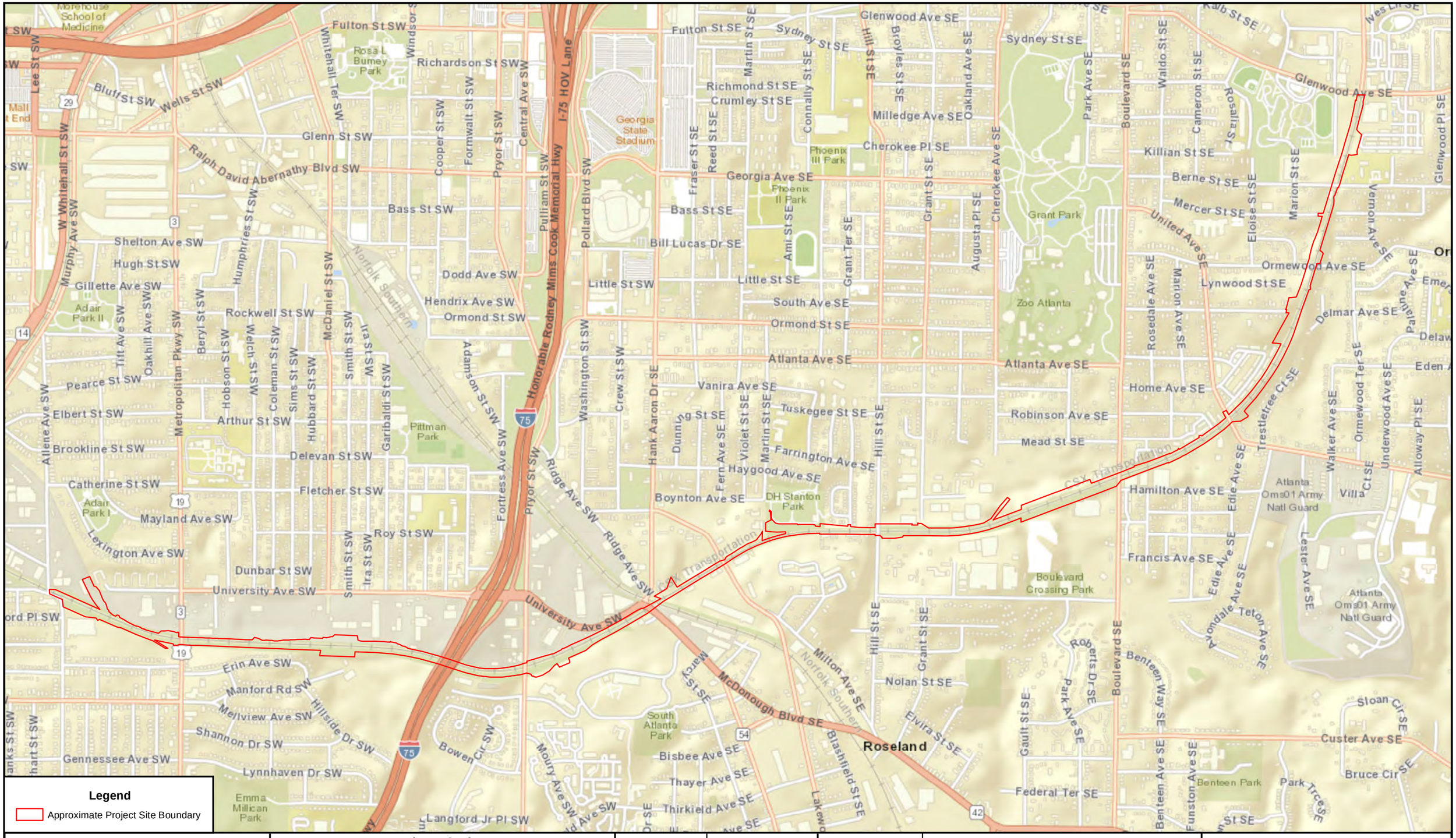
0 500 1,000 2,000 3,000

1 inch = 1,129 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

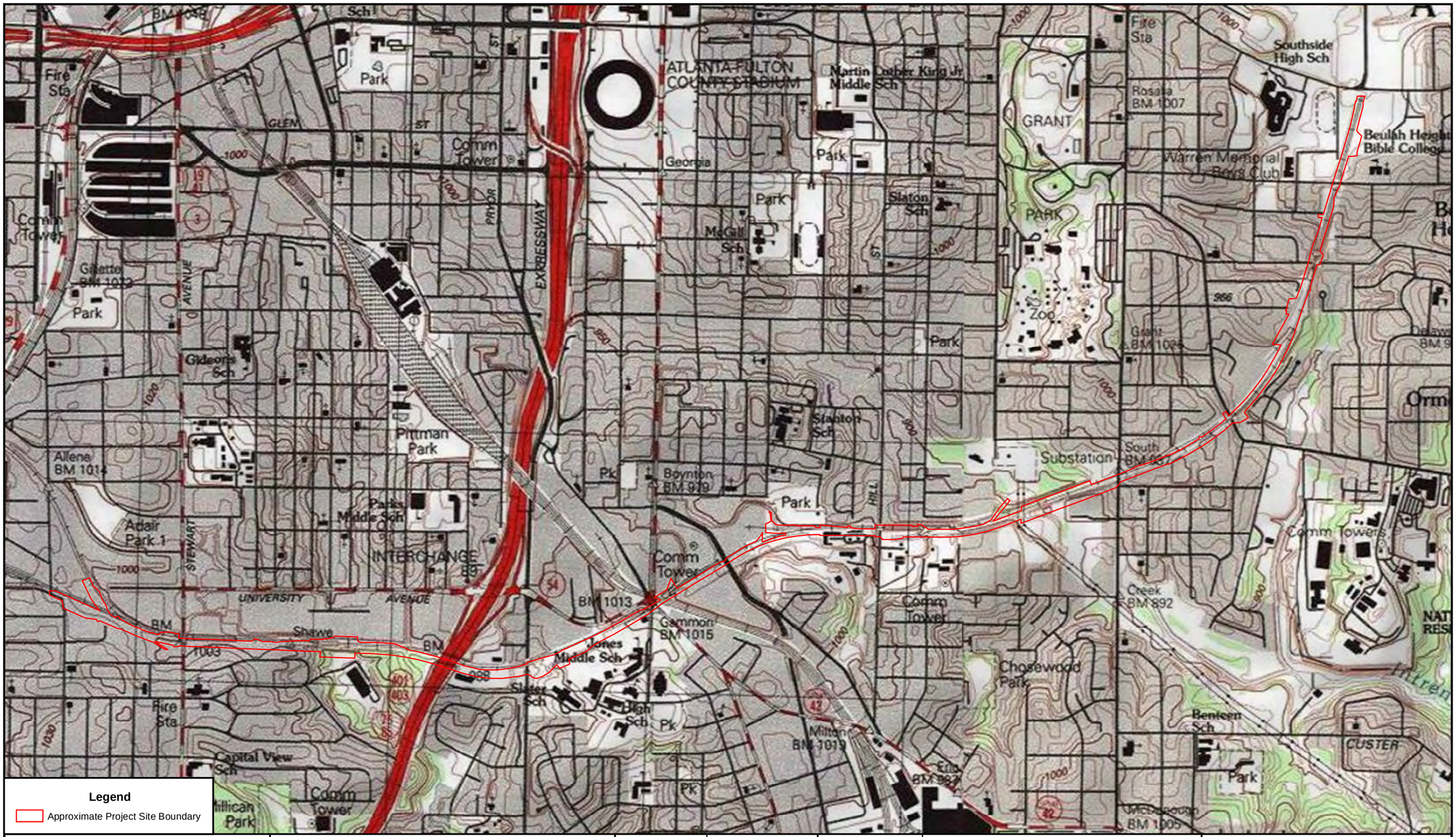
Title:	Project Site Location Map (Aerial Photograph)
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 1



UNITED CONSULTING	**Figure Scale** N 0 500 1,000 2,000 3,000 1 inch = 1,129 feet	**Prepared:**	MJF	**Title:**	Project Site Location Map (Street Map)
		Checked:	RCG	**Project:**	Atlanta Beltline Southside Trail
		Date:	6/7/2019	**Project No.**	KMHRN-17-GA-01191-02
				Client:	Kimley Horn

Figure 2



Legend

Approximate Project Site Boundary

UNITED CONSULTING

Figure Scale

N

0 500 1,000 2,000 3,000

1 inch = 1,129 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	USGS Topographic Map
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 3

UNITED CONSULTING

Figure Scale

N

0 500 1,000 2,000 3,000

1 inch = 1,129 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Soil Sample Location Map Overview
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4a

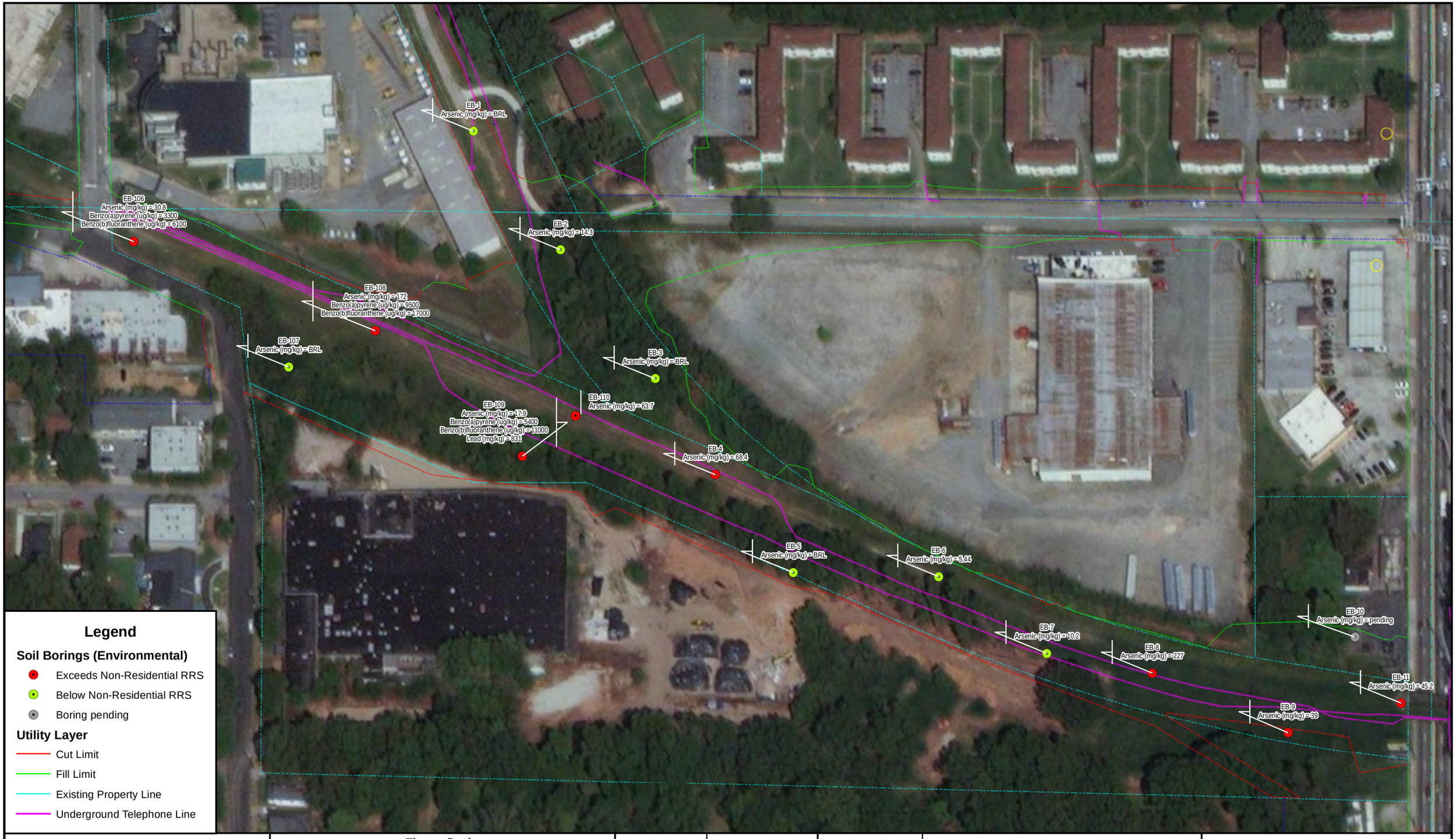


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Figure Scale

N

0 50 100 200 300

1 inch = 113 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Allene to Metropolitan Soil Sample Locations
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4b

EB-12
Arsenic (mg/kg) = 133

EB-14
Arsenic (mg/kg) = 230

EB-15
Arsenic (mg/kg) = 30.5

EB-16
Arsenic (mg/kg) = 314

EB-18
Arsenic (mg/kg) = 224

EB-20
Arsenic (mg/kg) = 94.5

EB-21
Arsenic (mg/kg) = 116

EB-23
Arsenic (mg/kg) = 73.5

EB-25
Arsenic (mg/kg) = 208
Benzene (ug/kg) = 1500

EB-26
Arsenic (mg/kg) = 131

EB-28
Arsenic (mg/kg) = 4.86

EB-29
Arsenic (mg/kg) = 14.3

EB-30
Arsenic (mg/kg) = 17.6

EB-32
Arsenic (mg/kg) = 13.8

EB-34
Arsenic (mg/kg) = 417

EB-13
Arsenic (mg/kg) = 16.3

EB-17
Arsenic (mg/kg) = 5.91

EB-19
Arsenic (mg/kg) = 8.48

EB-22
Arsenic (mg/kg) = 418

EB-24
Arsenic (mg/kg) = 200

EB-27
Arsenic (mg/kg) = BRL

EB-31
Arsenic (mg/kg) = BRL

EB-33
Arsenic (mg/kg) = 262

Legend

Soil Borings (Environmental)

- Exceeds Non-Residential RRS
- Below Non-Residential RRS

Utility Layer

- Cut Limit
- Fill Limit
- Existing Property Line
- Underground Telephone Line
- Approximate GDOT Fiber
- City of Atlanta Fiber

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Figure Scale

N

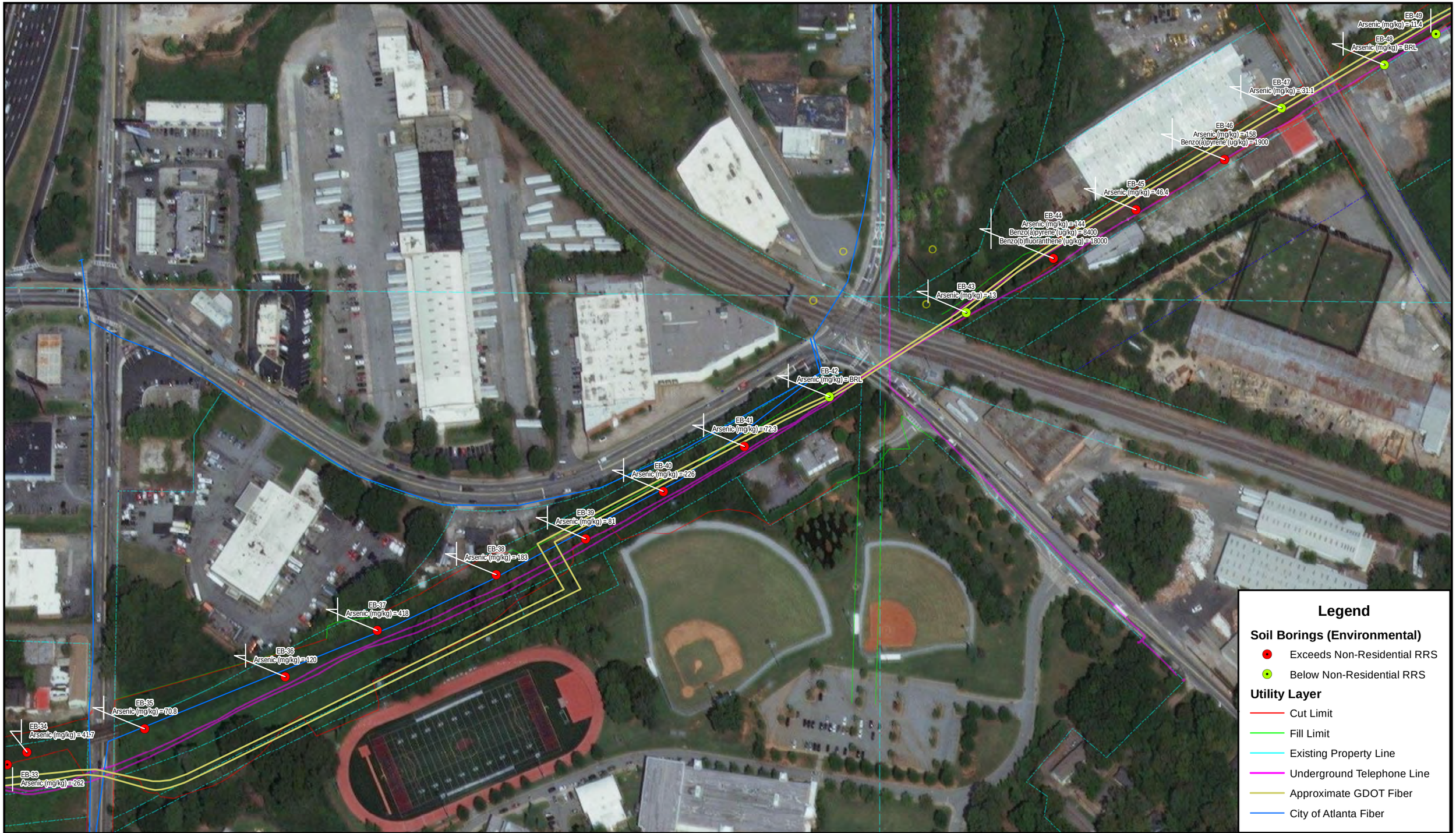
0 125 250 500 750

1 inch = 268 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Metropolitan to Pryor Soil Sample Locations
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4c



UNITED CONSULTING

Figure Scale

N

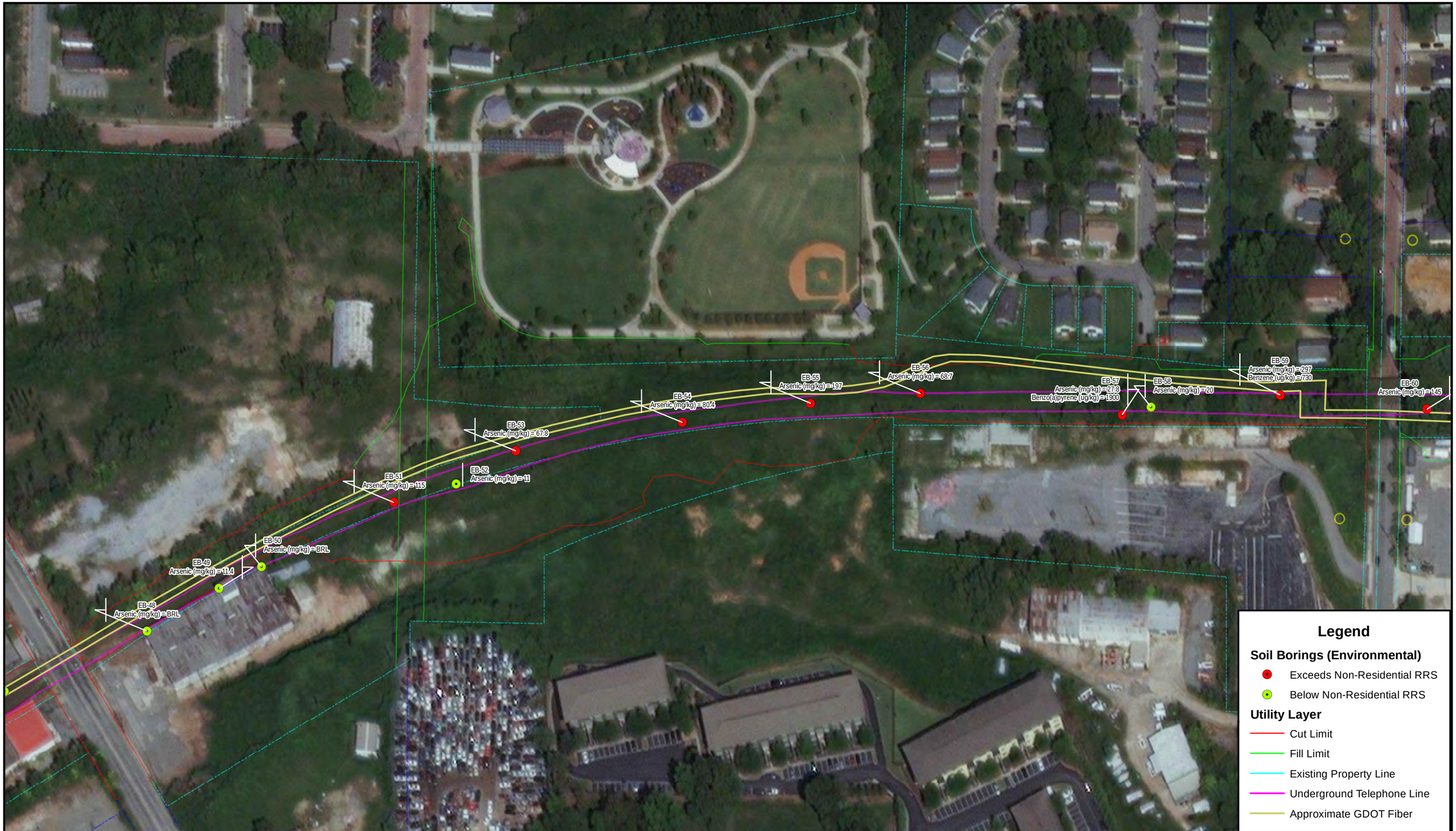
0 75 150 300 450

1 inch = 183 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Pryor to Milton Soil Sample Locations
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4d



UNITED CONSULTING

Figure Scale

N

0 62.5 125 250 375

1 inch = 132 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Milton to Hill Soil Sample Locations
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4e

UNITED CONSULTING

Figure Scale

N

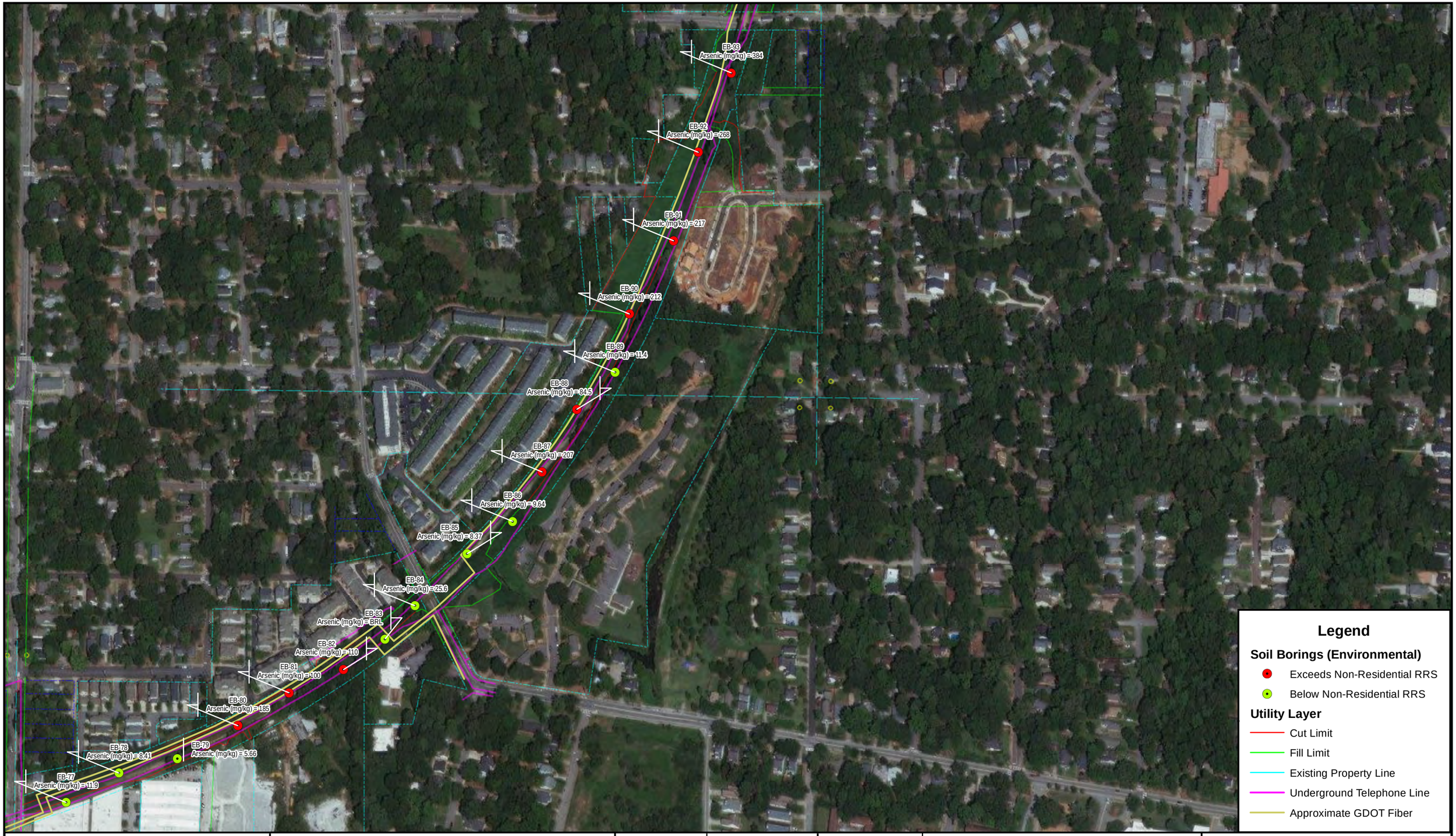
0 100 200 400 600

1 inch = 200 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Hill to Boulevard Soil Sample Locations
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4f



UNITED CONSULTING

Figure Scale

N

0 100 200 400 600

1 inch = 300 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Boulevard to Ormewood Soil Sample Locations
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4g

EB-105
Arsenic (mg/kg) = BRL

EB-104
Arsenic (mg/kg) = 102

EB-103
Arsenic (mg/kg) = 26.4
Lead (mg/kg) = 733

EB-102
Arsenic (mg/kg) = BRL
Benzo(a)pyrene (ug/kg) = 2100

EB-101
Arsenic (mg/kg) = 59.4

EB-100
Arsenic (mg/kg) = 11.7

EB-99
Arsenic (mg/kg) = BRL

EB-98
Arsenic (mg/kg) = 61.7

EB-97
Arsenic (mg/kg) = 169

EB-96
Arsenic (mg/kg) = 49

EB-95
Arsenic (mg/kg) = 36.6

EB-94
Arsenic (mg/kg) = 17.9

Legend

Soil Borings (Environmental)

- Exceeds Non-Residential RRS
- Below Non-Residential RRS

Utility Layer

- Cut Limit
- Fill Limit
- Existing Property Line
- Underground Telephone Line
- Approximate GDOT Fiber

UNITED CONSULTING

Figure Scale

N

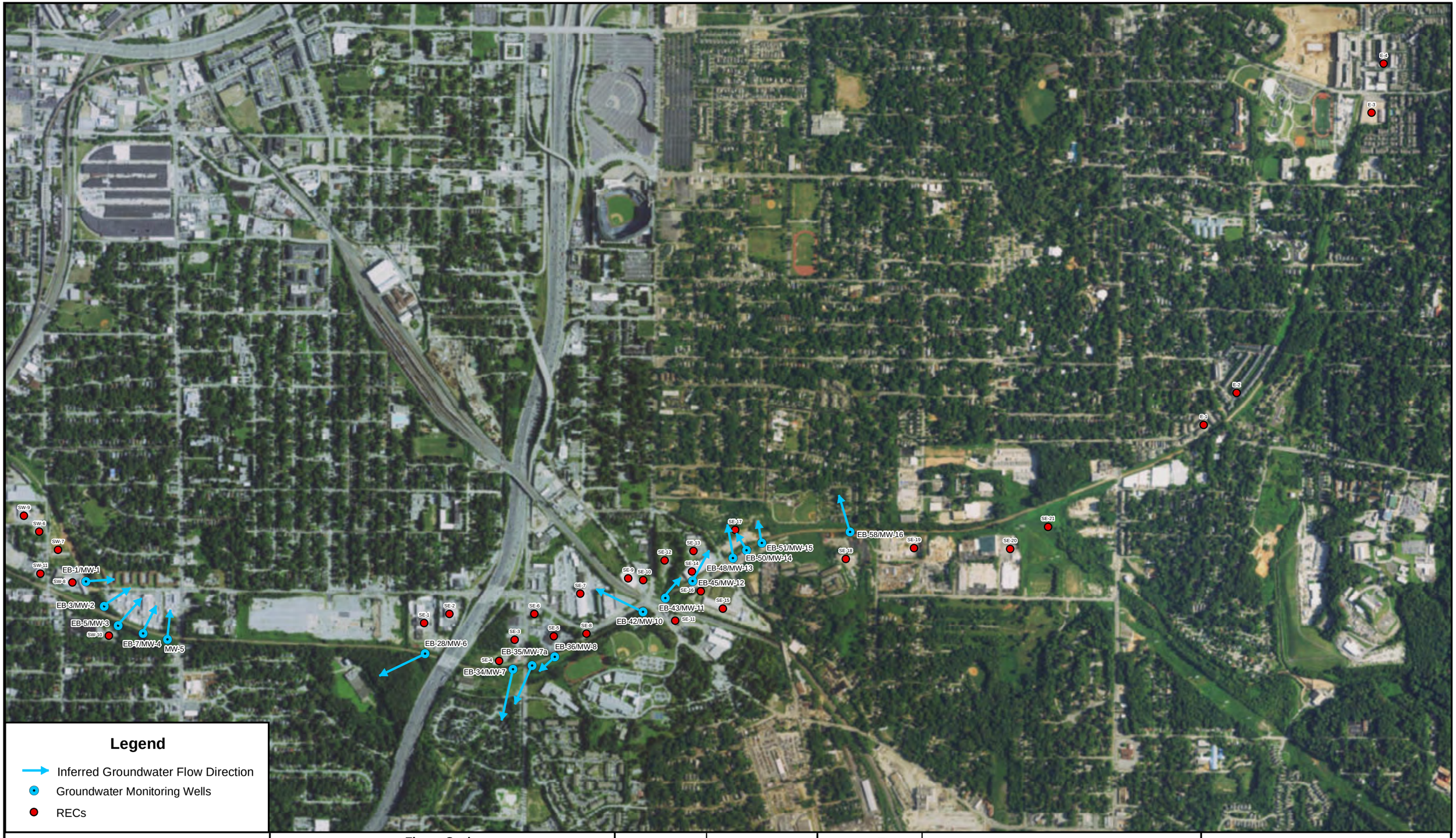
0 125 250 500 750

1 inch = 248 feet

Prepared:	MJF
Checked:	RCG
Date:	6/7/2019

Title:	Ormewood to Glenwood Soil Sample Locations
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4h



UNITED CONSULTING

Figure Scale

N

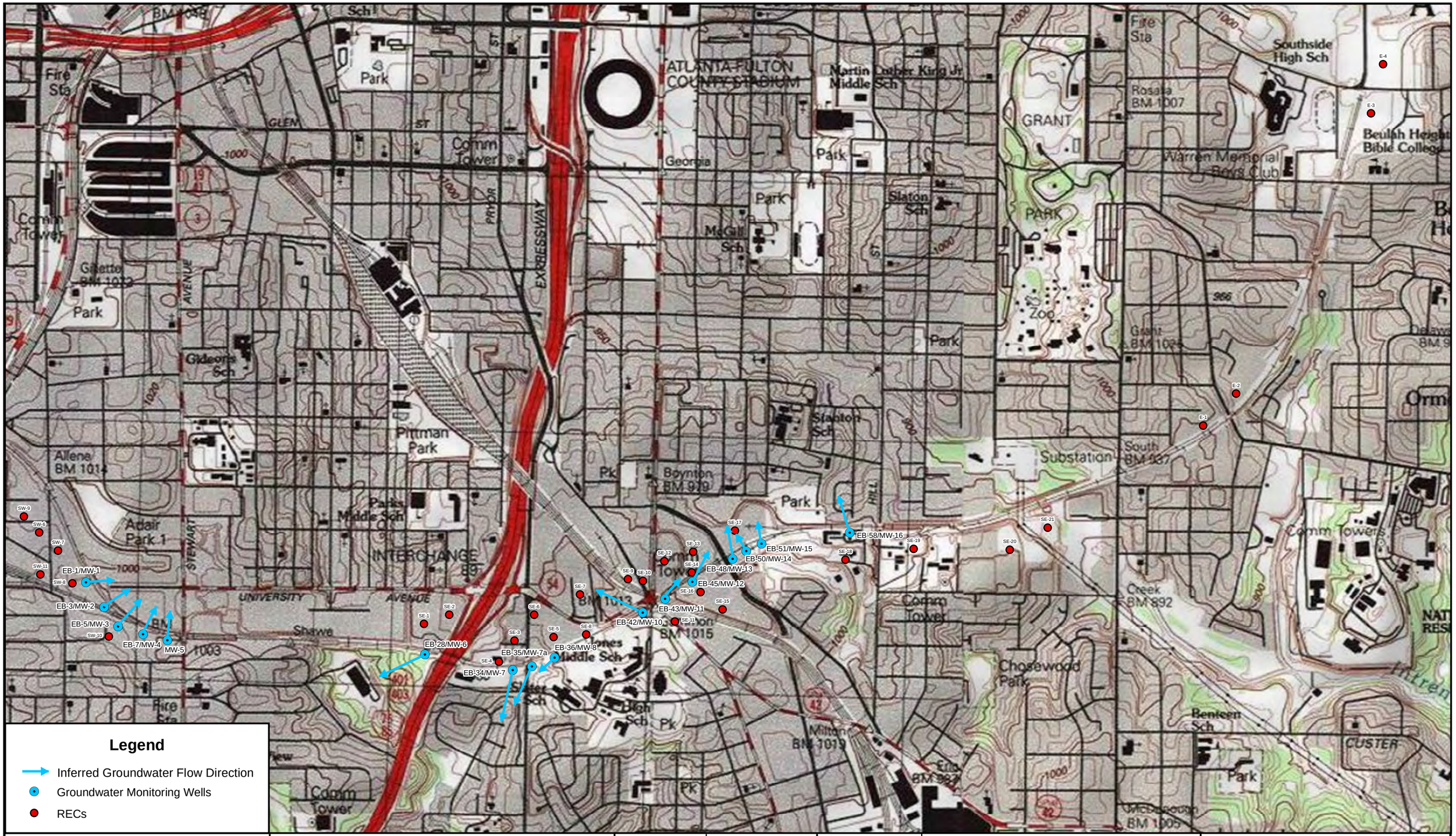
0 500 1,000 2,000 3,000

1 inch = 1,129 feet

Prepared:	MJF
Checked:	RCG
Date:	September 14, 2018

Title:	Inferred Groundwater Potentiometric Surface Map
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 5a



Legend

- Inferred Groundwater Flow Direction
- Groundwater Monitoring Wells
- RECs

UNITED CONSULTING

Figure Scale

N

0 500 1,000 2,000 3,000

1 inch = 1,129 feet

Prepared:	MJF
Checked:	RCG
Date:	September 14, 2018

Title:	Inferred Groundwater Potentiometric Surface Map
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 5b

Southwest Corridor Section, G720+00 to G825+00, See Report Section 4.2

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SW-5	Figure 3 G785 to G788	Off-site, Regulatory, Adjacent, upgradient	GA Non-HSI listing	Parcel located south of the corridor at 1006 Murphy Avenue SW Originally constructed in the late 1940s as a State Farmers Market that included fourteen warehouses. In addition to its use as a farmers market, this property has been used as a State of Georgia Government Surplus Material and Food Storage and Distribution facility and most recently as the Fulton County Department of Corrections Warehouse Facility. The northwestern most portion of this parcel is listed as a GA Non-HSI site addressed as 1006 Murphy Avenue. This was reported as having lead in the groundwater in October 2001.	Initially conduct a file review to assist in the development of the subsurface sampling program. Install one monitoring well to check for regulated impacts. Test for VOCs, SVOCs, and metals.
SW-6	Figure 3 G801 to G803	Off-site, Regulatory, 150 feet upgradient	CERCLIS NFRAP listed facility	1121 Allene Avenue SW This property was developed in the early 1950s as a tire recap and warehouse facility. This site is listed as a CERCLIS facility with a status of NFRAP under the name of J&W Pallet & Drum Co. It has a removal action date of 5/23/05. This facility is still in place.	Initially conduct a file review to assist in the development of the subsurface sampling program. The groundwater monitoring wells described for W-7 will also serve to evaluate impacts W-6.
SW-7	Figure 3 G801 to G807	Off-site, Regulatory, Adjacent, upgradient	GA UST and LUST listings	1160 Allene Avenue SW This property was developed in the early 1950s with a filling station, a truck rental facility and a truck repair facility. This facility is still in operation as Harmon Brothers Charter Service. This facility is listed as having a confirmed release from a UST in January 1999. The cleanup status is listed as No Further Action. The facility is listed as having two USTs containing diesel currently in use and 3 USTs removed from the ground. In May 2007, the City of Atlanta engaged MACTEC to perform a delineation of impacted soil in the southeastern portion of this property. 12 soil borings were advanced and 13 soil samples analyzed for petroleum. The results of the sample analysis indicated that petroleum impacted soils could have migrated onto the subject site.	Initially conduct a file review to assist in the development of the subsurface sampling program. Install one to two monitoring wells to check for regulated impacts. Test for VOCs, SVOCs, and metals. Advance a series of soil borings adjacent to the southeastern portion of the property to check for regulated impacts. Test for VOCs, SVOCs, and metals.

Southwest Corridor Section, G720+00 to G825+00, See Report Section 4.2

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SW-8	Figure 3 G807 to G813	Off-site, Regulatory, Historical, Adjacent, upgradient	Historical Records, GA UST listing	1190 Allene Avenue SW This property was developed in the early 1920s as the National Oil Company, Inc. with an oil storage structure, a garage, and gasoline and oil tanks. This facility was demolished in the early 1960s and the property remained undeveloped until the current facility, a communications switching facility owned and operated by Sprint Communications Company LP, was constructed in the mid 1980s. This facility is listed as having three USTs containing diesel currently in use.	Install one to two monitoring wells to check for regulated impacts. Test for VOCs, SVOCs, and metals.
SW-9	Figure 3 G799 to G801	Off-site, Historical, 150 feet upgradient.	Historical Records	783 Warner Street SW This property was developed in the mid to late 1920s as a structural and ornamental steel fabrication facility which included a steel crane and associated gasoline tank. This facility operated in such a capacity until the late 1940s when it was converted to a produce and meat warehouse facility.	Install one monitoring well to check for regulated impacts. Test for VOCs, SVOCs, and metals.
SW-10	Figure 3 G810 to G824	Off-site, Regulatory, Historical, Adjacent, upgradient	Historical Records, GA SHWS listing	1246 Allene Avenue SW This property was developed in the late 1940s to early 1950s with a battery manufacturing facility and a butane gas storage area. The battery manufacturing facility is still in existence but is no longer in business. This facility is listed as a State Hazardous Waste Site (SHWS) with a known release of lead in soil at levels exceeding the reportable quantity. Investigations are being conducted to determine how much cleanup is necessary for source materials, soil, and groundwater. Corrective action is pending.	Initially conduct a file review to assist in the development of the subsurface sampling program. Install a series of monitoring wells to check for regulated impacts. Test for VOCs, SVOCs, and metals.

Southwest Corridor Section, G720+00 to G825+00, See Report Section 4.2

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SW-11	Figure 3 G808 to G809	Off-site, Historical, 450 feet upgradient.	Historical Records,	Southeast corner of the intersection of Allene Avenue SW and Woodrow Avenue SW – This parcel was developed as a coal yard from at least 1932 through the mid 1950s when it was developed as a parking area and a warehouse. This parcel also had a gasoline tank located on it during this time period.	Initially conduct a file review to assist in the development of the subsurface sampling program. The groundwater monitoring wells described for W-7 and W-8 will also serve to evaluate impacts of W-11.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-1	Figure 4 G853 to G857	Off-site, Historical, Adjacent, Upgradient	Historical Records	Baggett Transportation Company – Truck Repair and Maintenance 290 University Ave SW Historical records indicate that a truck repair facility occupied the western portion of property from the mid 1950s until the early 1990s. Site is currently occupied by Sam and Son Wholesale grocery.	Install one groundwater monitoring well near station G855 inner side to check for regulated impacts. Test for VOCs, SVOCs, and Metals.
SE-2	Figure 4 G853 to G857	Off-site, Historical, 350 feet Upgradient	Historical Records	Capitol Truck Center – Truck Repair and Maintenance 260 University Ave SW Historical records indicate that a truck repair facility occupied the property from the mid 1950s until the early 1990s. Site is currently occupied by Southeastern Stages	The groundwater monitoring well described in Finding No. SE-1 will also serve to evaluate the past operations at Finding No. SE-2.
SE-3	Figure 4 G866-G868	Off-site Regulatory, 350 feet Upgradient	Listed as HSRA Notifier	Property of Balco Realty 1269 Pryor Road A release notification was submitted in January 2000 due to the presence of PCBs, lead, barium, chromium and cadmium in soil and/or groundwater. The EPD determined that the release did not exceed a reportable quantity for soil and groundwater and the site was not listed on the HSI. Historical records indicate that the property was occupied with a laundry supply company in the 1970s.	Initially, conduct a file review to assist with the development of the subsurface sampling program. Install one groundwater monitoring well at a location to be selected after file review to check for regulated impacts. Test for PCBs, VOCs, SVOCs and Metals.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-4	Figure 4 G861 to G868	Off-site, Regulatory, Historical, Adjacent, Upgradient	Spills Listing, Historical Records	1275 Pryor Road A spill of paint and oil was reported to the Georgia EPD in December 2001. Records indicate that the spill impacted a storm drain pipe. According to the EDR report, the City of Atlanta also responded to this site regarding several spills. No follow-up information was available from the EDR report. Historical records indicate that this property was commercially developed in the mid 1960s. In the 1978 Sanborn map, the property was occupied by an auto repair facility. Historical aerial photographs reveal numerous vehicles, indicative of a salvage yard, on this property and the property to the south on the other side of the railroad tracks. An unimproved road connecting the two properties is evident in the aerial photographs, which was also observed during the field reconnaissance.	The groundwater monitoring well described in Finding No. SE-3 will also serve to evaluate the past operations at Finding No. SE-4. Advance two soil borings along the corridor's inner boundary to check for shallow soil impacts.
SE-5	Figure 4 G873 to G876	Off-site, Regulatory, Historical, Adjacent, Upgradient	Multiple Listings as RCRA-CESQG, FINDS, LUST, UST, HSRA Notifier, Historical Records	Cummings Power South 100 University Avenue In 1989 and 1990 four USTS were removed from the ground and two USTs were closed in place. A release to the environment was reported during these activities and the site received "No Further Action Required" status in November 1990. In March 2006 the site notified the EPD of a release of dichloroethane to groundwater. The EPD determined that the release to groundwater did not exceed a reportable quantity and the site was not listed on the HSI. Historical records indicate that an auto repair facility occupied the property from the mid 1960s until the early 1980s.	Install one groundwater monitoring well to check for regulated impacts. Test for PCBs, VOCs, SVOCs and Metals.
SE-6	Figure 4 G870 to G871	Off-site, Historical, 650 feet Upgradient	Historical Records	Former Filling Station 1238 South Pryor Street Historical records indicate that a former gasoline station was located at the southeastern quadrant of Pryor Street and University Avenue. The former gasoline station appears to have been constructed in the late 1960s and occupied the property until the early 1980s.	The groundwater monitoring well described in Finding No. SE-5 will also serve to evaluate the past operations at Finding No. SE-6.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-7	G845+20 to G916+26 Figure 4	Off-site Regulatory, 200 feet Upgradient	Multiple listings as RCRA-NonGen, AST, Finds, ERNS, Spills	Allwaste Tank Cleaning, Allwaste Paint Cleaning and Weaver Trucking 99 University Avenue The commercial property addressed at 99 University Avenue has been occupied by a number of suspect businesses since the 1960s which include: Huber and Huber Motor Transport, Tank Cleaning Services Inc., Allwaste Tank Cleaning, Southern Freight and Weaver Trucking. Allwaste Tank Cleaning appears on the RCRA generator list and the Georgia Spills list. Allwaste Tank Cleaning business operations consisted of cleaning the interior of chemical and/or food grade tanker trucks. The facility was listed as a RCRA large quantity generator during the occupancy. In 1989 a complaint was filed against Allwaste Tank Cleaning alleging that the site's waste water treatment tank was inoperable and waste water was being dumped down the storm water drain. The Georgia EPD responded to the complaint and confirmed that the waste water treatment tank was inoperable and employees were draining waste liquids into the storm drain. Additionally, in November 1992 Weaver Trucking notified the Georgia EPD that two pole mounted transformers had been knocked down causing approximately 40 gallons of PCB oil to be released. This site is currently occupied by Southern Freight, Knowles Trucking, Annexus Storage, GES Exposition and RAC Logistics.	The groundwater monitoring well described in Finding No. SE-5 will also serve to evaluate the past operations at Finding No. SE-7.
SE-8	Figure 4 G876 to G880	Off-site, Regulatory, Adjacent, Upgradient	Listed as RCRA-NonGen, Historical Records	General Oil Recovery 70 University Avenue General Oil Recovery is listed as a non generator of hazardous waste. According to the EDR report, no deviations from permitted activities or violations have been reported at this facility. This property is currently occupied by University Tire Store. Historical records indicate that a former gasoline station occupied the property from the mid 1960s until the early 1980s.	Install one groundwater monitoring well to check for regulated impacts. Test for VOCs, SVOCs and Metals.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-9	Figure 4 G886 to G887	Off-site, Historical, 400 feet Upgradient	Historical Records	Former Gasoline Station 1161 Ridge Avenue Historical records indicate that a former gasoline station was present at the southwest intersection of Ridge Avenue and the north-south Southern Railroad from at least the 1950s until the early 1970s.	The groundwater monitoring well described in Finding No. SE-10 will also serve to evaluate the past operations at Finding No. SE-9.
SE-10	Figure 4 G887 to G889	Off-site, Regulatory, Historical, Upgradient	Historical Records, LUST Listing	Texaco Food Mart 1169 Hank Aaron Drive Historical records indicate that a former gasoline station and auto repair facility occupied the property located at northeast intersection of Ridge Avenue and Capitol Avenue from at least the 1950s until the early 1990s. The facility has undergone remediation and was granted "no further action" status in June 2004.	Initially, conduct a file review to assist with the development of the subsurface sampling program. Install one groundwater monitoring well at a location to be selected after file review to check for regulated impacts. Test for PCBs, VOCs, SVOCs and Metals.
SE-11	Figure 4 G887 to G889	Off-site Historical, 250 feet Upgradient	Historical Records	Former Gas Station 28 McDonough Boulevard Historical records indicate that a former gasoline station was present at the northeast intersection of McDonough Boulevard and the north-south Southern Railroad from at least the 1950s until the early 1970s.	The groundwater monitoring well described in Finding No. SE-10 will also serve to evaluate the past operations at Finding No. SE-11.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-12	Figure 4 G887 to G889	Off-site, Regulatory, Adjacent, Upgradient	Historical Records	Auto Repair and Junk Yard A former auto repair facility was historically located adjacent to the corridor on Capitol Avenue from at least the 1950s until the early 1990s. The area north of the auto repair facility consisted of residential apartments from the mid 1950s until the mid 1970s. In the 1978 aerial photograph, the residential apartments were demolished and the property appears to have been used as an auto salvage yard until the late 1990s.	Install one groundwater monitoring well near station G889 inner side to check for regulated impacts. Test for VOCs, SVOCs and Metals.
SE-13	Figure 4 G887 to G889	Off-site Historical, 400 feet Upgradient	Historical Records	Taxi Cab Company 55 Milton Avenue The commercial property located at 55 Milton Avenue appears to be developed in the late 1930s. Sanborn Maps show the property was occupied by Universal Concrete Pipe Company from at least the late 1930s until at least the late 1960s. By the late 1960s, this facility was occupied by a taxi cab company. Aerial photographs suggest that routine maintenance and taxi cab repair have been performed at the property since the late 1960s.	Install one groundwater monitoring well near station G893 center line to check for regulated impacts. Test for VOCs, SVOCs and Metals.
SE-14	G845+20 to G916+26 Figure 4	Off-site Regulatory, Adjacent, Upgradient	Spills Listings, Historical Records	Unknown LUST 79 Milton Ave SE Historical records indicate that the property adjacent to the corridor, addressed at 79 Milton Avenue, was commercial developed in the 1960s. According to the Sanborn maps, the facility was utilized as a lumber warehouse. The facility addressed appears on the Georgia Spills list as Unknown LUST, although no record of the presence of USTs and or Leaking USTs was identified. The Georgia EPD responded to a reported release of gasoline in December 1996. No follow-up information was available from the EDR report. A gasoline spill was reported on December 17, 1996. The site is currently owned by Fulton County.	The groundwater monitoring well described in Finding No. SE-13 will also serve to evaluate the past operations at Finding No. SE-14.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-15	Figure 4 G891 to G897	Off-site Regulatory, 250 feet Upgradient	RCRA-NonGen, UST, LUST	Standard Trucking Co 125 Milton Ave SE The property located at 125 Milton Avenue was commercially developed in the 1960s and was occupied by Brown Motor Transport. This property was later occupied by Standard Trucking Company and appears on the LUST list. According to the EDR report, an 8,000-gallon diesel UST, 8,000-gallon UST with contents not listed, and 11,000-gallon gasoline UST were removed prior to 1991. A release to the environment was reported during these activities and the site received "no further action" status in October 1991. A fourth 12,000-gallon diesel UST was removed in June 2005 and "No Further Action Required" status was granted in June 2005. The site is currently owned by Rawson Hill LLC.	The groundwater monitoring well described in Finding No. SE-13 will also serve to evaluate the past operations at Finding No. SE-15. Conduct a file review to evaluate the advisability of an additional monitoring well.
SE-16	Figure 4 G891 to G897	Off-site, Active, Historical, Adjacent, Upgradient	Observations, Historical Records	JB Distribution Co 95 Milton Ave SE JB Distribution Company is an active chemical compounding and wholesale company. The facility does not appear on any of the regulatory lists. Historically, this property appears to have been commercially developed since at least the 1930s. According to historical records, the property was utilized as a warehouse for farm equipment and supplies in the 1950s and an ink and insulation warehouse in the 1970s.	The groundwater monitoring well described in Finding No. SE-13 will also serve to evaluate the past operations at Finding No. SE-16.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-17	Figure 4 G899 to G903	Off-site Regulatory, Adjacent, Upgradient	Multiple Listings as CERCLA-NFRAP, HSI, Brownfields, UST	<u>US Plating & Bumper Service 72, 78 and 80 Milton Ave SE</u> The property north of the corridor, along and to the east of Milton Avenue, has been occupied by various commercial properties since at least the late 1930s. Specifically, the properties located at 72, 78 and 80 Milton Avenue have been occupied by Atlanta Cotton Oil Company, metal working facility, sewing textile facility, Lawrence Smith Planning Mill, and coal yard. The facility addressed at 78 Milton Avenue was occupied by US Plating and Bumper, an industrial and commercial electroplating company from the 1960s until a fire destroyed the facility in the early 1990s. The site appears on the CERCLA-NFRAP list, HSI list, and UST list. US Plating and Bumper has been the subject of a number of environmental investigations which has identified the metals arsenic, barium, cyanide, lead and nickel and/or VOCs in soil and groundwater. In June 2005 the US Plating and Bumper facility was accepted into the Georgia Brownfield Program. Records indicate that one diesel UST of an unknown size is present at 72 Milton Ave. No additional records of the status of this UST was identified. The site is currently vacant.	Initially, conduct a file review of the US Plating & Bumper Service HSI Site No. 10264. The file review will assist with the development of a more specific subsurface sampling program. Based on the current surveys, it appears that portions of HSI site are included as part of the potential corridor acquisition. As such, a more thorough subsurface sampling program will likely be recommended for the portions included in the potential acquisition.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-18	Figure 4 G908 to G918	Off-site Regulatory, Adjacent, Upgradient	Multiple Listings as LUST, UST, Spills	Fulton Trucking Company and Standard Trucking Company 1195 Milton Terrace Standard Truck and Equipment and Fulton Trucking Company were located south of the corridor immediately west of Hill Street since at least the 1960s. Standard Truck and Equipment refurbished and sold used utility construction trucks. Historical aerial photographs illustrate an extensive area around Standard Truck and Equipment building and extending to the west and north, along the southern border of the corridor, which appears to have been used as an auto salvage yard. The majority of these vehicles have been removed and the area is currently overgrown with vegetation. Fulton Trucking Company appears on the LUST, UST and Spills lists. In 2001 the following tanks were removed from the ground: 7,000-gallon diesel, 3,000-gallon diesel and 2,500-gallon gasoline. A release to the environment was reported during the removal activities and the site received "no further action" status in August 2001. The Georgia EPD responded to a reported release of gasoline in January 1991. No follow-up information was available from the EDR report.	Install one groundwater monitoring well near station G906 outer side to check for regulated impacts. Test for VOCs, SVOCs and Metals.
SE-19	Figure 5 G935 to G937	Off-site Regulatory, Adjacent, Upgradient	UST, LUST Listings	BMTS Satellite St. 1146 Englewood Ave The area south of the corridor, east of Hill Street, has been historically occupied by the City of Atlanta Public Works facility. Historical records list this property occupied by the City Construction Department between the early 1940s through the 1980s. Additionally, an asphalt plant was present at this location from the at least the 1960s until the early 1980s. The City of Atlanta Public Works facility appears on the LUST list. According to the EDR report, two 6,000-gallon gasoline USTs, one 20,000-gallon diesel UST, two 3,000-gallon USTs with contents not listed, and one 500-gallon gasoline were removed from the ground in 1998. These tanks were replaced with a 20,000-gallon diesel, 12,000-gallon gasoline and 3,000-gallon other, which are currently in use at this location. A release to the environment was reported during these activities and the site received "no further action" status in June 1999.	Initially, conduct a file review to assist with the development of the subsurface sampling program. Install one groundwater monitoring well near station G920 outer side. Test for VOCs, SVOCs and Metals.

Southeast Corridor Section, G825+00 to G950+00, See Report Section 4.3

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
SE-20	Figure 5 G935 to G940	Off-site Regulatory, Adjacent, Partially Upgradient	RCRA-NonGen, Former RCRA-LQG, Listings	Royal Airline Linen of Atlanta 460 Englewood Ave Parcel Records indicate the property addressed at 460 Englewood Avenue is currently occupied by the National Linen Service which does not appear to perform any dry cleaning activities. However, the site was previously occupied by a commercial dry cleaning and laundering service facility, Royal Airline Linen of Atlanta. According to the EDR report, this site is currently listed as an inactive RCRA generator but was previously classified as a RCRA large quantity generator. Numerous record keeping violations were noted at the facility.	Install one groundwater monitoring wells near station G935 outer side to check for regulated impacts. Test for VOCs, SVOCs and Metals.
SE-21	G916+26 to G992+17 Figure 5	Off-site Regulatory, Adjacent, Partially Upgradient	UST, LUST, Listings	City Wide Wrecker Service 480 Englewood Ave Parcel The future Boulevard Crossing Park which was acquired by the City of Atlanta in 2006 and 2007 is located to the south of the corridor along Boulevard. The future park site is comprised of an assemblage of seven tracks of land totaling approximately 21 acres. Reportedly, Peachtree Environmental, Inc., completed a Phase I and limited Phase II of the future Boulevard Crossing Park site in October and November 2005. Additionally, Environmental Technology Resources, Inc., reportedly removed two 3,000-gallon USTs in February 2006. City Wide Wrecker Service was formerly located at 480 Englewood Avenue which is one of the seven tracts acquired by the City of Atlanta. City Wide Wrecker Service appears on the LUST list. According to the EDR report, one 1,000-gallon gasoline UST is temporarily out of service and the site received “no further action” status in March 2007.	Develop sampling program, if any, based on review of prior reports.

East Corridor Section, G950+00 to G80+00, See Report Section 4.4

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
E-1	Figure 5 G957 to G966	Off-site Historical, Adjacent, Upgradient	2004 Phase I, Historical Records, Listed as GA NON-HSI	Former Truck Depot - Generator of Hazardous Waste Historical records (aerial photographs) indicate this property was developed from at least 1955 to 1993. H. B. Fuller, adhesives manufacturer, was in operation on this property along Mead Street in 1978. The City's 2004 Phase I indicated a former truck depot with a leaking underground storage tank (LUST). However, no current listing for a LUST was noted in the EDR report The EDR report indicates an initial NON-HSI listing in July 2001 for a release to groundwater of tetrachloroethene. The EDR report identifies another NON-HSI listing for the Property of Jolynn Wagoner along Mead Street where the same constituent was encountered in September 2004. Since 2004, the property has been redeveloped with the Old Field Condominium complex.	Initially conduct a file review to assist with the development of the subsurface sampling program. Install one well to check for regulated impacts. Test for VOCs, SVOCs and Metals.
E-2	Figure 5 G966 to G974	Off-site Historical, Adjacent, Upgradient	Historical Records	Former Industrial Property Historical records (aerial photographs) indicate this property was developed from at least 1938 to 1993. A steel erecting contractor business is indicated on this property in 1978. Since 2004, the property has been redeveloped with the Enclave @ Grant Park and the Burnette @ Grant Park condominiums. No current listing for this property was noted in the EDR report.	Install one well to check for regulated impacts. Test for VOCs, SVOCs and Metals.

East Corridor Section, G950+00 to G80+00, See Report Section 4.4

Finding No.	Location Global Stationing	Finding Type	Finding Source	Description and Opinion	Conclusion
E-3	Figure 6 G1007 to G1012	Off-site Historical, Adjacent, Upgradient	Historical Records, Listed as RCRA NON GEN, LUST, UST, GA NON HSI	Former Industrial Property Historical records (Sanborn maps) indicate this property was developed and occupied by the Atlanta Oak Flooring Company from at least 1932 to 1950. By 1960, numerous smaller buildings on-site had been replaced by two large structures located in the northwest and southeast corners of this property. The 1978 Sanborn map indicates Pioneer Plastics, addressed as 915 Glenwood Avenue, was in operation in the northwest building adjacent to the subject site. U.S. Electric, a wholesale business, is currently in operation at this address. Maryland Baking Company of Georgia, addressed as 951 Glenwood Avenue, occupied the building to the southeast in 1978. The Sweetheart Cup Company bought the bakery and operated until 1998. By April 2002, the bakery was demolished and the property was residentially redeveloped. The EDR report indicates the RCRA listing is in reference to the presence of halogenated and non-halogenated solvents in use at the former Pioneer Plastics. Additionally, 1UST was removed and was granted "no further action" status by the GA-EPD in March 1998 at this facility. The EDR report also indicates the Sweetheart Cup Company received a NON-HSI listing, date not reported, for a release to groundwater of cis-1,2-dichloroethene.	Initially conduct a file review to assist with the development of the subsurface sampling program. Install 1well to check for regulated impacts. Test for VOCs, SVOCs and Metals.
E-4	Figure 6 G10 to G23	Off-site Historical, Adjacent, Upgradient	Historical Records, Listed as LUST, UST	Former Industrial Property Historical records (Sanborn maps) indicate this property was developed and occupied by the Williams Brother Flooring Company from at least 1932 to 1978. Aerial photographs indicate the lumberyard was still in operation in 1993. By March 1999, demolition of the lumber yard is indicated on this property. The 2004 brownfield review indicated a former service station with a leaking underground storage tank. This acreage has been redeveloped with Glenwood Park, a mixed retail/residential complex. The EDR report indicates that one UST was removed and granted "closure" in July 1991 and 5 LUSTs were removed and were granted "no further action" status by the GA-EPD in August 1996.	Consider Brownfield implications prior to a future invasive assessment along the right-of-way of Bell Kennedy Way.

UNITED CONSULTING

F3 – ANALYTICAL SUMMARY TABLES

Table 1: Well Construction Summary

Well No.	Construction Date	Bore Depth	Well Depth	Screen Interval	Seal Interval	Depth to GW from TOC
		(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)
MW-1	6/11/2018	25	24.83	14.83 to 24.83	0.5 to 12.83	18.41
MW-2	6/11/2018	24	23.80	13.8 to 23.8	0.5 to 11.8	22.3
MW-3	6/11/2018	28	27.80	17.8 to 27.8	0.5 to 15.8	26
MW-5	6/11/2018	32	31.80	21.8 to 31.8	0.5 to 19.8	28.08
MW-6	6/7/2018	16	15.10	5.1 to 15.1	0.5 to 3.1	10.19
MW-7a	6/5/2018	39	38.95	28.95 to 38.95	0.5 to 26.95	34.59
MW-8	6/5/2018	28	27.90	17.9 to 27.9	0.5 to 15.9	22.43
MW-10	6/5/2018	8	7.90	2.9 to 7.9	0.5 to 2	1.77
MW-11	6/1/2018	8	7.90	2.9 to 7.9	0.5 to 2	1.32
MW-12	6/1/2018	20	19.85	9.85 to 19.95	0.5 to 7.85	17.95
MW-13	5/31/2018	22	21.83	11.83 to 21.83	0.5 to 9.83	15.42
MW-14	5/31/2018	8	7.90	2.9 to 7.9	0.5 to 2	5.88
MW-15	5/31/2018	11	10.95	5.95 to 10.95	0.5 to 3.95	4.25
MW-16	6/1/2018	40	39.36	29.36 to 39.36	0.5 to 27.36	35.24

Notes:

Well borehole diameter was 3 1/2 inches, nominal
Well pipe was 1-inch in diameter polyvinyl chloride (PVC)
Well screen number 10 (0.010-inch) slot size PVC
Well filter material was filter sand.
Stick-up refers to the pipe height relative to the ground surface
TOC is top of casing
ft bgs is feet below ground surface

Table 2: Soil Screening Measurements

Boring ID	Depth (feet below ground surface)										
	0-2	2-4	4-8	8-12	12-16	16-20	20-24	24-28	28-32	32-36	36-40
EB-1 / MW-1	0.3		0	0	0	0	0	0	DNE	DNE	DNE
EB-2	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-3 / MW-2	0		0	0	0	0	0	DNE	DNE	DNE	DNE
EB-4	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-5 / MW-3	0		0	0	0	0	0	0	DNE	DNE	DNE
EB-6	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-7 / MW-4	0	0	0	0	0	0	0	DNE	DNE	DNE	DNE
EB-8	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW-5	0	0	0	0	0	0	0	0	0	DNE	DNE
EB-9	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-10	Boring pending										
EB-11	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-12	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-13	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-14	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-15	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-16	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-17	0.1	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-18	0.1	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-19	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-20	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-21	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-22	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-23	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-24	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-25	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-26	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-27	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-28 / MW-6	0		0	0	0	DNE	DNE	DNE	DNE	DNE	DNE
EB-29	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-30	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-31	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-32	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-33	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-34 / MW-7	0		0	0	0	0	0	0	DNE	DNE	DNE
EB-35 / MW-7a	0		0	0	0	0	0	0	0	0	0
EB-36 / MW-8	0		0	0	0	0	0	0	DNE	DNE	DNE
EB-37	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-38	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-39	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-40	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-41	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-42 / MW-10	0		DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-43 / MW-11	0		DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-44	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-45 / MW-12	0		0	0	0	0	DNE	DNE	DNE	DNE	DNE
EB-46	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-47	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-48 / MW-13	0	0	0	0	0	0	0	DNE	DNE	DNE	DNE
EB-49	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-50 / MW-14	0		0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-51 / MW-15	0		0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-52	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-53	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-54	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-55	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-56	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-57	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-58 / MW-16	0	0	0	0	0	0	0	0	0	0	0
EB-59	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-60	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-61	Boring pending										
EB-62	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-63	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-64	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-65	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-66	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-67	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-68	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-69	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-70	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-71	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-72	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-73	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-74	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-75	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-76	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-77	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-78	0	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-79	2.8	2.2	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-80	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-81	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-82	0.8	**22.9**	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-83	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-84	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-85	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-86	0.2	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-87	0.8	0.1	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-88	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-89	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-90	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-91	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-92	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-93	0.2	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-94	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-95	0.4	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-96	0.9	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-97	0.1	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-98	4.3	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-99	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-100	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-101	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-102	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-103	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-104	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
EB-105	0	0	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE

Notes:

BOLD — Measurements indicate elevated readings above background concentration of 5.0 ppm

DNE — Due to refusal or shallower termination depth)

Units recorded in parts per million (ppm)

Table 3: Groundwater Depth Summary

Well No.	Groundwater Data	
	Measured Date	Depth to Water (ft btc)
MW-1	6/7/2018	17.95
MW-2	6/13/2018	22.3
MW-3	6/13/2018	26
MW-4	6/13/2016	dry
MW-5	6/13/2018	28.08
MW-6	6/15/2018	10.19
MW-7	6/13/2018	dry
MW-7a	6/12/2018	34.59
MW-8	6/6/2018	22.43
MW-10	6/6/2018	1.77
MW-11	6/6/2018	1.32
MW-12	6/7/2018	17.95
MW-13	6/7/2018	15.42
MW-14	6/7/2018	5.88
MW-15	6/7/2018	4.25
MW-16	6/12/2018	35.24

Notes:

ft btc - feet below top of casing

Elevations were measured to nearest 0.01-foot relative. Units are in feet below top of casing (ft btc). Th
Depth to water measured from TOC.

Elevations have not been surveyed.

MW-9 and MW-17 through MW-23a to be installed at future date.

Table 4 - Summary of Soil Analytical Results - Detections Only

		RCRA 8 Metals (mg/kg)						VOCs (ug/kg)						
		Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Benzene	m,p-Xylene	o-Xylene	Tetrachloroethene	Toluene	Total Xylenes	Trichloroethene
	Notification Concentration	41	500	39	1,200	400	17	20	20,000	20,000	180	14,400	20,000	130
Highlighted cell indicates value greater than RRS	Non-Residential RRS*	38	1,000	39	1,200	400	17	500	1,000,000	1,000,000	500	100,000	1,000,000	500
	Type 5 RRS*	63	-	-	-	-	-	-	-	-	-	-	-	-
EB-1 (0-2)	6/11/2018	BRL	94.4	BRL	26	70.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-2 (0-2)	6/11/2018	14.3	104	BRL	29.4	273	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-3 (0-2)	6/11/2018	BRL	45.1	BRL	30.3	13.6	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-4 (0-2)	6/11/2018	**68.4**	54.4	BRL	17.3	36	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-5 (0-2)	6/11/2018	BRL	42.4	BRL	95.4	35.6	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-6 (0-2)	6/11/2018	5.44	24.7	BRL	43.7	120	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-7 (0-2)	6/11/2018	10.2	84.5	BRL	95.4	44.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-7 (19-21)	6/11/2018	BRL	48.8	BRL	170	22.4	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-8 (0-2)	6/11/2018	**227**	117	2.23	15.2	157	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-9 (0-2)	6/11/2018	39	75.9	BRL	24.1	125	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-10	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending
EB-11 (0-2)	6/11/2018	**45.2**	53.7	BRL	15.6	69.4	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-12 (0-2)	6/7/2018	**133**	171	BRL	11.2	64.8	BRL	**390**	BRL	BRL	**410**	2500	5200	BRL
EB-13 (0-2)	6/7/2018	16.3	166	BRL	32	391	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-14 (0-2)	6/7/2018	**230**	141	BRL	30.8	91.9	0.205	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-15 (0-2	6/7/2018	30.5	137	BRL	17.6	71.4	BRL	BRL	BRL	BRL	BRL	880	1600	BRL
EB-16 (0-2)	6/7/2018	**314**	106	BRL	12.1	109	0.436	BRL	BRL	BRL	BRL	2200	3000	BRL
EB-17 (0-2)	6/7/2018	5.91	107	BRL	44.2	375	0.191	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-18 (0-2)	6/7/2018	**224**	193	BRL	15.4	74.6	BRL	BRL	BRL	BRL	BRL	1200	2500	BRL
EB-19 (0-2)	6/7/2018	8.48	132	BRL	33.8	15.2	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-20 (0-2)	6/7/2018	**94.5**	67.2	BRL	61.3	102	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-21 (0-2)	6/7/2018	**116**	181	BRL	38.1	23.9	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-22 (0-2)	6/6/2018	**41.8**	93.6	BRL	7.72	17	BRL	BRL	1100	820	BRL	840	1920	BRL
EB-23 (0-2)	6/6/2018	**73.5**	113	BRL	26	27	BRL	**430**	2000	1200	BRL	2600	3200	BRL
EB-24 (0-2)	6/6/2018	**200**	157	1.97	19.6	96.6	BRL	BRL	760	580	BRL	560	1340	BRL
EB-25 (0-2)	6/6/2018	**208**	113	1.85	10.7	57.5	BRL	**1500**	830	590	BRL	1900	1420	BRL
EB-26 (0-2)	6/6/2018	**131**	133	BRL	12.7	82.7	BRL	**370**	1100	760	BRL	1400	1860	BRL
EB-27 (0-2)	6/6/2018	BRL	91.6	BRL	87.8	18.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-28 (0-2)	6/7/2018	4.86	151	BRL	39.6	20.5	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-29 (0-2)	6/6/2018	14.3	123	BRL	43.1	36.4	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-30 (0-2)	6/5/2018	17.6	148	BRL	23.3	66.6	BRL	BRL	BRL	BRL	15	BRL	BRL	BRL
EB-31 (0-2)	6/5/2018	BRL	33.5	BRL	23.8	13.5	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-32 (0-2)	6/5/2018	13.8	103	BRL	43.4	179	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-33 (0-2)	6/5/2018	**262**	141	3	13.8	64	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-34 (0-2)	6/6/2018	**41.7**	164	BRL	18.1	47	BRL	BRL	BRL	BRL	BRL	400	BRL	BRL
EB-34 (23-25)	6/7/2018	BRL	132	BRL	26.3	9.01	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-35 (0-2)	6/5/2018	**70.8**	124	BRL	17.4	67.4	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-36 (0-2)	6/5/2018	**120**	213	BRL	14.1	127	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-37 (0-2)	6/5/2018	**418**	136	4.87	17.7	112	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-38 (0-2)	6/14/2018	**183**	151	BRL	30.1	65.9	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-39 (0-2)	6/5/2018	**81**	163	BRL	31.6	73.7	BRL	BRL	450	360	BRL	340	810	BRL
EB-40 (0-2)	6/5/2018	**226**	142	2.79	14.6	115	BRL	BRL	920	610	BRL	930	1530	BRL
EB-41 (0-2)	6/5/2018	**72.3**	265	BRL	32.6	54.4	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-42 (0-2)	6/5/2018	BRL	134	BRL	19.2	7.07	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-43 (0-2)	6/1/2018	13	153	BRL	40.1	27.6	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-44 (0-2)	6/1/2018	**144**	77.6	1.69	12.4	108	BRL	BRL	350	BRL	BRL	600	350	BRL
EB-45 (0-2)	6/1/2018	**46.4**	51.9	BRL	4.93	24.1	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-46 (0-2)	6/1/2018	**158**	105	2.04	14.3	132	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-47 (0-2)	6/1/2018	31.1	159	BRL	31.9	51.3	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-48 (0-2)	5/31/2018	BRL	258	BRL	38.3	13.8	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-49 (0-2)	6/1/2018	11.4	114	BRL	29.7	93.9	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-50 (0-2)	5/31/2018	BRL	114	BRL	32.3	136	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-51 (0-2)	5/31/2018	**115**	165	2.43	32	158	0.153	BRL	790	510	BRL	1100	1300	BRL
EB-52 (0-2)	6/1/2018	11	167	BRL	50.8	222	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-53 (0-2)	6/7/2018	**67.8**	195	BRL	14.8	93.1	BRL	BRL	BRL	BRL	BRL	840	1200	BRL
EB-54 (0-2)	6/4/2018	**80.4**	97.7	2.73	19	140	0.151	BRL	430	320	BRL	350	750	BRL
EB-55 (0-2)	6/4/2018	**197**	152	2.56	18.8	150	BRL	BRL	540	410	BRL	460	950	BRL
EB-56 (0-2)	6/4/2018	**68.7**	91.4	BRL	30.7	59.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-57 (0-2)	6/4/2018	27.8	123	BRL	19	315	0.305	BRL	490	330	BRL	490	820	BRL
EB-58 (0-2)	6/1/2018	20	74.9	BRL	16.2	78.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-59 (0-2)	6/7/2018	**297**	177	2.99	15.3	132	BRL	**730**	NA	NA	BRL	4700	6300	BRL
EB-60 (0-2)	6/4/2018	**145**	79	BRL	14.8	112	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-61	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending
EB-62 (0-2)	5/30/2018	**41.6**	149	BRL	24.1	31.8	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-63 (0-2)	5/31/2018	BRL	138	BRL	29.1	34	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-64 (0-2)	5/31/2018	**108**	118	BRL	11.3	73.5	BRL	**610**	1800	1200	BRL	2500	3000	BRL
EB-65 (0-2)	5/31/2018	**246**	215	BRL	16.4	131	0.134	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-66 (0-2)	5/31/2018	BRL	145	BRL	18.4	8.18	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-67 (0-2)	5/30/2018	27	94	BRL	23	24.3	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-68 (0-2)	6/14/2018	29.6	108	BRL	34.4	38.1	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-69 (0-2)	5/30/2018	**57.2**	110	BRL	18.1	33.2	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-70 (0-2)	6/4/2018	BRL	167	BRL	20.6	98.2	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-71 (0-2)	5/30/2018	24.1	126	BRL	6.32	36.5	0.136	BRL	BRL	BRL	BRL	BRL	BRL	18
EB-72 (0-2)	5/30/2018	13.4	145	BRL	31.1	18.5	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-73 (0-2)	5/30/2018	**515**	128	2.25	12	86.5	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-74 (0-2)	6/14/2018	**91.7**	151	BRL	8.89	112	0.485	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-75 (0-2)	5/30/2018	6.63	136	BRL	14.7	39.1	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-76 (0-1)	6/7/2018	16.5	148	BRL	9.37	133	BRL	8.6	BRL	BRL	BRL	BRL	BRL	BRL
EB-77 (0-2)	6/6/2018	11.9	166	BRL	7.92	32.4	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-78 (0-2)	6/6/2018	8.41	137	BRL	8.55	12.1	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-79 (0-1)	6/7/2018	5.66	91	BRL	27.7	17.1	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-80 (1-1.5)	6/7/2018	**185**	164	2.22	16	316	BRL	BRL	BRL	BRL	6.2	BRL	BRL	BRL
EB-81 (0-2)	6/14/2018	**100**	173	BRL	9.72	123	BRL	BRL	BRL	BRL	68	BRL	BRL	BRL
EB-82 (0-1)	6/7/2018	**110**	95.2	BRL	85.6	48.2	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-83 (0-1)	6/7/2018	BRL	227	BRL	79.7	15.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-84 (0-1)	6/7/2018	25.6	178	BRL	61.1	47.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-85 (0-2)	6/14/2018	8.37	69.5	BRL	5.05	22.5	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-86 (0-2)	6/6/2018	9.64	77.3	BRL	13	44	BRL	BRL	570	430	BRL	BRL	1000	BRL
EB-87 (1.5-2)	6/6/2018	**207**	136	2.08	20.6	138	BRL	BRL	560	410	BRL	640	970	BRL
EB-88 (0-1)	6/6/2018	**84.5**	267	BRL	32.6	57.5	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-89 (0-1)	6/6/2018	11.4	150	BRL	63	29.8	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-90 (0-1)	6/6/2018	**212**	180	2.19	31.7	80.1	BRL	BRL	1100	680	BRL	910	1780	BRL
EB-91 (1-1.5)	6/6/2018	**217**	114	1.96	12.5	88.2	BRL	BRL	580	480	BRL	450	1060	BRL
EB-92 (0.5-1)	6/6/2018	**268**	253	2.51	16.5	53.6	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-93 (1-1.5)	6/6/2018	**384**	248	3.86	20.6	126	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-94 (0-1)	6/7/2018	17.9	30.2	BRL	10.8	29.5	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-95 (0-1)	6/7/2018	36.6	198	BRL	28.3	59.8	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-96 (0-1)	6/7/2018	**49**	88.2	BRL	12.4	140	BRL	BRL	NA	NA	BRL	250	370	BRL
EB-97 (0-0.5)	6/7/2018	**169**	133	BRL	11.8	107	BRL	BRL	NA	NA	BRL	BRL	550	BRL
EB-98 (0-1)	6/7/2018	**61.7**	65.7	BRL	9.42	38.6	BRL	BRL	NA	NA	BRL	BRL	370	BRL
EB-99 (0-1)	6/7/2018	BRL	18.6	BRL	5.11	6.03	BRL	BRL	NA	NA	BRL	BRL	BRL	BRL
EB-100 (0-2)	6/13/2018	11.7	62.7	BRL	9.31	20.6	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-101 (0-2)	6/13/2018	**59.4**	61.6	BRL	8.5	46.2	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-102 (0-2)	6/13/2018	BRL	27.9	BRL	11	11.6	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-103 (0-2)	6/14/2018	26.4	374	BRL	8.88	**733**	0.168	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-104 (0-2)	6/13/2018	**102**	87.1	BRL	24.1	302	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-105 (0-2)	6/14/2018	BRL	85.4	BRL	29.6	139	0.442	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-106 (0-1)	4/12/2019	30.8	99.3	BRL	29.7	121	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-107 (0-1)	4/12/2019	BRL	37.5	BRL	7.4	35.3	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-108 (0-1)	4/12/2019	**172**	63	BRL	9.49	134	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-109 (0-1)	4/12/2019	17.9	118	BRL	34.9	**831**	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-110 (0-1)	4/12/2019	**63.7**	66.9	BRL	10.8	58.3	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL

		SVOCs (ug/kg)																	PCBs (ug/kg)	
	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Bis(2-ethylhexyl)phthalate	Butyl benzyl phthalate	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	Aroclor 1254	Aroclor 1260
Notification Concentration	300,000	130,000	500,000	5,000	1,640	5,000	500,000	5,000	50,000	50,000	5,000	5,000	500,000	360,000	5,000	100,000	110,000	500,000	1,550	1,550
Non-Residential RRS*	300,000	130,000	1,000,000	5,000	1,640	5,000	500,000	46,000	50,000	50,000	140,000	5,000	500,000	360,000	572,000 / 2,230,000	100,000	110,000	500,000	1,550	1,550
Type 5 RRS*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-1 (0-2)	BRL	BRL	BRL	790	720	1400	590	600	BRL	BRL	910	BRL	830	BRL	540	BRL	BRL	850	NA	NA
EB-2 (0-2)	BRL	BRL	BRL	BRL	BRL	610	BRL	BRL	BRL	BRL	420	BRL	400	BRL	BRL	BRL	BRL	380	NA	NA
EB-3 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-4 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-5 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-6 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-7 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-7 (19-21)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-8 (0-2)	BRL	BRL	BRL	BRL	BRL	590	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	460	470	BRL	NA	NA
EB-9 (0-2)	BRL	BRL	430	470	500	1200	580	500	BRL	BRL	670	BRL	590	BRL	520	BRL	BRL	630	NA	NA
EB-10	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	NA	NA
EB-11 (0-2)	BRL	BRL	BRL	BRL	470	940	530	BRL	BRL	BRL	560	BRL	500	BRL	430	BRL	BRL	560	NA	NA
EB-12 (0-2)	BRL	1300	1100	840	1300	2900	1400	620	BRL	BRL	1300	BRL	990	BRL	1300	BRL	450	1000	NA	NA
EB-13 (0-2)	BRL	BRL	BRL	BRL	BRL	640	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-14 (0-2)	BRL	BRL	BRL	BRL	BRL	410	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-15 (0-2	BRL	BRL	BRL	BRL	BRL	510	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-16 (0-2)	BRL	BRL	BRL	BRL	BRL	1800	BRL	BRL	910	BRL	770	BRL	BRL	BRL	540	BRL	BRL	BRL	NA	NA
EB-17 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	2300	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-18 (0-2)	BRL	1300	780	720	980	2600	1300	BRL	BRL	BRL	1000	BRL	1000	BRL	1100	BRL	BRL	1200	NA	NA
EB-19 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-20 (0-2)	BRL	BRL	BRL	BRL	BRL	440	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	690	470	BRL	NA	NA
EB-21 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-22 (0-2)	BRL	650	BRL	910	1100	2800	1000	BRL	BRL	BRL	1200	BRL	1100	BRL	970	450	580	1000	NA	NA
EB-23 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-24 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-25 (0-2)	BRL	BRL	BRL	450	BRL	960	BRL	BRL	BRL	BRL	550	BRL	1100	BRL	BRL	BRL	750	870	NA	NA
EB-26 (0-2)	BRL	BRL	BRL	BRL	BRL	1200	390	BRL	BRL	BRL	640	BRL	620	BRL	BRL	1000	710	580	NA	NA
EB-27 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-28 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-29 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-30 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	390	BRL	BRL	NA	NA
EB-31 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-32 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-33 (0-2)	BRL	BRL	BRL	BRL	430	1400	420	BRL	BRL	BRL	510	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-34 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	420	BRL	BRL	BRL	BRL
EB-34 (23-25)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-35 (0-2)	BRL	BRL	BRL	BRL	BRL	520	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	550	510	BRL	NA	NA
EB-36 (0-2)	BRL	450	620	730	720	1800	810	490	BRL	BRL	950	BRL	1000	BRL	790	780	890	1000	BRL	BRL
EB-37 (0-2)	BRL	BRL	BRL	510	520	1500	500	BRL	BRL	BRL	640	BRL	640	BRL	450	680	580	730	NA	NA
EB-38 (0-2)	BRL	BRL	BRL	BRL	BRL	700	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-39 (0-2)	BRL	BRL	BRL	BRL	BRL	410	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	800	750	BRL	NA	NA
EB-40 (0-2)	BRL	430	BRL	610	660	1500	670	480	BRL	BRL	900	BRL	890	BRL	640	490	570	940	NA	NA
EB-41 (0-2)	BRL	BRL	BRL	BRL	BRL	1000	BRL	BRL	BRL	BRL	410	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-42 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-43 (0-2)	BRL	BRL	510	530	710	1600	BRL	BRL	BRL	BRL	770	BRL	820	BRL	480	BRL	BRL	610	NA	NA
EB-44 (0-2)	BRL	5200	2900	4800	**8400**	**18000**	4500	2000	BRL	BRL	**5000**	1700	3900	BRL	**5400**	380	630	4900	NA	NA
EB-45 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-46 (0-2)	BRL	750	1300	2000	**1900**	2900	1400	1100	BRL	BRL	2000	460	3700	BRL	1500	420	2400	3100	NA	NA
EB-47 (0-2)	BRL	BRL	BRL	BRL	BRL	470	BRL	BRL	BRL	BRL	BRL	BRL	460	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-48 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-49 (0-2)	BRL	BRL	BRL	670	640	1300	BRL	BRL	BRL	BRL	750	BRL	1300	BRL	BRL	BRL	480	1000	NA	NA
EB-50 (0-2)	BRL	BRL	BRL	550	530	1100	BRL	1100	530	BRL	610	BRL	1300	BRL	BRL	BRL	680	1000	NA	NA
EB-51 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	560	BRL	BRL	NA	NA
EB-52 (0-2)	BRL	BRL	BRL	BRL	BRL	1000	BRL	BRL	BRL	BRL	BRL	BRL	500	BRL	BRL	BRL	BRL	520	NA	NA
EB-53 (0-2)	BRL	BRL	BRL	BRL	BRL	570	BRL	BRL	BRL	BRL	BRL	BRL	450	BRL	BRL	530	520	470	NA	NA
EB-54 (0-2)	BRL	BRL	BRL	BRL	510	1300	460	BRL	BRL	BRL	570	BRL	530	BRL	480	570	600	540	NA	NA
EB-55 (0-2)	BRL	BRL	BRL	BRL	BRL	760	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	610	560	BRL	NA	NA
EB-56 (0-2)	BRL	BRL	BRL	BRL	BRL	480	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-57 (0-2)	BRL	530	600	1600	**1900**	2300	1600	720	BRL	BRL	1700	BRL	3400	BRL	1400	400	2200	3300	NA	NA
EB-58 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-59 (0-2)	BRL	BRL	BRL	BRL	BRL	600	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	880	640	BRL	NA	NA
EB-60 (0-2)	BRL	410	690	1300	1400	2100	980	610	BRL	BRL	1500	BRL	3400	BRL	950	BRL	2900	3100	NA	NA
EB-61	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	NA	NA
EB-62 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-63 (0-2)	BRL	BRL	BRL	BRL	BRL	420	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-64 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-65 (0-2)	BRL	1400	2100	2700	**3200**	**8800**	1400	2100	BRL	BRL	3600	590	3100	BRL	1200	BRL	670	2900	NA	NA
EB-66 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-67 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-68 (0-2)	BRL	BRL	BRL	BRL	420	1100	BRL	BRL	BRL	BRL	480	BRL	BRL	BRL	BRL	BRL	420	420	NA	NA
EB-69 (0-2)	BRL	BRL	BRL	BRL	BRL	580	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-70 (0-2)	BRL	BRL	BRL	1000	860	1600	540	BRL	BRL	BRL	1000	BRL	2100	BRL	560	BRL	1000	1700	NA	NA
EB-71 (0-2)	BRL	470	BRL	620	1100	1800	730	650	BRL	BRL	840	BRL	840	BRL	470	BRL	BRL	890	NA	NA
EB-72 (0-2)	BRL	BRL	BRL	BRL	BRL	460	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-73 (0-2)	BRL	BRL	490	550	1100	3400	730	3500	BRL	BRL	900	BRL	770	BRL	BRL	BRL	BRL	750	NA	NA
EB-74 (0-2)	BRL	BRL	BRL	BRL	BRL	1200	BRL	BRL	BRL	BRL	490	BRL	490	BRL	BRL	620	630	520	NA	NA
EB-75 (0-2)	BRL	BRL	BRL	BRL	BRL	450	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-76 (0-1)	BRL	BRL	BRL	910	1000	1800	840	BRL	BRL	BRL	1200	BRL	1500	BRL	760	430	750	1900	NA	NA
EB-77 (0-2)	BRL	BRL	BRL	900	800	1700	670	BRL	BRL	BRL	950	BRL	1900	BRL	590	BRL	1000	1500	NA	NA
EB-78 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-79 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-80 (1-1.5)	BRL	BRL	BRL	BRL	BRL	920	BRL	BRL	BRL	BRL	570	BRL	570	BRL	BRL	510	640	610	NA	NA
EB-81 (0-2)	BRL	BRL	BRL	BRL	510	1200	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-82 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-83 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-84 (0-1)	BRL	BRL	BRL	BRL	BRL	770	BRL	BRL	BRL	1200	490	BRL	880	BRL	BRL	BRL	780	930	NA	NA
EB-85 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	410	BRL	BRL	NA	NA
EB-86 (0-2)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-87 (1.5-2)	BRL	BRL	BRL	440	BRL	890	BRL	BRL	BRL	BRL	730	BRL	1300	BRL	BRL	1100	1500	950	NA	NA
EB-88 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-89 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-90 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-91 (1-1.5)	BRL	410	510	510	590	1900	670	BRL	BRL	BRL	880	BRL	750	BRL	580	410	470	750	NA	NA
EB-92 (0.5-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	610	530	BRL	NA	NA
EB-93 (1-1.5)	BRL	BRL	BRL	490	BRL	1200	BRL	BRL	BRL	BRL	740	BRL	590	BRL	BRL	1100	1100	550	NA	NA
EB-94 (0-1)	BRL	470	420	640	870	1600	890	540	BRL	BRL	960	BRL	870	BRL	730	BRL	BRL	920	NA	NA
EB-95 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-96 (0-1)	BRL	BRL	BRL	BRL	BRL	390	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-97 (0-0.5)	BRL	BRL	BRL	BRL	BRL	500	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	520	650	BRL	NA	NA
EB-98 (0-1)	BRL	BRL	BRL	BRL	BRL	770	BRL	790	BRL	BRL	BRL	BRL	550	BRL	BRL	BRL	BRL	570	NA	NA
EB-99 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	NA	NA
EB-100 (0-2)	BRL	490	BRL	540	700	1,700	630	BRL	BRL	BRL	680	BRL	780	BRL	560	BRL	BRL	850	NA	NA
EB-101 (0-2)	BRL	450	460	750	1100	2900	880	BRL	BRL	BRL	990	BRL	810	BRL	770	BRL	410	960	NA	NA
EB-102 (0-2)	490	BRL	1000	3000	**2100**	4500	1500	1300	BRL	BRL	3200	450	7800	510	1300	BRL	3600	7800	NA	NA
EB-103 (0-2)	BRL	BRL	BRL	480	770	1900	990	680	BRL	BRL	810	BRL	660	BRL	680	BRL	BRL	680	BRL	BRL
EB-104 (0-2)	BRL	490	BRL	470	610	1600	650	BRL	BRL	BRL	640	BRL	660	BRL	620	BRL	BRL	650	NA	NA
EB-105 (0-2)	BRL	BRL	BRL	BRL	BRL	430	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-106 (0-1)	BRL	860	1200	1900	**3300**	**6100**	2000	2400	1100	BRL	2600	730	2300	BRL	2100	BRL	400	2700	NA	NA
EB-107 (0-1)	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
EB-108 (0-1)	BRL	3100	2100	3600	**9500**	**17000**	BRL	3900	BRL	BRL	4400	2600	3100	BRL	BRL	BRL	430	4200	NA	NA
EB-109 (0-1)	BRL	1000	1600	3300	**5400**	**11000**	3100	3400	BRL	BRL	3600	1200	2900	BRL	3300	BRL	BRL	4000	350	150
EB-110 (0-1)	BRL	BRL	530	480	700	1400	560	580	BRL	BRL	710	BRL	620	BRL	510	BRL	BRL	770	NA	NA

NOTES:
Volatile Organic Compounds (VOCs), Semi-VOCs, and polychlorinated biphenyls (PCBs) reported in micrograms per kilogram (ug/kg)
Resource Conservation and Recovery Act 8 metals (RCRA 8 Metals) reported in milligrams per kilogram (mg/kg)
RRS is Georgia Environmental Protection Division (EPD) Risk Reduction Standard
Sample collection depth is shown in parenthesis following sample ID
*Non-Residential RRS and Type 5 RRS obtained from CAP Amendment 2 Approval Letter, from column titled DAF of 1 Selected Nonresidential, and Type 5, respectively
If only one number is shown for the Non-Residential RRS, this number applies to surficial soils (0-2 ft) and subsurface soils (>2 ft). Otherwise, the the two numbers are for <2 ft / > 2 ft.

LEGEND

(yellow)	Indicates detection greater than the applicable non-residential RRS
(pink)	Indicates detection greater than the applicable Type 5 RRS
BOLD	Indicates detection exceeds Georgia EPD Notification Concentration
BRL	Below laboratory reporting limit
NA	Not Analyzed
(green)	United Consulting developed non-residential RRS for these constituents following the pre-September 25, 2018 RRS methods. These values are being included for use on this project.

Table 5 - Summary of Groundwater Analytical Results - Detections Only

		RCRA 8 Metals (mg/L) [Total / Dissolved]					VOCs (µg/L)	SVOCs (µg/L)	PCBs (µg/L)
		Arsenic	Barium	Chromium	Lead	Mercury	Target Compound List	Target Compound List	Target Compound List
	MCL	0.01	2	0.1	0.015	0.002	Various	Various	Various
	Type 1 Groundwater Criteria (GC)	0.01	2	0.1	0.015	0.002	Various	Various	Various
EB-106-GW	4/12/2019	**0.011** / BRL	**0.514** / **0.0332**	**0.182** / BRL	**0.0814** / BRL	BRL / BRL	BRL	BRL	NA
EB-107-GW	4/12/2019	BRL / BRL	**0.13** / **0.0495**	**0.0268** / BRL	BRL / BRL	BRL / BRL	BRL	BRL	BRL
EB-109-GW	4/12/2019	BRL / BRL	**0.0724** / **0.0457**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	BRL
MW-1	6/18/2018	BRL / BRL	**0.063** / **0.0606**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-2	6/13/2018	BRL / BRL	**0.0888** / **0.0847**	BRL / BRL	BRL / BRL	**0.00045** / BRL	BRL	BRL	NA
MW-3	6/13/2018	BRL / BRL	**0.158** / **0.0325**	**0.0188** / BRL	**0.0524** / BRL	BRL / BRL	BRL	BRL	BRL
MW-4	dry					dry			
MW-5	6/13/2018	BRL / BRL	**0.106** / **0.104**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-6	6/15/2018	BRL / BRL	**0.0439** / NA	BRL / NA	BRL / NA	BRL / NA	BRL	BRL	NA
MW-7	dry					dry			
MW-7a	6/12/2018	BRL / BRL	**0.0787** / **0.0335**	**0.0113** / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-8	6/6/2018	BRL / BRL	**0.0587** / **0.0624**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	BRL
MW-10	6/6/2018	BRL / BRL	**0.066** / **0.0702**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	BRL
MW-11	6/6/2018	BRL / BRL	**0.133** / **0.142**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-12	6/7/2018	BRL / BRL	**0.0721** / **0.0795**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-13	6/7/2018	BRL / BRL	**0.0837** / **0.0836**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-14	6/7/2018	BRL / BRL	**0.0716** / **0.0747**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-15	6/7/2018	BRL / BRL	**0.0545** / **0.0587**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-16	6/12/2018 VOCs, 6/18/2018 SVOCs Metals	BRL / BRL	**0.178** / **0.167**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
MW-2-Duplicate	6/13/2018	BRL / BRL	**0.0889** / **0.0877**	BRL / BRL	BRL / BRL	BRL / BRL	BRL	BRL	NA
DUP-2-GW	6/15/2018	BRL / BRL	**0.0632** / NA	BRL / NA	BRL / NA	BRL / NA	BRL	BRL	NA
DUP-12	4/12/2019	NA	NA	NA	NA	NA	NA	BRL	NA

NOTES:

Exceeds MCL and/or Type 1 GC

Volatile Organic Compounds (VOCs), Semi-VOCs (SVOCs), and polychlorinated biphenyls (PCBs) reported in micrograms per kilogram (µg/L)

Resource Conservation and Recovery Act 8 metals (RCRA 8 Metals) reported in milligrams per liter (mg/L)

Dissolved metals not analyzed if turbidity was less than 10 NTU

MCL is United States Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL)

Type 1 Groundwater Criteria (Type 1 GC) per Georgia Environmental Protection Division (EPD) Table 1 of Appendix (391-3-19) III

UNITED CONSULTING

F4 – NON-ARSENIC REMEDIAL EFFORTS

Through the Phase II/Initial BSCS as summarized in Attachment F1, there were nine borings locations with non-arsenic constituents of concern (COCs) with concentrations above the Type 3 non-residential Risk Reduction Standards (RRS). The approximate locations of these nine areas are illustrated on Figures 1 and 2 within this Attachment. The following boring locations and associated detected constituents exceeding non-residential RRS were the focus of the non-arsenic remedial efforts:

- benzene at EB-25;
- benzo(a)pyrene and benzo(b)fluoranthene at EB-44;
- benzo(a)pyrene at EB-46;
- benzo(a)pyrene at EB-57;
- benzene at EB-59;
- benzene at EB-64;
- benzo(a)pyrene and benzo(b)fluoranthene at EB-65;
- benzo(a)pyrene at EB-102; and
- lead at EB-103.

Following is a brief summary of the delineation sampling and remedial efforts performed. This is being provided as a summary, complete details will be provided in later Interim and/or Final PPCSR(s).

Please note that there are three additional areas with non-arsenic impacts requiring remediation. These are between Allene Ave and the Mainline SST. Delineation efforts for these three additional areas are currently in progress. Remediation of these areas will be conducted at a later time, in accordance with this Appendix F.

Delineation Sampling Approach

Prior to the remedial efforts, pre-remediation delineation sampling was performed. These sampling efforts were performed in March 2018. The sampling approach/frequency of the non-arsenic delineation sampling was consistent with the existing master BeltLine Corrective Action Plan (CAP), as amended. This was also discussed with Brownfield staff, prior to its implementation. A total of 63 hand auger borings were advanced to obtain soil samples for potential laboratory analysis. This included six borings around each of the original borings with impact concentrations above their applicable RRS (two step outs of three borings each, with the step outs being approximately 5-feet apart), plus one boring at the original boring location with the exceedance for vertical delineation. The borings were advanced to depths of approximately 2 to 5 feet.

One sample from each of the 63 borings was collected for potential laboratory analysis of arsenic, lead, benzene, benzo(a)pyrene, and/or benzo(b)fluoranthene, depending on the constituents detected at the respective original boring location. Although the delineation assessment was performed for the purposes of delineating non-arsenic constituents, arsenic was analyzed in the step out borings if there was an exceedance of arsenic at the original boring location (at EB-25, EB-44, EB-46, EB-59, EB-64, and EB-65). The samples from each of

the horizontal step out borings were collected from within apparent fill materials. The samples from each of the vertical delineation borings were collected at depth intervals of approximately 2.5-3 feet below ground surface (ft. bgs) and 3.5 to 4 ft. bgs.

Soil samples were collected from a set of three inner step out borings that were advanced in three equidistant directions from the original boring, if possible, and analyzed for the respective constituents. Soil samples were collected from a second set of three outer step out borings, and these samples were submitted to the laboratory on hold, and analyzed only if the inner step out boring from that direction still exceeded applicable non-residential RRS for the respective constituent(s). A minimum safe buffer distance of 5 feet from utilities is required per the existing master BeltLine CAP. Step out boring directions were modified accordingly to avoid breaching the approximate 5-foot safe distance buffer, per approximate utility locations presented to United Consulting in CAD files and original GDOT fiber plans. Approximate remediation area shapes were generated based on the analytical results from the step out borings. The shapes of the planned remediation areas were generally oval-shaped, based on the three-direction step out boring approach, and to be consistent with remediation performed on other portions of the BeltLine.

Three samples were also collected from the needed remedial areas for analysis of VOCs, SVOCs, and RCRA metals via the toxicity characteristic leaching procedure (TCLP) to assess potential landfill disposal options. These were from borings EB-25R (0-2), EB-44R (0-2), and EB-103R (0-1).

Delineation Sampling Results

Nine areas requiring remediation for non-arsenic constituents were identified, as outlined above. At each of the remediation areas, the initial vertical delineation sample was in compliance with applicable RRS, thus, each non-arsenic remediation area required excavation to 2.5 ft. bgs. Groundwater was encountered at approximately 2 ft. at EB-44R, so remediation was planned to the top of the groundwater at this area. Figures 1 through 8 show the remediation areas, and their estimated limits as established by the plotted utilities and delineation sampling results. The actual shapes and sizes of the remediation area were determined during the remediation activities in the field, based on field conditions (i.e. utility locations determined by the remediation contractor). The delineation sampling analytical results are summarized on Table 1 in Attachment F4. Following is a brief summary of the delineation results per remedial area.

Remediation Area 1

Benzene was detected at a concentration exceeding the non-residential RRS at EB-25. Benzene was not detected in the initial EB-25 step out borings.

Remediation Area 2

Benzo(a)pyrene and benzo(b)fluoranthene were detected at concentrations exceeding their respective applicable non-residential RRS at EB-44. Benzo(a)pyrene and benzo(b)fluoranthene were not detected in the initial EB-44 step out borings.

Remediation Area 3

Benzo(a)pyrene was detected at a concentration exceeding the non-residential RRS at EB-46. There was a plotted utility present to the northwest, limiting delineation/remediation in that direction. Benzo(a)pyrene was detected at concentrations exceeding its applicable RRS in the EB-46 inner and outer step out borings to the southeast of the original boring location. Borings in other directions were below its RRS. Additional borings were not advanced beyond the second step out to the southeast due to close proximity of the property boundary. This excavation was planned for excavation to the property boundary to the southeast of this boring location.

A fence and concrete slab were present as part of improvements to the offsite property adjoining to the southeast of the Subject Property at this location. The fence and a portion of the concrete slab encroached within the BeltLine corridor property boundary. The fence and concrete slab was planned for removal during the remediation activities in this area.

Remediation Area 4

Benzo(a)pyrene was detected at a concentration exceeding the non-residential RRS at EB-57. There was a plotted utility present to the north, limiting delineation/remediation in that direction. Benzo(a)pyrene was detected above its applicable RRS in two of the inner step out borings, but below applicable RRS in the two respective outer step out borings. Benzo(a)pyrene was not detected in the other inner step out boring.

Remediation Area 5

Benzene was detected at a concentration exceeding the non-residential RRS at EB-59. There was a plotted utility present to the north, limiting delineation/remediation in that direction. Benzene was not detected in the initial EB-59 step out borings.

Remediation Area 6

Benzene was detected at a concentration exceeding the non-residential RRS at EB-64. There was a plotted utility present to the north, limiting delineation/remediation in that direction. Benzene was not detected in the initial EB-64 step out borings.

Remediation Area 7

Benzo(a)pyrene and benzo(b)fluoranthene were detected at concentrations exceeding their respective non-residential RRSs at EB-65. Benzo(a)pyrene and benzo(b)fluoranthene were not detected in the initial EB-65 step out borings.

Remediation Area 8

Benzo(a)pyrene was detected at a concentration exceeding the non-residential RRS at EB-102. There was a plotted utility present to the northwest, limiting delineation/ remediation in that direction. Benzo(a)pyrene was not detected in the initial EB-102 step out borings.

Remediation Area 9

Lead was detected at a concentration exceeding applicable non-residential RRS at EB-103. Lead was not detected in the initial EB-103 step out borings.

Based on the three samples tested via the TCLP, the soils were not characteristically hazardous, and therefore acceptable for Subtitle D landfill disposal.

Remediation Activities

Through Lewallen Construction Co. (Lewallen), the contractor responsible for constructing the interim hiking trail, Atlanta BeltLine, Inc. retained Titan Environmental Services, LLC to perform the needed non-arsenic soil remediation. United Consulting observed and documented the remedial activities, which were performed by Titan in May 2019.

Prior to the remediation activities, United Consulting staked each of the nine remedial areas, including its center location, and the lateral limits as illustrated in the aforementioned Figures 3 to 8. Titan was responsible for having actual utility locations marked prior to the excavation process. Once the utilities were marked, it was determined that remedial areas 3, 4, 5, and 7 needed to be reduced in size from the estimated limits illustrated on Figures 3 to 8 to stay approximately 5-feet from the utilities as required in the PPCAP, as amended. A utility was marked through the center of remedial area 1 (at EB-25), which was a planned approximate 10-foot circular excavation area, and therefore it could not be remediated.

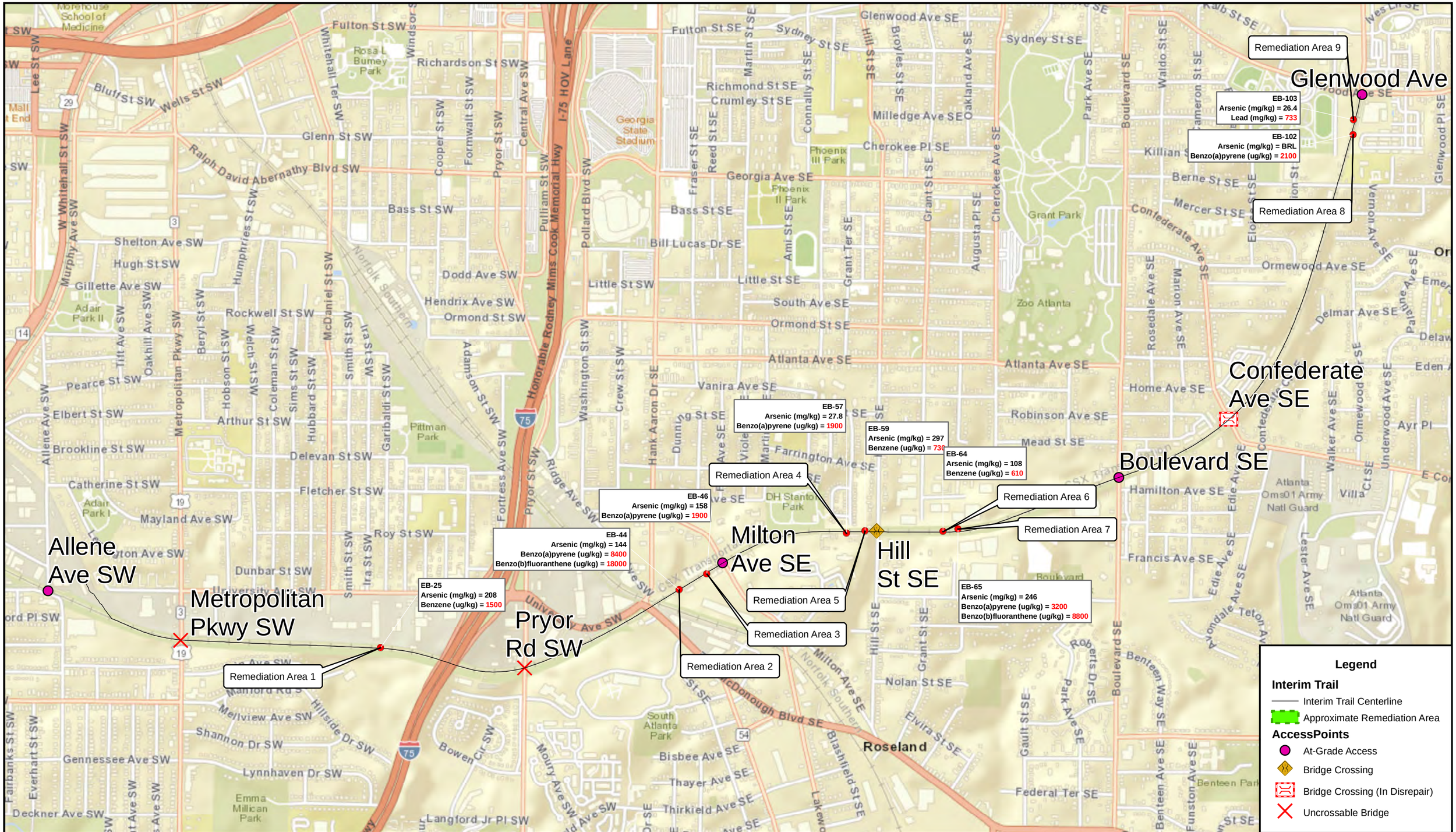
During the remediation process, 49.73 tons on impacted soils were excavated, transported, and disposed at Eagle Point Landfill in Ball Ground, Georgia. Disposal manifests are included in Attachment F4. Directly following the excavation of the impacted soils at each removal area, the excavation was backfilled with stone graded aggregate base (GAB) from Vulcan Materials. This was not recycled material.

Supporting Attachments

Figure 1	Remediation Areas Overview – Street Map
Figure 2	Remediation Areas Overview – Aerial
Figure 3	Remediation Area 1 (EB-25 Area)
Figure 4	Remediation Area 2 (EB-44 Area)
Figure 5	Remediation Area 3 (EB-46 Area)
Figure 6	Remediation Areas 4 & 5 (EB-57 and EB-59 Areas)
Figure 7	Remediation Areas 6 & 7 (EB-64 and EB-65 Areas)
Figure 8	Remediation Areas 8 & 9 (EB-102 and EB-103 Areas)

Table 1	Summary of Step-Out Analytical Results – Detections Only

Disposal Manifests



UNITED CONSULTING	**Figure Scale** N 0 500 1,000 2,000 3,000	**Prepared:**	MJF	**Title:**	Remediation Areas Overview - Street Map
		Checked:	RCG	**Project:**	Atlanta Beltline Southside Trail
				Project No.	KMHRN-17-GA-01191-02
				Client:	Kimley Horn

Figure 1

NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.

UNITED CONSULTING

Figure Scale

N

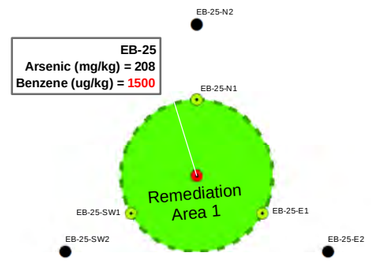
0 500 1,000 2,000 3,000

Prepared:	MJF
Checked:	RCG

Title:	Remediation Areas Overview - Aerial
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 2

NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.



Legend

Utility Layer

- Underground Telephone Line
- Property Boundary

Stepout Borings (Results for Non-As COCs)

- Below Non-Residential RRS with DAF of 1 (excluding arsenic)
- Exceeds Non-Residential RRS with DAF of 1 (excluding arsenic)
- Sample Not Analyzed
- Approximate Remediation Area

UNITED CONSULTING

Figure Scale

N

0 5 10 20 30

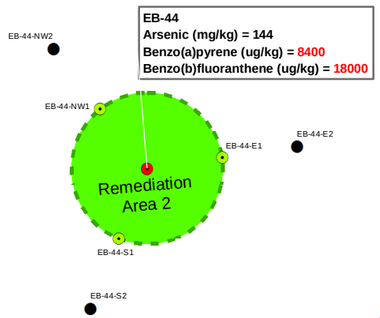
1 inch = 10 feet

Prepared:	MJF
Checked:	RCG
Date:	3/27/2019

Title:	Remediation Area 1 (EB-25 Area)
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 3

NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.



Legend

Utility Layer

- Underground Telephone Line
- Property Boundary
- Approximate GDOT Fiber

Stepout Borings (Results for Non-As COCs)

- Below Non-Residential RRS with DAF of 1 (excluding arsenic)
- Exceeds Non-Residential RRS with DAF of 1 (excluding arsenic)
- Sample Not Analyzed
- Approximate Remediation Area

UNITED CONSULTING

Figure Scale

N

0 5 10 20 30

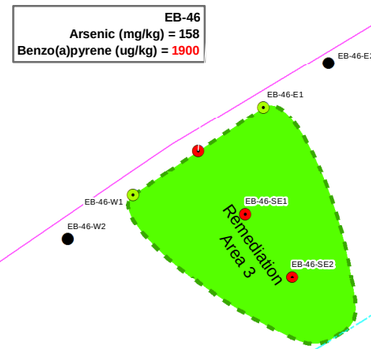
1 inch = 10 feet

Prepared:	MJF
Checked:	RCG
Date:	3/27/2019

Title:	Remediation Area 2 (EB-44 Area)
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 4

NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.



Legend

Utility Layer

- Underground Telephone Line
- Property Boundary
- Approximate GDOT Fiber

Stepout Borings (Results for Non-As COCs)

- Below Non-Residential RRS with DAF of 1 (excluding arsenic)
- Exceeds Non-Residential RRS with DAF of 1 (excluding arsenic)
- Sample Not Analyzed
- Approximate Remediation Area

UNITED CONSULTING

Figure Scale

N

0 5 10 20 30

1 inch = 10 feet

Prepared:	MJF
Checked:	RCG
Date:	3/27/2019

Title:	Remediation Area 3 (EB-46 Area)
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 5

NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.

EB-59
Arsenic (mg/kg) = 297
Benzene (ug/kg) = 730

EB-59-W1 EB-59-E1 EB-59-E2
EB-59-W2
EB-59-S1
EB-59-S2
Remediation Area 5

EB-57
Arsenic (mg/kg) = 27.8
Benzo(a)pyrene (ug/kg) = 1900

EB-57-W2 EB-57-W1 EB-57-E1 EB-57-E2
EB-57-S1
EB-57-S2
Remediation Area 4

Legend

Utility Layer
- Underground Telephone Line
- Property Boundary
- Approximate GDOT Fiber

Stepout Borings (Results for Non-As COCs)
- Below Non-Residential RRS with DAF of 1 (excluding arsenic)
- Exceeds Non-Residential RRS with DAF of 1 (excluding arsenic)
- Sample Not Analyzed
- Approximate Remediation Area

UNITED CONSULTING

Figure Scale

N

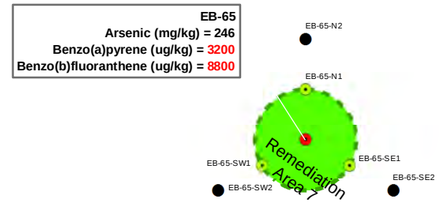
0 10 20 40 60

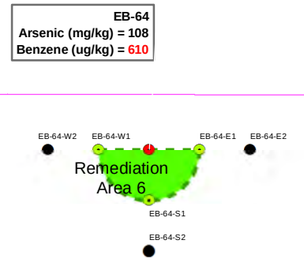
1 inch = 20 feet

Prepared:	MJF
Checked:	RCG
Date:	3/27/2019
Title:	Remediation Areas 4/5 (EB-57/59 Areas)
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 6

NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.





Legend

Utility Layer

- Underground Telephone Line
- Property Boundary
- Approximate GDOT Fiber

Stepout Borings (Results for Non-As COCs)

- Below Non-Residential RRS with DAF of 1 (excluding arsenic)
- Exceeds Non-Residential RRS with DAF of 1 (excluding arsenic)
- Sample Not Analyzed
- Approximate Remediation Area

UNITED CONSULTING

Figure Scale

N

0 7.5 15 30 45

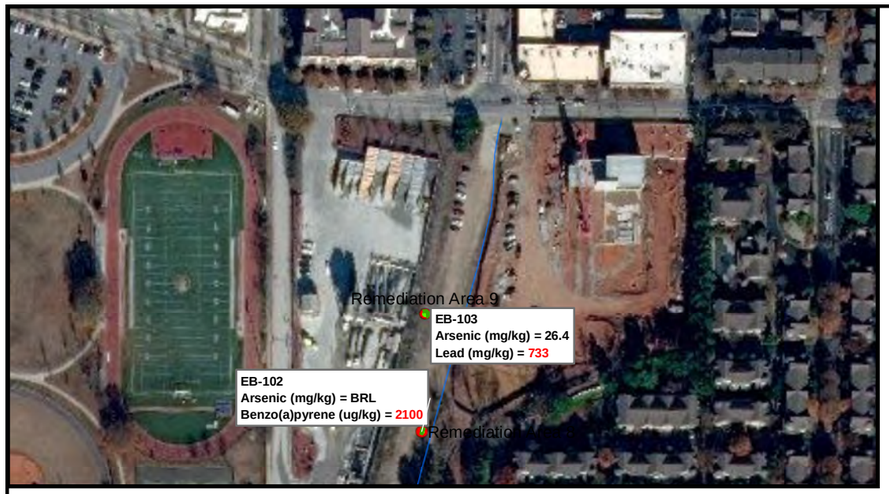
1 inch = 15 feet

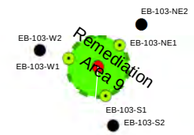
Prepared:	MJF
Checked:	RCG
Date:	3/27/2019

Title:	Remediation Areas 6/7 (EB-64/65 Areas)
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 7

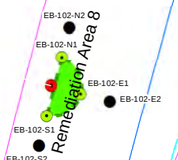
NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.





EB-103
Arsenic (mg/kg) = 26.4
Lead (mg/kg) = 733

EB-102
Arsenic (mg/kg) = BRL
Benzo(a)pyrene (ug/kg) = 2100



Legend

Utility Layer
- Underground Telephone Line
- Property Boundary
- Approximate GDOT Fiber

Stepout Borings (Results for Non-As COCs)
- Below Non-Residential RRS with DAF of 1 (excluding arsenic)
- Exceeds Non-Residential RRS with DAF of 1 (excluding arsenic)
- Sample Not Analyzed
- Approximate Remediation Area

UNITED CONSULTING

Figure Scale

N

0 7.5 15 30 45

1 inch = 25 feet

Prepared:	MJF
Checked:	RCG
Date:	3/27/2019

Title:	Remediation Areas 8/9 (EB-102/103 Areas)
Project:	Atlanta Beltline Southside Trail
Project No.	KMHRN-17-GA-01191-02
Client:	Kimley Horn

Figure 8

NOTE: All utility locations are approximate and actual locations are unknown. United Consulting not responsible for damage to utilities.

Table 1 - Summary of Step-Out Analytical Results - Detections Only

Remediation Area Designation	Sample ID:	Date Collected	RCRA 8 Metals (mg/kg)		VOCs (ug/kg)	SVOCs (ug/kg)	
			Arsenic	Lead	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthene
		Notification Concentration	41	400	20	1,640	5,000
	Highlighted cell indicates value greater than RRS	Non-Residential RRS*	38	400	500	1,640	5,000
		Type 4 RRS*	63	-	-	-	-
			-	-	-	-	-
1	EB-25 (0-2)	6/6/2018	**208**	57.5	**1500**	BRL	**960**
	EB-25R (2.5-3)	3/8/2019	4.63	NA	BRL	NA	NA
	EB-25-N1 (0-1)	3/8/2019	**185**	NA	BRL	NA	NA
	EB-25-N2 (0-1)	3/8/2019	**57.6**	NA	NA	NA	NA
	EB-25-SW1 (0-1)	3/8/2019	**39.7**	NA	BRL	NA	NA
	EB-25-SW2 (0-1)	3/8/2019	**96**	NA	NA	NA	NA
	EB-25-E1 (0-1)	3/8/2019	**260**	NA	BRL	NA	NA
	EB-25-E2 (0-1)	3/8/2019	**126**	NA	NA	NA	NA
2	EB-44 (0-2)	6/1/2018	**144**	108	BRL	**8400**	**18000**
	EB-44R (2.5-3)	3/8/2019	Not sampled due to groundwater @ 2'				
	EB-44-NW1 (0-1)	3/8/2019	**107**	NA	NA	BRL	BRL
	EB-44-NW2 (0-1)	3/8/2019	**109**	NA	NA	NA	NA
	EB-44-S1 (0-1)	3/8/2019	**91**	NA	NA	BRL	510
	EB-44-S2 (0-1)	3/8/2019	24.3	NA	NA	NA	NA
	EB-44-E1 (0-1)	3/8/2019	**213**	NA	NA	BRL	BRL
	EB-44-E2 (0-1)	3/8/2019	**71.3**	NA	NA	NA	NA
3	EB-46 (0-2)	6/1/2018	**158**	132	BRL	**1900**	2900
	EB-46R (2.5-3)	3/11/2019	BRL	NA	NA	BRL	NA
	EB-46-SE1 (0-2)	3/11/2019	**55.1**	NA	NA	**2500**	NA
	EB-46-SE2 (0-1)	3/11/2019	40.7	NA	NA	**12000**	NA
	EB-46-W1 (0-1)	3/11/2019	**51.1**	NA	NA	BRL	NA
	EB-46-W2 (0-1)	3/11/2019	**54.8**	NA	NA	NA	NA
	EB-46-E1 (0-1)	3/11/2019	19.5	NA	NA	BRL	NA
4	EB-57 (0-2)	6/4/2018	27.8	315	BRL	**1900**	2300
	EB-57R (2.5-3)	3/7/2019	NA	NA	NA	BRL	NA
	EB-57-W1 (0-1)	3/7/2019	NA	NA	NA	BRL	NA
	EB-57-E1 (0-1)	3/7/2019	NA	NA	NA	**2000**	NA
	EB-57-E2 (0-1)	3/7/2019	NA	NA	NA	930	NA
	EB-57-S1 (0-1)	3/7/2019	NA	NA	NA	**3600**	NA
	EB-57-S2 (0-1)	3/7/2019	NA	NA	NA	**860**	NA
5	EB-59 (0-2)	6/7/2018	**297**	132	**730**	BRL	600
	EB-59R (2.5-3)	3/6/2019	BRL (BRL Duplicate 4)	NA	BRL (BRL Duplicate 4)	NA	NA
	EB-59-S1 (0-2)	3/6/2019	2.73	NA	BRL	NA	NA
	EB-59-W1 (0-0.5)	3/6/2019	**304**	NA	BRL	NA	NA
	EB-59-W2 (0-2)	3/6/2019	**98.5**	NA	NA	NA	NA
	EB-59-E1 (0-2)	3/6/2019	**142**	NA	BRL	NA	NA
	EB-59-E2 (0-2)	3/6/2019	BRL	NA	NA	NA	NA
6	EB-64 (0-2)	5/31/2018	**108**	73.5	**610**	BRL	BRL
	EB-64R (2.5-3)	3/6/2019	BRL (BRL Duplicate 3)	NA	BRL	NA	NA
	EB-64-E1 (0-1)	3/6/2019	34.9	NA	BRL	NA	NA
	EB-64-W1 (0-1)	3/6/2019	**199**	NA	BRL	NA	NA
	EB-64-W2 (0-1)	3/6/2019	**69.2**	NA	NA	NA	NA
	EB-64-S1 (0-1)	3/6/2019	14	NA	BRL	NA	NA
7	EB-65 (0-2)	5/31/2018	**246**	131	BRL	**3200**	**8800**
	EB-65R (2.5-3)	3/6/2019	BRL	NA	NA	BRL	BRL
	EB-65-N1 (0-2)	3/6/2019	21.9	NA	NA	BRL (BRL Duplicate 2)	460 (470 Duplicate 2)
	EB-65-SE1 (0-2)	3/6/2019	**246**	NA	NA	BRL	730
	EB-65-SE2 (0-2)	3/6/2019	**41.6**	NA	NA	NA	NA
	EB-65-SW1 (0-2)	3/6/2019	**198**	NA	NA	BRL	610
	EB-65-SW2 (0-2)	3/6/2019	10.3	NA	NA	NA	NA
8	EB-102 (0-2)	6/13/2018	BRL	11.8	BRL	**2100**	4500
	EB-102R (2.5-3)	3/6/2019	NA	NA	NA	BRL	NA
	EB-102-S1 (0-1)	3/6/2019	NA	NA	NA	650	NA
	EB-102-N1 (0-1)	3/6/2019	NA	NA	NA	410	NA
	EB-102-S1 (0-1)	3/6/2019	NA	NA	NA	1200	NA
9	EB-103 (0-2)	6/14/2018	26.4	**733**	BRL	770	1900
	EB-103R (2.5-3)	3/6/2019	NA	12.5	NA	NA	NA
	EB-103-N1 (0-2)	3/6/2019	NA	129	NA	NA	NA
	EB-103-S1 (0-2)	3/6/2019	NA	77.4 (63.1 Duplicate 1)	NA	NA	NA
	EB-103-W1 (0-2)	3/6/2019	NA	45	NA	NA	NA

NOTES:

Volatile Organic Compounds (VOCs) and Semi-VOCs reported in micrograms per kilogram (ug/kg)

Resource Conservation and Recovery Act 8 metals (RCRA 8 Metals) reported in milligrams per kilogram (mg/kg)

RRS is Georgia Environmental Protection Division (EPD) Risk Reduction Standard

Sample collection depth is shown in parenthesis following sample ID

*Non-Residential RRS and Type 4 RRS obtained from CAP Amendment 2 Approval Letter, from column titled DAF of 1 Selected Nonresidential, and Type 5, respectively

LEGEND

	Indicates detection greater than the applicable non-residential RRS
	Indicates detection greater than the applicable Type 4 RRS
BOLD	Indicates detection exceeds Georgia EPD Notification Concentration
BRL	Below laboratory reporting limit
NA	Not Analyzed

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of 1	3. Emergency Response Phone	4. Waste Tracking Number
		404-477-3437	201905

GENERATOR

5. Generator's Name and Mailing Address: Atlanta Beltline, Inc.

Generator's Site Address (if different than mailing address): Atlanta Beltline, Inc. Former CSX Rail Spur, SW Atlanta, GA 30331

Generator's Phone:

11017-306

6. Transporter 1 Company Name: Pinnacle Roll Off Systems — U.S. EPA ID Number

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address: Eagle Point Landfill, 4880 Old Federal Road, Ball Ground, GA 30107 — U.S. EPA ID Number

770-781-2721

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Non-Regulated Soil Approval # AEP 19022 (acct: 11291)	01	DT	15	TN
2.					
3.					
4.					

13. Special Handling Instructions and Additional Information

14. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurat... marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international a...

Generator's/Offeror's Printed/Typed Name: Kevin Burke as agent — Signature

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Po...

Transporter Signature (for exports only): Da...

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name — Signature

Transporter 2 Printed/Typed Name — Signature

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Resid...

Manifest Ref...

17b. Alternate Facility (or Generator)

Facility's Phone:

17c. Signature of Alternate Facility (or Generator)

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item...

Printed/Typed Name — Signature

Eagle Point Landfill
4880 Old Federal Road
Ball Ground, GA 30107

Weighmaster: [illegible]

Ticket #: [illegible]

Date In/Out:
07-May-2019 10:15 am
07-May-2019 10:33 am

Customer: [illegible]

Contract: [illegible]

Gross Weight: [illegible]
Tare Weight: [illegible]
Net Weight: [illegible]

Ref: [illegible]

Vehicle: [illegible]

INVOICE
[illegible]

Qty Unit Description Rate Tax Total
[illegible]

Tax Amount

Charge Amount

169-BLC-O 5 11977 (Rev. 9/09)

...PY

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number

2. Page 1 of 1

3. Emergency Response Phone: 404-477-3637

4. Waste Tracking Number: 201905

5. Generator's Name and Mailing Address: Atlanta Beltline, Inc.

Generator's Site Address (if different than mailing address): Atlanta Beltline, Inc. Former CSX Rail Spur, SW Atlanta, GA 30351

1618204

Generator's Phone:

6. Transporter 1 Company Name: Pinnacle Roll Off Systems — U.S. EPA ID Number:

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address: Eagle Point Landfill, 8880 Old Federal Road, Ball Ground, GA 30107 — U.S. EPA ID Number:

Facility's Phone: 770-781-2721

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non-Regulated Soil Approval # AEP 19022 (acct: 11291)	01	DT	15	TN
2. N286			17.75	
3. Newsome Trucking				
4. 706-479-108[illegible]				

13. Special Handling Instructions and Additional Information

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this [...] marked and labeled/placarded, and are in all respects in proper condition for transport acco[...] and are classified, packaged,

Generator's/Offeror's Printed/Typed Name: Kevin Burke as agent — Month 5 Day 6 Year 19

15. International Shipments ☐ Import to U.S. ☐

Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Bill Sires — Month 5 Day 10 Year 19

Transporter 2 Printed/Typed Name — Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Full Rejection

17b. Alternate Facility (or Generator)

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

Eagle Point Landfill
8880 Old Federal Road
Ball Ground, GA 30107

Weighmaster: [illegible]
Ticket #: [illegible]

Date In/Out:
10-May-2019 11:52 am
10-May-2019 12:06 pm

Customer: [illegible]
[illegible] / ATLANTA

Contract: [illegible] ATLANTA BELTLINE [illegible]

Gross Weight: 60,[illegible].00 lb
Tare Weight: 25,[illegible].00 lb
Net Weight: 35,500.00 lb — 17.75 TN

Ref: 201905
Vehicle: N286

INVOICE
[illegible]

Qty	Unit Description	Rate	Tax	Total
17.75	TN [illegible]			

Net Amount:

Change due:

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifes[t except as noted] in item 17a

Printed/Typed Name: [signature] — Signature: [signature] — Month 5 Day 10 Year 19

169-BLC-O 5 11977 (Rev. 9/09)

DESIGNATED FACILITY'S COPY

1618 ton

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number | 2. Page 1 of | 3. Emergency Response Phone | 4. Waste Tracking Number

5. Generator's Name and Mailing Address: Atlanta Beltline, Inc.

Generator's Site Address (if different than mailing address): Atlanta Beltline, Inc. Former CSX Rail Spur, SW Atlanta, GA 30351

Generator's Phone:

6. Transporter 1 Company Name: Pinnacle Roll Off Systems — U.S. EPA ID Number

7. Transporter 2 Company Name: P303 — U.S. EPA ID Number

8. Designated Facility Name and Site Address: Eagle Point Landfill, 3880 Old Federal Road, Ball Ground, GA 30107 — U.S. EPA ID Number

770-781-2721

Facility's Phone:

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1	Non-Regulated Soil Approval # AEP 19022 (acct: 11291)	01	DT	15	TN
2.					
3.					
4.					

15.14

13. Special Handling Instructions and Additional Information

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully an... marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable inter... — aged,

Generator's/Offeror's Printed/Typed Name: Kevin Burke as agent — Signature — Year: 19

15. International Shipments ☐ Import to U.S. ☐ Export from U.S.

Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name — Signature — Year

Transporter 2 Printed/Typed Name — Signature — Year

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ R... — Manifest

17b. Alternate Facility (or Generator)

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item...

Printed/Typed Name: R. Ingold — Signature — Month: 05 — Day: 13 — Year: 19

Eagle Point Landfill
3880 Old Federal Road
Ball Ground, GA 30107

15.14 TN

GENERATOR | INT'L | TRANSPORTER | DESIGNATED FACILITY

F5 – PLANNED CORRECTIVE ACTIONS FOR SST

In accordance with CAP Amendment #2 and based on the approach applied along the Eastside Trail and Northeast Corridor, a site-specific corrective action approach has been developed for the SST. The planned site-specific corrective action approach follows. Please note, as presented in Attachment F4, non-arsenic soil impact concentrations above the Type 3 non-residential Risk Reduction Standards (RRS) have already been addressed at nine of the twelve requiring remediation, as possible. Such process was verbally discussed with and approved by Brownfield staff before it was implemented.

- Through the Phase II/Initial BSCS and Additional Phase II as summarized in Attachment F1, there were twelve borings locations across the SST with non-arsenic constituents of concern (COCs) with concentrations above the non-residential RRS. The constituent detections and their associated non-residential 3 RRS are included in Table 4 in attachment F3.

- At each of the twelve borings locations with non-arsenic COCs with concentrations above the non-residential RRS, pre-excavation delineation sampling will be performed in accordance with the BeltLine Corrective Action Plan (CAP), as amended. This will include the minimum safe buffer distance of 5-feet from utilities.

- Once the non-arsenic COCs impact areas are delineated, as possible, these areas will be excavated and the materials disposed of under manifest in an appropriately regulated landfill, based on laboratory analysis. The final limits of the removals will be based upon the pre-excavation delineation sampling results, utility locations, property lines, and depths to groundwater.

- In the event that utilities causing limitations for the removals of soils impacted with non-arsenic COCs at concentrations above the non-residential RRS are removed, additional remediation and pre- or post-excavation confirmation sampling will be performed. In this instance, the sampling would be for the same constituent(s) with the RRS exceedance(s).

- Across the SST, there are 56 boring locations with arsenic with concentrations above the non-residential RRS of 38 milligrams per kilogram (mg/Kg). An attempt will be made to delineate the arsenic impacts to below the 38 mg/Kg threshold. The delineation will be conducted to:

    - The extent that the percent complete construction plans (for the final trail) show a minimum of 1-foot of materials (i.e. fill or concrete) will be placed to meet final grades. A typical cross-section of this process is depicted on the attached figure (Figure D.7.10), which is a reproduction from Attachment D.7 of Appendix D to CAP Amendment #2;

    - If that the above is not possible in an area, delineation sampling will include two iterations of borings (two step outs of three borings each, with the step outs being approximately 5-feet apart), as well as a vertical delineation boring as outlined in the BeltLine CAP, as amended;

    - If the above delineation sampling is not successful, remediation would include excavation to a maximum of 10-feet laterally from the last boring with arsenic

concentrations above 38 mg/Kg. Vertical excavation will only be conducted to the depth to allow for a minimum of 1 foot of material (i.e. fill or concrete) to be placed on top of the excavation to meet final grades.

- Once the arsenic impact areas are delineated to 38 mg/Kg, as possible, these areas will be excavated and the materials disposed of under manifest in an appropriately regulated landfill, based on laboratory analysis. The final limits of the removals will be based upon the pre-excavation delineation sampling results, construction plans, utility locations, property lines, and depths to groundwater.

- Depending on the timing of the non-arsenic and/or arsenic remedial actions, each remediated area may be backfilled with quarry stone (such as graded aggregate base, or other stone), or other appropriate materials that have been demonstrated to be in compliance with the non-residential RRS.

- The final trail design is in various stages of completion, with the final design and construction controlled by funding. Generally, the SST construction will include the installation of retaining structures along the sides of the corridor and at certain roadways followed by grading to establish a generally level surface as designed for the construction of the approximate 14-foot wide concrete trail. A utility vault will be installed along the trail alignment at an approximate depth of 2 feet. The first segment currently planned for construction is Segment 1, approximately from stations STA 100+31 to 146+00.

- Following the above non-arsenic and arsenic remedial actions, as possible, the site work for the construction of the final trail will be conducted in accordance with a soil and groundwater management plan. At a minimum, this plan will outline protocols for managing the known environmental conditions and for addressing potential unforeseen conditions. This will include management options for both soil export potentially leaving the corridor to facilitate construction, and soil import if needed.

- Following grading of a sufficient acreage for the construction of the final trail, the available 0.5-acre sampling areas per the Type 5 RRS will be evaluated using the 5-point composite sampling methodology. This sampling will be conducted before the final landscaping is installed. Since arsenic is the only identified COC that will be remaining at that time, the composite soil samples will be analyzed for arsenic only.

- As described in detail in the previous Type 5 Arsenic Exposure Assessment (see Attachment D.4 of the Appendix D to CAP Amendment #2) the sampling areas or sub-areas which exceed the statistically determined exposure point concentration of no greater than the target concentration of 63 mg/Kg of arsenic as a default will be excavated and disposed of under manifest in an appropriately regulated landfill, based on laboratory analysis. A typical schematic of this process is depicted on the attached figure (Figure D.7.11), which is a reproduction from Attachment D.7 of Appendix D to CAP Amendment #2.

- Once Segment 1 of the SST is constructed and the Type 5 RRS sampling is complete and demonstrated to be in compliance, an Interim Prospective Purchaser Compliance Status Report (PPCSR) will need to be submitted. Additional Interim PPCSRs will be submitted for the SST, as the construction is completed.

- An Environmental Covenant was previously drafted for the entire BeltLine corridor. This Environmental Covenant has not yet been filed. The filing of such would not be completed until after the entire BeltLine is constructed in the distant future. Until such time as a final environmental covenant is drafted, interim corrective measures along the SST will be maintained through a Monitoring and Maintenance Plan (MMP) that may be amended as redevelopment progress. This MMP will later be submitted to the Brownfield Program.

Supporting Attachments

Figure D.7.10 Typical Cross-Section of Arsenic Impacted Soil Condition
Figure D.7.11 Typical Plan View & Cross-Section of Soil Barrier

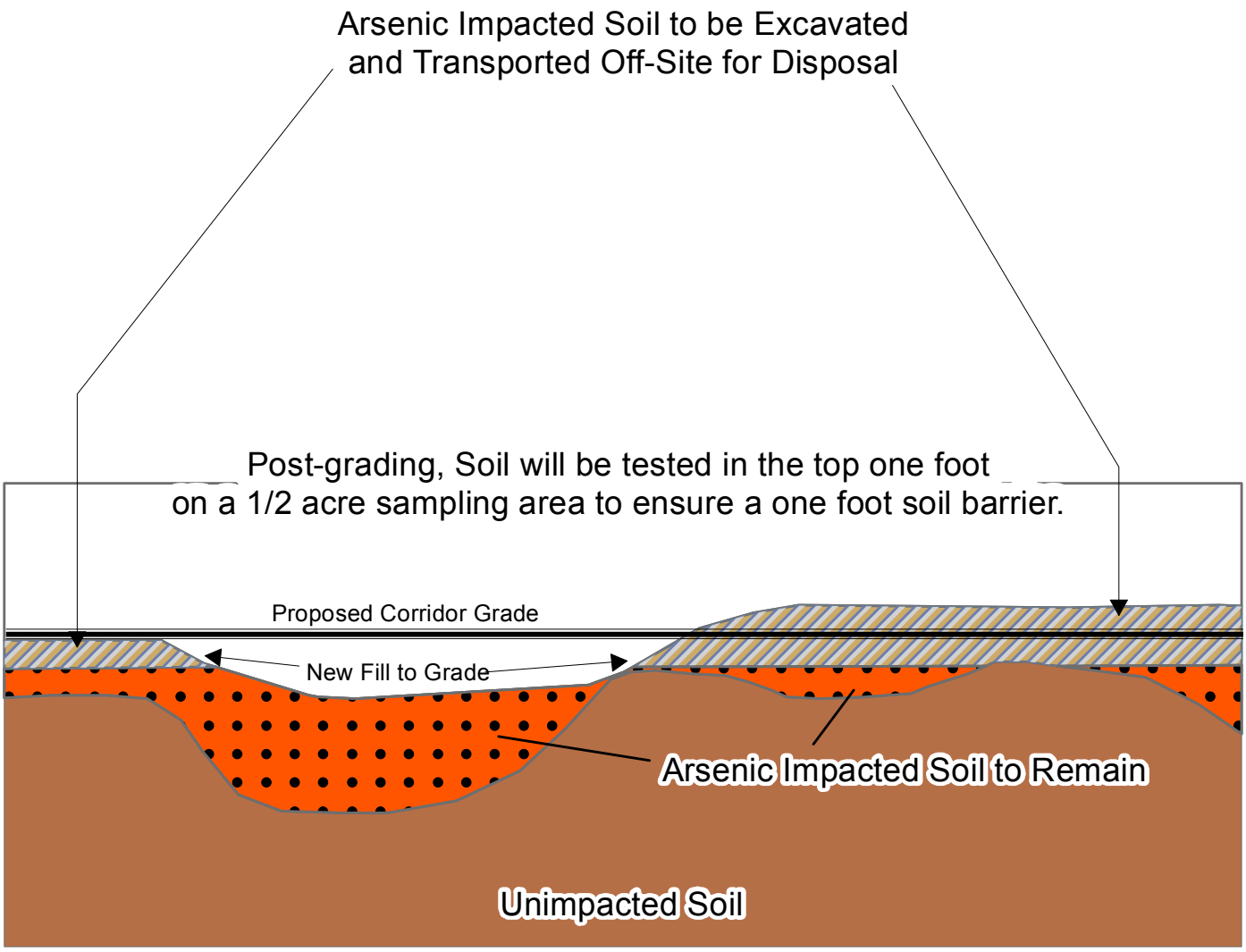


IMAGE IS NOT TO SCALE

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Atlanta BeltLine

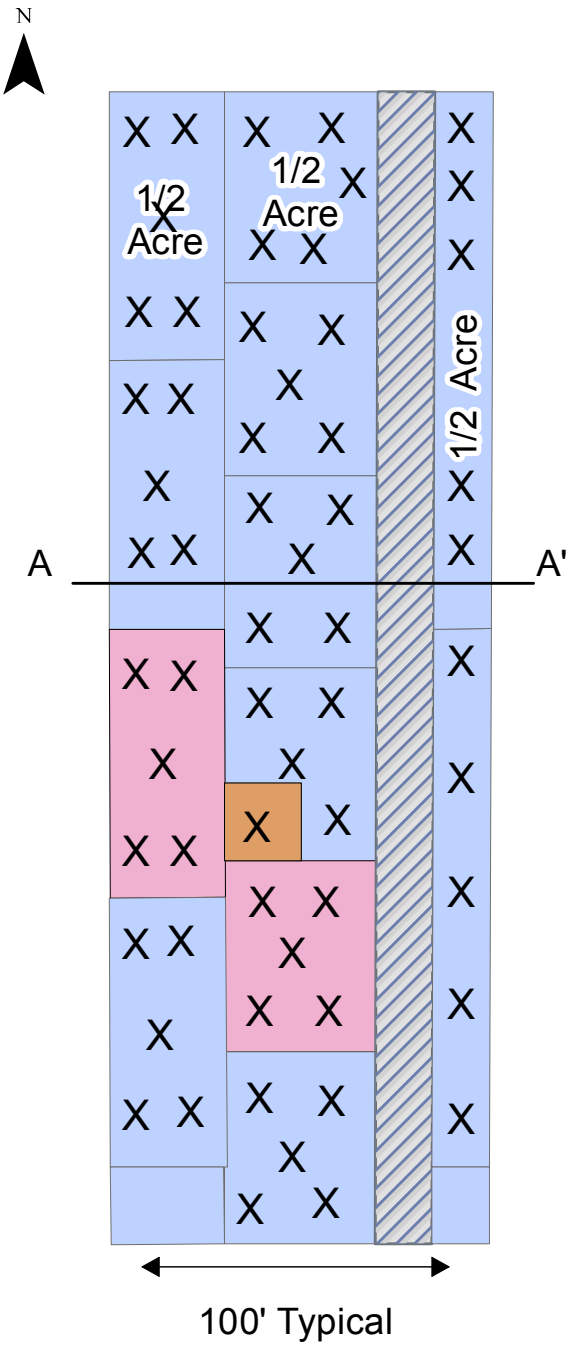
amec foster wheeler

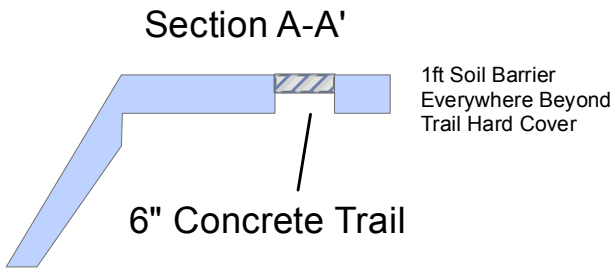
Typical Cross-Section of Arsenic Impacted Soil Condition

Atlanta Beltline - NE Corridor

JOB NO. 6121130277-0279

Figure D.7.10





IMAGES ARE NOT TO SCALE

Legend

- Concrete Trail
- Typical 1/2 Acre Soil Barrier Sampling Area
- X — Random Selected Locations for 5 Point Composite Samples Per 1/2 Acre Sampling Area
- Soil Barrier Replaced by Clean Soil Based on Results of Composite Samples on a Full 1/2 Acre
- Soil Barrier Replaced on Only Part of 1/2 Acre Sampling Area Based on Testing of Point Samples

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Typical Plan View & Cross-Section of Soil Barrier

Atlanta Beltline -NE-Corridor

JOB NO. 6121130277-0279

Figure D.7.11

APPENDIX B

QAPP, dated June 24, 2021

A1.0 TITLE AND APPROVAL PAGE

Site Specific
Quality Assurance Project Plan

Atlanta BeltLine – Southside Trail
Segments 2, 3, and 4/5
Submittal Date: June 24, 2021

EPA Brownfield Cooperative Agreement
Recipient No. BF 01D11520

Prepared by
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625 Holcomb Bridge Road
Norcross, Georgia 30071

Prepared for:
Atlanta BeltLine, Inc.
100 Peachtree Street NW, Suite 2300
Atlanta, Georgia 30303

Approvals Signatures:

June 24 2021
Spencer C. Cox Date
United Project Manager

June 24 2021
Russell C. Griebel, P.G. Date
United Program Manager

June 24 2021
Scott D. Smelter Date
United Quality Assurance/Control Manager

Camilla Warren Date
US EPA Designated Approving Official/Project Officer

Shannon Ridley Date
Georgia EPD Brownfield Program Manager

A2.0 TABLE OF CONTENTS

APPENDICES

A3.0 DISTRIBUTION LIST

The following individuals will/may receive copies of the approved Quality Assurance Project Plan (QAPP) and any subsequent revisions or amendments:

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This distribution list should be updated, as the project evolves to include any future persons responsible for project implementation.

A4.0 PROJECT/TASK ORGANIZATION

The project team for the Atlanta BeltLine includes the following agencies/companies, associated representatives, and their roles and responsibilities. United Consulting has been assisting Atlanta BeltLine, Inc. (ABI), Invest Atlanta (IA) and the City of Atlanta (COA) in developing the environmental remedial approach of the site. United Consulting has been assisting in the preparation of documents associated with the grant management under the Environmental Protection Agency (EPA) Cleanup Cooperative Agreement Grant Number: BF 01D11520.

A checklist of the required content references and locations within this document is provided in Appendix A. The Quality Assurance Project Organization Chart is provided in Appendix B and a summary of the project participants and their specific roles and responsibilities are provided below:

Camilla Warren – USEPA Brownfields Region 4 Quality Assurance Manager's Designated Approving Official: The Brownfields Region 4 Quality Assurance Manager's Designated Approving Official (DAO) provides a technical assistance role to the Region 4 Project Officer/Manager working on Brownfield sites. The DAO's role is to provide technical review of the QAPP, and other related documents that are generated. This includes the approval of this Site Specific QAPP, any addenda QAPPs, respectively and any revisions.

Shannon Ridley – GAEPD Brownfields Unit Manager: The EPD Unit Manager provides technical and compliance review of the work plan (herein referenced to as Appendix F to Corrective Action Plan Amendment #2, June 7, 2019) that is the basis for the development of this QAPP. The Unit Manager is involved with all facets of the Project from application, through assessment, clean up and on-going compliance in accordance with the Georgia Brownfield Act.

Brandon Sharp – United Consulting's Field Team Leader: The Field Team Leader will perform the following duties:

- Oversee the field team activities;
- Coordinate the field activities and laboratory analyses;
- Conduct the field activities per the approved QAPP, including QAPP Addenda, and supervise the field sampling team;
- Distribute the approved QAPP, including QAPP Addendum or Addenda, to the field sampling team;
- Report problems encountered in the field to the Project Manager;
- Implement corrective action(s) in the field, as directed by the Project Manager;
- Document corrective action(s) in the field logbook to be provided to the Project Manager;
- Communicate corrective action(s) to the Laboratory Project Manager to remedy problems encountered during the analytical analyses;
- Review and validate data; and,
- Prepare reports.

Spencer Cox – United Consulting Project Manager: The Project Manager will be the primary decision maker for the project. He will be the primary user of the collected data to determine if further action is necessary to meet the project's objectives. The Project Manager's specific responsibilities are to:

- Approve the QAPP and subsequent revisions, as required to meet project requirements;
- Distribute the QAPP, including QAPP Addendum or Addenda, to members of project team;
- Overall responsibility of the cleanup project;
- Oversee project activities in accordance with the QAPP and Design;
- Validate field data;
- Report to the EPD, the EPA Brownfields Project Manager, ABI, the COA, and IA regarding the project status and assisting ABI in their preparation of public notices related to the cleanup activities;
- Make project decisions with the authority to allocate necessary resources to complete the project;
- Communicate corrective action(s) to the Field Team Leader to remedy problems encountered during the field activities;
- Compile documentation detailing corrective action(s) and provide to the QA/QC Officer and other team members, as appropriate; and,
- Assist in contractor audits relative to Davis-Bacon Act compliance.

Russell C. Griebel, P.G. – United Consulting Program Manager: The Program Manger will be responsible for overall quality on the project, support of the Project Manager in all tasks referenced above, and will focus on interaction between ABI, COA, EPA and EPD. He will also be responsible for final internal review and approval of the QAPP documents, internal QA audits, and QC implementation of the Brownfields projects.

Scott D. Smelter – United Consulting Principal/Quality Assurance/Control (QA/QC) Officer: The Project Principal is responsible for the project's technical quality and accuracy. Mr. Smelter is United Consulting's Project Principal for this project. Mr. Smelter's responsibilities are to assure that the scope, organization, and schedule for each task will meet the project's quality standards. The QA/QC Officer will remain independent of the team members/groups responsible for data generation and will provide QA/QC technical assistance to the Project Manager. The QA/QC Officer will be responsible for internal review and approval of the QAPP.

Luke Von Oldenburg, CIH – United Consulting's Health and Safety Officer: The Health and Safety Officer will perform analysis of health and safety issues, including preparation of site-specific health and safety plans (HASPs) for each assignment by United Consulting. This officer all also be responsible for review of other contractors HASPs to ensure they meet site-specific project requirements. A Site Health and Safety Officer (SHSO), generally the Site Manager/Field Team Leader, will be designated from the work crew assigned to each site, and will serve as the on-site resource for health and safety issues or concerns and administering the site specific HASP. Mr. Von Oldenburg will assist and advise the United Consulting team as necessary.

United Consulting Staff – Field Team Members: The Field Team Members will perform field activities per the QAPP, including QAPP Addendum or Addenda, and at the direction of the Field Team Leader and Principal.

Remediation Contractor – ABI is in the process of retaining a remediation contractor for the soil remedial actions that will be performed under the Grant. The remediation contractor will have an appointed representative. The representative will perform the following duties:

- Provide continual oversight of soil remediation activities to ensure compliance with the Cleanup Work Plan and QAPP;
- Follow all Federal and project specific Health and Safety requirements in accordance with the Cleanup Work Plan and QAPP;
- Upon receipt from the United Consulting Project Manager, make available the approved QAPP documents and subsequent revisions to the members of the remediation team;
- Report any remediation activity problems to the United Consulting Field Team Leader and Project Manager;
- Implement corrective actions in the field as directed by the United Consulting Project Manager; and,
- Corrective actions will be documented in the field logs and provided to the United Consulting Project Manager.

Ioana Pacurar – AES Laboratory Director: – The Laboratory Director is responsible for the following:

- Coordinating the analysis of the samples and the laboratory validation of the data;
- Coordinating the receipt of the samples at the laboratory, selecting the analytical team, ensuring internal laboratory audits are conducted per the Laboratory's Quality Assurance Manual (QAM) (Appendix E), and distributing the applicable sections of the QAPP and subsequent revisions to members of the analytical team; and,
- Instituting corrective actions for problems encountered in the chemical analyses and reporting laboratory problems affecting the project data to the United Consulting Project Manager and United Consulting QA/QC Reviewer. Corrective actions for chemical analyses will be detailed in a QA report that will be provided via electronic and conventional mail.

A5.0 PROBLEM DEFINITION/BACKGROUND

The project will be administered on behalf of Invest Atlanta by Atlanta BeltLine, Inc. (ABI). Awarding of the grant is funding remediation of contaminated soil throughout the property (herein referred to as the "Subject Property" or the "Site"). The development of this QAPP and other documents (i.e. ABCA and SMP) associated with the awarded grant process are being paid for by ABI outside of the grant.

A5.1 Site Description

The Atlanta BeltLine – Southside Trail runs along an abandoned railroad corridor generally starting just west of the I-75/I-85 Downtown Connector (Pittsburgh Yards) and extending approximately 1.9-miles east to Boulevard SE in Atlanta, Georgia (herein referred to as Segments 2 and 3). As an add alternate, the project may include the Boulevard SE to Glenwood Avenue SE interim trail portion (herein referred to as Segment 4/5) if scope and budget allows once bids are received from the remediation contractor. The overall segments vary in width, with an average of approximately 100 feet. The site covers a total of approximately 24-acres and is currently undeveloped with the exception of a railroad bed, which runs the length of the Subject Property; the rail infrastructure (with the exception of bridges) had been removed since 2019. City right-of-ways cross the rail corridor at-grade, as well as above and below corridor grade. The general location of the site and each segment is illustrated on Figure 1.

A5.2 Site History

The first development of the BeltLine area began in the late 1800s when the Atlanta & West Point Railroad began construction of a 5-mile connecting rail line from its northern terminus at Oakland City to Hulsey Yard on the Georgia Railroad which encompasses the southeastern quarter of the overall BeltLine. Following completion of the overall system in 1902, the rail line operated until its decline and eventual abandonment in 1996.

The railroad corridor passes through residential, commercial, and industrial areas of the city although the surrounding area is now generally developed primarily with commercial and residential properties.

A5.3 Future Use

The Atlanta BeltLine is a comprehensive transportation, economic development, and urban redevelopment effort in the City of Atlanta (COA). The Atlanta BeltLine is envisioned as a combination of greenspace, trails, transit, and new development along 22-miles of freight rail corridor that encircle the urban core of the City of Atlanta. The project is one of the largest efforts underway to remediate and redevelop environmentally impacted properties for the long-term benefit of the community.

The project is an overall economic catalyst for Atlanta, providing access to jobs in communities largely abandoned by the industrial decline that spread along the former freight route. As the Atlanta BeltLine develops the corridor, remediation under the Georgia Brownfield Program is an early step and core component of the construction and redevelopment effort.

A5.4 Previous Environmental Investigations

A5.4.1 Atlanta BeltLine History

The Atlanta BeltLine Southside Trail (SST) has been separated into various segments, with the Subject Property known as the Segment 2, 3, and 4/5. The following summarizes environmental investigations and communications between ABI, various consultants, and the Georgia EPD regarding the overall Atlanta BeltLine project.

An initial Brownfield application was submitted to the EPD in December 2004 for the North Avenue BeltLine Tract in the form of a Brownfield Corrective Action Plan (CAP). Since that time, ABI and the Invest Atlanta (IA) has submitted numerous Amendments to the initial CAP.

In 2010, Atlanta BeltLine, Inc. (ABI) and the Atlanta Development Authority (ADA) submitted an Amendment to the Brownfield Corrective Action Plan to consolidate separate CAPs into a single revised CAP under the name Atlanta BeltLine Properties. In addition, parcels were added to incorporate them as part of the Atlanta BeltLine Properties under the approved Brownfield CAP. The EPD subsequently provided a letter approving the requested Amendment and acknowledging that additional parcels will be incorporated into the Atlanta BeltLine Properties CAP as property acquisitions and developments proceed.

As described in the approved 2010 CAP Amendment (#1), areas which warrant corrective action will require confirmation soil sampling to further define the limits of impacted soil on the Subject Property that exceed the applicable soil Risk Reduction Standards (RRS). Soil areas that exceed the RRS will then be subject to further corrective action in order to bring the site into compliance with the approved CAP. Since future use of the Atlanta BeltLine Properties is a linear system of trails, transit, and green space, the primary intent of the applicants is to comply with non-residential soil RRS (Type 3 or 4). Where feasible, compliance with residential soil RRS (Type 1 or 2) is an optional goal. Where compliance with Type 1-4 soil RRS is technically impracticable, remedial action consistent with a Type 5 RRS approach will be executed.

In late 2010, MACTEC (now part of Wood PLC) completed a Phase I Environmental Site Assessment on the Atlanta BeltLine Corridor from Simpson Road to DeKalb Avenue in Atlanta, Fulton and DeKalb County, Georgia, which includes the Subject Property. MACTEC concluded that, in addition to the general environmental concerns associated with past site use, a number of adjacent properties along the corridor were identified as recognized environmental conditions (RECs) and environmental concerns relative to the Subject Property. MACTEC recommended subsurface sampling and testing along the corridor in the vicinity of the various identified RECs.

In March 2011, CAP Amendment #2 was submitted, which established a procedure whereby EPD will review and approve a site-specific Appendix to the CAP for each segment of the BeltLine. The document also included a presentation of various soil RRS, which were planned for use during the various corrective actions. On April 14, 2011, EPD approved CAP Amendment #2, which included Appendix B for the Eastside Trail Project (10th Street and Monroe Drive south to DeKalb Avenue). The approval letter also approved certain RRS, which included those listed in Section A.2 of that Amendment.

In June 2019, Appendix F to PPCAP Amendment #2 was submitted, specifically related to the SST portion of the Atlanta BeltLine. The purpose of the submittal was to provide EPD with soil and groundwater data for the SST section of the Atlanta BeltLine corridor and to propose the corrective action approach for this trail section. On July 11, 2019, EPD approved this submittal. This document is reproduced in Appendix D of this report.

Arsenic was identified as a non-point source relic from historic pesticide application along the railroad corridor and therefore is exempt as a regulated substance. Although arsenic was considered to be an unregulated substance, ABI chose to give special attention to the arsenic impacts and a Type 5 RRS was developed. Under the developed Type 5 RRS, the use of engineering controls (i.e. exposure barriers) was selected to limit exposure as remediation of the extensive sporadic arsenic impacts was not feasible.

A5.4.2 Recent Sampling Assessments

Thus far, non-arsenic impacted soils across the site have undergone remediation to the extent possible barring the presence of potential utility conflicts. Arsenic impacted soils remain, which are the focus of the remedial actions under this EPA grant. These soils will be addressed in accordance with the May 2010 Addendum to the Brownfield Corrective Action Plan (CAP), as later amended for the site. The CAP was approved by the Georgia Environmental Protection Division (GA EPD) on May 18, 2010. More particularly, the corrective measures for the site are included in the June 7, 2019 Appendix F to PPCAP Amendment #2, which was approved by the GA EPD on July 11, 2019. Measures for implementation of corrective actions is the overall Work Plan for this project.

United Consulting previously completed a Phase II Environmental Assessment/Initial Brownfield Site Characterization Sampling (Phase II/BSCS) on the Subject Property and various other portions of the Southside Trail, in a report dated from September 19, 2018. A total of 105 borings were advanced across the Southside Trail, with one shallow soil sample (generally in the top 2 feet of the soil column) collected from each boring. The soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) 8 Metals, and/or polychlorinated biphenyls (PCBs), depending on boring location. That analysis identified various metals, VOC, and SVOC impacts, depending on location.

Arsenic was detected in various soil samples collected from each Segment. The following boring locations and their associated arsenic detections exceeded the non-residential Risk Reduction Standards (RRSs), which were the focus of delineation: 1) for Segment 2: arsenic at EB-33 through EB-41, and EB-44 through EB-46, 2) for Segment 3: EB-51, EB-53 through EB-56, EB-59, EB-60, EB-62, EB-64, EB-65, EB-69, EB-73, and EB-74, and 3) for Segment 4/5: EB-81 through EB-82, EB-87, EB-88, EB-90 through EB-93, EB-96 through EB-98, EB-101, and EB-104. Areas above that were previously remediated for non-arsenic constituents include: 1) for Segment 2: EB-44 and EB-46, 2) for Segment 3: EB-57, EB-59, EB-64, and EB-65, and 3) for Segment 4/5: EB-102 and EB-103. These non-arsenic remediation areas were generally documented within Appendix F to CAP Amendment #2, dated June 7, 2019.

United Consulting has recently conducted delineation sampling of the arsenic hot spots. Such was conducted following the requirements outlined in the EPD approved CAP, as amended, including Appendix F to Amendment #2. Initially an attempt was made to delineate the arsenic impacts to below the Type 3 RRS of 38 mg/Kg. The delineation was conducted to:

- The extent that the percent complete construction plans (for the final trail) show a minimum of 1-foot of materials (i.e. fill or concrete) will be placed to meet final grades;

- If the above was not possible in an area (conservatively, each area had delineation borings advanced regardless of the above), pre-excavation confirmation/delineation sampling included two iterations of borings (two step-outs of three borings each, with the step outs being approximately 5-feet apart), as well as a vertical delineation boring as outlined in the Atlanta BeltLine CAP, as amended. For this, United Consulting installed approximately 84 soil borings (2 step-outs of 3 borings around each of the 12, plus 1 at center for vertical delineation). Initially, soil samples from each of the inner three step-out borings and the center boring was tested for arsenic. Additional samples were placed on hold, pending the initial step-out testing results. Those additional samples were released as needed. The goal of the sampling program was to define the arsenic impact removal areas prior to the actual remediation activities, as possible. This was to assist with increasing the efficiency of the remediation process. The borings were drilled using hand auger techniques.

- If the above delineation sampling was unsuccessful, remediation will include excavation to a maximum of 10-feet laterally from the last boring with arsenic concentrations above 38 mg/Kg. Vertical excavation will only be conducted to the depth to allow for a minimum of 1 foot of material (i.e. fill or concrete) to be placed on top of the excavation to meet final grades. This was approved in the EPD approved CAP, as amended.

The results of the above delineation activities were documented in three separate delineation reports (Segments 2, 3, and 4/5 separately), dated October 23, 2020. A discussion of those results are further discussed in the Problem Definition - Section 5.6 below. Pertinent information including Tables, Figures, and Exhibits are reproduced as part of this site-specific QAPP.

A5.5 Conceptual Site Model

An evaluation of potential exposure pathways and receptors were previously evaluated by MACTEC. This evaluation included herein has been updated based upon the data collected to date. A conceptual site model of the exposure pathways for the Subject Property is discussed below.

Topography along the corridor is variable and characterized by rolling terrain and moderate to steep hills in the north. Based on a review of the Geology of the Greater Atlanta Region, the Subject Property is underlain by fill soil (soils placed by man) and/or soil derived from the in-place weathering of the igneous and metamorphic rocks that comprise the Piedmont (residual soils). The soils at the Subject Property typically range from clayey silt near ground surface to silty sands with depth. Due to the variety of terrain in which the Subject Property is located, the depth to groundwater varies significantly, from as shallow as near surface up to an estimated 30 feet below ground surface.

Due to long term railroad activity, a railroad bed of varying width is located throughout the length of the Subject Property. Norfolk Southern, the previous operator of the corridor, retained ownership of the railroad track and ties and has completed efforts to remove the track and ties for appropriate off-site recycling. The railroad ballast is generally comprised of gravel that, due to the age of the rail road corridor and lack of maintenance, has been silted in from erosion. Further, ballast material encountered through site sampling to date, in general, has become comingled with surrounding soils and is mostly

indistinguishable with surficial fill soils and recently placed aggregate stone. Based on previous EPD documents, this ballast material is suitable for reuse as backfill and for stabilization stone during site development.

Subsurface site characterization assessments have identified regulated Constituents of Interest (COI) in soil, primarily arsenic, lead, benzene, benzo(a)pyrene, and benzo(b)fluoroanthracene. Non-metal impacts to soil identified on the Subject Property have generally been below non-residential Risk Reduction Standards (RRS). However, soil constituent concentrations in excess of applicable RRS have been identified, primarily arsenic.

Groundwater analytical testing from the 16 temporary monitoring wells between the various segments did not identify groundwater impacts to the Subject Property. Groundwater impacts identified at REC properties appear to be localized, associated with off-site activities, and have not encroached the Subject Property.

Based on the conceptual site model, constituents of interest in soil is the potential exposure pathway for this project. It was concluded that the following exposure pathways are currently incomplete:

- Exposure to COI in surface water and sediment because there are no surface water bodies in the know areas of impacts, and no groundwater impacts have resulted from the releases to soil;
- Exposure to COI in the vapor phase, as VOC impacts are limited and have already been remediated as well as the corridor being open air; and
- Exposure to COI in groundwater, as no COI have been identified in groundwater above a Type 1 RRS.

The possibility of potential exposure to COI in soil in exceedance of residential RRS will be addressed through remediation methods prior to redevelopment under Brownfields Program by ABI, and/or with the implementation of Type 5 engineering and/or institutional controls which have been determined and approved by the EPD.

A5.6 Problem Definition

Under the approved Brownfield CAP, as amended, ABI is required to remediate soil to applicable non-residential RRS. Based on previous clean-up efforts along the Atlanta BeltLine Corridor, which had similar heavy freight rail and adjacent industrial uses, and the above sampling assessments, United Consulting has found numerous areas of arsenic impacted soil that exceed the approved non-residential Type 3 RRS. This included arsenic in the soil samples collected from the surface to two feet bgs in 39 sample locations.

Through the above sampling, following is a summary of the needed remedial areas per segment:

- Segment 2; 12 remedial areas, with an estimated 702 tons of impacted soils requiring removal and landfill disposal.
- Segment 3; 13 remedial areas, with an estimated 418 tons of impacted soils requiring removal and landfill disposal; and

- Segment 4/5; 14 remedial areas, with an estimated 342 tons of impacted soils requiring removal and landfill disposal.

The locations and limits of the remedial areas in accordance with the EPD approved CAP, as amended, are generally noted on Figure 2 and illustrated in detail on Exhibits 1 through 39. There are 39 remedial areas, with an estimated total tonnage of 1,462 tons.

Non-arsenic impacted areas were also previously identified and subsequently remediated to the extent possible in accordance with the CAP.

Arsenic cannot be destroyed in the environment; it can only change its form or become attached to, or separated, from particles. It may change its form by reacting with oxygen or other molecules present in air, water, or soil, or through metabolic action of plants or animals. For arsenic impacted soils, in-place treatment may reduce the mobility of arsenic by changing it to less soluble forms (i.e. to reduce its leaching pathway from soil to groundwater), but this does not remove the arsenic. To meet the CAP requirements, the arsenic impacted soil must meet the non-residential RRS.

Based on the conditions at the site, type of impacts requiring remediation, and past experience with EPD, excavation, transport and proper landfill disposal off-site is the only feasible and practical approach for the arsenic hot spot areas and the non-arsenic impacted soils, followed by a Type 5 RRS approach for the remaining arsenic conditions. This is the corrective action approach already approved by EPD and is the most practical cleanup approach.

A6.0 PROJECT/TASK DESCRIPTION AND SCHEDULE

Based on the previous investigations and this plan, the following section describes the cleanup actions to be conducted as part of the soil remediation.

Prior to initiating cleanup activities, a site-specific Health and Safety Plan (HASP) will be prepared by the selected contractor to meet the requirements of Occupational Safety and Health Administration (OSHA) Standard 1910.120. This document will outline the potential hazards, level of personal protection to be used, procedures for environmental and worker monitoring, and establish emergency situation measures. It is assumed that the fieldwork will be performed in Level D personal protection including at a minimum: safety-toed boots, hard-hats, high-visibility clothing/vests, and safety glasses. The Georgia 811 Safe-Dig Utility Protection Center must be contacted to locate underground utilities at least 72 hours prior to initiating subsurface disturbance. Additionally, Georgia Department of Transportation (GDOT) utilities must be contacted to locate private lines at least 72 hours prior to initiating subsurface disturbance. Each utility partner may request that a representative be present while excavation occurs. Utility locating and confirmation will likely occur in stages due to the size of the Subject Property and the anticipated progression of excavation activities along the corridor. All land disturbance activities work will be completed within the confines and under the guidelines of the property owner's Land Disturbance Permit with the City of Atlanta.

The Brownfield corrective action activities proposed/anticipated at the Subject Property include:

- Soil excavation in those areas where regulated constituents exceed applicable RRS;
- Confirmation, if need, through soil sampling and testing that site soils are in compliance with applicable RRS; and,
- Source or unforeseen condition removal, if any.

A6.1 Source Removal

Railroad equipment, switches, transformers, and/or electrical boxes will be removed from the Subject Property. At this time, railroad ties have currently been removed with other visible equipment, which are not considered source material. No buried objects of environmental concern are anticipated, but if found, will be assessed and removed as discovered.

A6.2 Soil Corrective Actions and Confirmation Sampling

Excavation of contaminated soil will be conducted on the basis of existing data, initial confirmation data that has been collected or based on field observations conducted during grading, utility conflicts/construction or other ground-disturbing activities.

Figures depicting the known remedial areas are included in Appendix C. The only remaining COI is arsenic as other COI have been remediated under the CAP, as amended.

Specifically, soil contamination is associated with the following areas:

- Segment 2: EB-33 through EB-41, and EB-44 through EB-46;
- Segment 3: EB-51, EB-53 through EB-56, EB-59, EB-60, EB-62, EB-64, EB-65, EB-69, EB-73, and EB-74; and,
- Segment 4/5: EB-81 through EB-82, EB-87, EB-88, EB-90 through EB-93, EB-96 through EB-98, EB-101, and EB-104.

Soils will be remediated in accordance with Chapter 391-3-19 of the Georgia EPD Hazardous Site Response Act (HSRA) criteria for corrective action, which is outlined in the PPCAP, as amended. To the extent possible with available grant dollars, the above locations with arsenic soil impact concentrations above the Type 3 RRS will be excavated and transported off-site for proper landfill disposal to the extent required under the approved CAP. Concurrent with the final trail construction, a Type 5 RRS will be implemented relative to the remaining arsenic conditions. This will be done later, using alternative funding. The same applies to any areas that cannot be completed due to existing utility conflicts, where those utilities are later removed during the final trail construction.

Excavated soil requiring off-site disposal shall be directly loaded onto trucks in approved GDOT containers, transported by licensed haulers, and disposed of at an approved landfill. If stockpiled prior to disposal, stockpiled soil shall be placed on plastic sheeting, covered with plastic and surrounded by hay bales or other erosion best management practice (BMP) controls while pending a determination by the environmental professional regarding management and proper disposal. Stockpiled soil shall be secured during all rain events and at the end of each work day to prevent disturbance.

A6.3 Disposal Characterization Soil Sampling

Soil has been previously characterized for handling and disposal purposes by Resource Conservation and Recovery Act metals by Toxicity Characteristic Leaching Procedure (TCLP) analysis. If the receiving disposal facility requires additional testing, it is recommended that additional testing be conducted.

Approval from the disposal facility for acceptance of waste materials shall be obtained in writing prior to transport of excavated soil from the Subject Property. This information should be provided to ABI for confirmatory purposes. Excavated soil shall be properly characterized and manifested in accordance with federal, state, and local laws, rules, and regulations prior to transport to an approved disposal facility. Remediation and transport of excavated soil shall be completed in accordance with federal, state, and local laws, rules, and regulations.

A6.4 Project Timeline

Cleanup activities are anticipated to begin within six months, subject to ABI's overall corridor redevelopment schedule, and the selection process for the appropriate remediation contractor. This cleanup is one step in providing regulatory closure with the Georgia EPD through the Brownfield program. An interim remediation report will be completed within six months of the completion of cleanup activities.

Approval of this QAPP by the USEPA is required prior to initiation of the remedial activities at the Subject Property. Upon receipt of USEPA's review and approval of the plan and after public outreach has

acceptably ended (i.e, no major public objections), the corrective action/excavation activities may commence. Please note that remediation activities may occur in several areas at once to meet the overall project deadline, and that the schedule is highly dependent on field conditions and local, state, and federal COVID-19 related restrictions. It is anticipated that the soil corrective actions will require approximately six to eight weeks to complete.

In the event that budget allows, the project team may extend remediation activities to additional segments of the Atlanta BeltLine Southside corridor.

A7.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT

The following seven steps are used to determine the criteria for project specific data quality objectives (DQO) when performing cleanup projects funded under the Brownfields RLF grant.

1) State the Problem:

Arsenic (primarily) impacted soils are present throughout the Subject Property. Impacted soil has the potential to harm human health and the environment.

2) Identify the Decision

Design phase investigation to further characterize and delineate the impacts, and then excavate, dispose of contaminated soil off-site, and backfill with clean soil or stone.

3) Identify Inputs to the Decision

- Previous soil and groundwater investigations conducted at the Subject Property;
- Historical records and documents with industry-specific experience;
- ABI's PPCAP, and subsequent amendments approved by EPD.

4) Define the Study Area Boundaries

Soil impact locations are provided in Appendix F to CAP Amendment #2 provided in Appendix D of this QAPP, and are further illustrated in Appendix C as Exhibits 1 through 39.

5) Develop a Decision Rule

Proceed with Design Phase Investigation and then soil excavation.

6) Specify Limits on Data Gaps/Errors

Limits on data gaps and errors associated with analytical sampling are specified throughout this document. Any unforeseen data gaps identified with respect to the previous reports which will be addressed with the Design Phase Investigation. If further data gaps are identified, they will require management decisions during the implementation of cleanup activities.

7) Optimize Design

The optimized design and sampling requirements are included in the CAP Amendment which serves as the Work Plan (included as Appendix D) and throughout this document.

A8.0 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

This section outlines the minimum training requirements for personnel conducting project activities. Current training records and certificates are kept in personnel files located at the respective headquarters of the project personnel. Specifically, these training documents will be kept on site by the following key personnel:

- Remediation Contractor Project Manager will ensure training certifications are kept for personnel on-site in the field trailer (or an on-site location), with copies made available to the United Consulting Project Manager and ABI and their representatives;
- ABI and their representatives will keep records of all their employees and contractors training certifications at their offices with digital copies available for review, as needed; and,
- United Consulting will keep records of all their employees' training certification on their person and at their Atlanta office located at 625 Holcomb Bridge Road, Norcross, Georgia 30071.

All training records will be made available upon request. Deficiencies and the need for new training are identified during annual personnel evaluations. Personnel deficient in any of the following requirements will not be allowed to conduct project activities.

All field personnel working on-site will have completed the 40-hour Hazardous Waste Operation and Emergency Response (HAZWOPER) and 8-hour annual refresher as required by OSHA 29 CFR 1910.120. Field personnel performing invasive investigations will have evidence of certification of respirator fit-test and cleaner to wear a respirator (if required). Additionally, all field personnel working on site will participate in corporate medical monitoring programs, as appropriate.

Training records will be maintained by each firm's human resources department and project-specific training will be maintained by the Project Manager.

A8.1 Hazardous Waste Operation and Emergency Response (HAZWOPER)

The respective project managers will ensure that all on-site personnel have current certificates of training for the 40-hour OSHA "Hazardous Waste Operations and Emergency Response" (HAZWOPER) with annual 8-hour refresher courses completed per 40 CFR Part 311 and 29 CFR 1910.120. All personnel mobilizing to the site shall carry a Certificate of Training identification card.

Any other personnel (County, EPA, contractors, etc.) visiting the Subject Property during cleanup activities must ensure their personnel have at a minimum an OSHA 40-Hr HAZWOPER training certification. All training certifications will need to be verified as a pre-requisite for site visit(s).

A8.2 Certifications

All team members must have valid and current specialized training required by the OSHA regulations to conduct the functions that they are assigned. Other training/certification needs may be determined by United Consulting's Project Manager and Health and Safety Officer in conjunction with applicable federal or state laws.

The laboratory chosen to perform the analytical analysis of environmental samples must be certified by the National Environmental Laboratory Accreditation Program (NELAP) and remain in compliance with all applicable regulations and standards. The analytical laboratory, methods of analysis, and applicable accreditation will be defined throughout this QAPP. It is anticipated that Analytical Environmental Services, Inc. (AES) laboratory will be utilized under this program. A copy of AES's Quality Assurance Manual (QAM) is provided as Appendix E.

A9.0 DOCUMENTS AND RECORDS

Documentation that may be produced for the Atlanta BeltLine project include:

- Field Documents
- Laboratory Documents
- Project Planning and Reporting Documents

All project documents will be filed per United Consulting's standardized project filing system; with all original documents held digitally via Microsoft SharePoint at United Consulting's Norcross, Georgia office (625 Holcomb Bridge Road, Norcross, Georgia 30071). All field-generated documents will be filed at ABI's office and their representatives' office. All documents will be maintained electronically for at least five years from completion of the project.

All technical documents and records will be maintained in accordance with the requirements set forth in the US EPA Region 4, Science and Ecosystem Support Division (SESD), "Field Branches Quality System and Technical Procedures" (http://www.epa.gov/region04/sesd/fbqstp).

A9.1 General Documentation and Records

General project documentation may include the following:

- Health and Safety Plans
- Agency notifications, permits, and compliance documentation
- Progress and/or status reports
- Correspondences directly-related to the project
- Data validation/quality assessment reports
- Project audit and quality assurance/quality control reports

A9.2 Field Documentation and Records

Field documentation that may be generated (where applicable) for field efforts conducted along the BeltLine corridor.

Field Documentation may include the following:

- Original chain of custody records and field log/books/notes
- Records obtained during clean up
- Field notes with field crew signatures or initials on all records/notes
- Photographic logs
- Field calibration logs

Field notes shall be documented during all site visits and typically include:

- Names of personnel, subcontractors, and others on-site
- Date and chronological summary of activities

- Ambient conditions
- Sample locations, descriptions, and identification (when applicable)
- Any sampling equipment and decontamination procedures
- Field calibration record and/or acknowledgement
- Documentation of all situations encountered in the field and resolution, if required.

Records (filed) should include all correspondences, field logs and data sheets, laboratory analytical reports, waste manifests, progress reports, and closeout reports, as applicable.

A9.3 Laboratory Documentation and Records

Sample that are collected for purposes of identifying additional materials or waste characterization, chain-of-custody records must accompany all samples from origin through disposal. All sample containers are labeled with sample location identification (Sample ID), preservative, sampler(s) name, analyses required, and date/time of collection. The Sample ID is linked to the labels, chain-of-custody, and field notes. Chain-of-custody records typically include the following information:

- Project Name and location
- Date and times of sample collection
- Name of sampler(s)
- Sample ID
- Name of samples
- Analyses required with preservation methods
- Timeframe (days) for sample results

The laboratory analytical results are typically provided via electronic copies generally within seven calendar days of sample receipt. The electronic copy will be placed in a server, which is routinely backed-up to ensure data integrity. Paper copies will be supplied by the laboratory only upon request or will be printed from the electronic copy by the United Consulting Project Manager.

The laboratory analytical report will include the following required information at a minimum:

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

The laboratory will manage the original raw data and the data validation report in electronic format. The Laboratory Director will maintain information on where the records are stored, and will identify who will be responsible for records management and how long specific types of records or documents will be maintained.

A9.4 Planning, Progress, and Closure Reports

Project planning documents will include:

- QAPP – United Consulting's Quality Assurance Project Plan will meet the EPA's requirements for EPA funded projects. This QAPP will specify the methods to be employed for determining the rationale for corrective actions required under Georgia Brownfields, documentation requirements, and methods for any sampling and analysis conducted at the site. This document will be made available in physical format on site at all times.

- HASP – A site specific Health and Safety Plan (HASP) will be generated by each contractor involved in implementation of the corrective actions outlined in this document as well as the work plan. The purpose of the HASP is to provide personnel required to work onsite with the information, guidelines, and procedures necessary to complete their assignment in a safe manner. The HASP should describe the site, scope of work, potential chemical and physical hazards, personal protective equipment (PPE), atmospheric monitoring requirements, decontamination procedures, emergency response procedures, medical surveillance program, personnel training requirements, and site control practices, as appropriate. Each firm working on this project shall perform their work in accordance with this QAPP, the EPD approved PPCAP, as amended, and their HASP. The overall safety at the construction site is the responsibility of the General Contractor (if selected) and/or the Remediation Contractor.

  Copies of these plans should be made available for review and approval prior to commencement of site work activities. This document shall be made available in physical format on site at all times.

- SMP – Implementation of any remediation or corrective actions will be performed under the control of a Soil Management Plan (SMP) to achieve compliance status under the required of the CAP, as amended. The SMP is a contingency plan which notifies contractors of known environmental conditions and addresses the potential for unknown conditions. During any ground disturbing activities associated with redevelopment (such as: remediation of known impacts, general grading, utility installation, foundation construction), contractors are assigned responsibility to make observations and to check for previously unknown subsurface impacts which may require documentation and/or corrective action. This document will be made available in physical format on site at all times.

Weekly progress reports will be submitted to ABI and United Consulting starting a minimum of one week prior to the onset of site work activities and will continue through completion of site work activities. This update will include at a minimum the following:

- Activity period
- Activities performed
- Updated schedule of activities
- Personnel and equipment on-site
- Corrective action completion and waste removed status
- Deviations from the design, if any

- Lessons learned, if any

An Interim Remediation Completion Report will be drafted following completion of corrective actions. This interim closure document will include the following components: Introduction and background, corrective actions conducted, delineation/confirmatory samples (if required), waste profile, manifests, tabulated landfill volumes, and summary conclusions.

An Interim Compliance Status Report (CSR) will be required by EPD once remediation and Type 5 soil confirmation sampling activities are completed prior to landscaping and completion of the trail. Typically, a CSR is written after ground disturbing construction activities are completed. This is anticipated to occur well into the future and is outside of the scope of the EPA grant. Other reports may include invoicing, progress reports, and/or meeting summaries.

B1.0 SAMPLING DESIGN PROCESS

The sampling design is based on the approach applied along other portions of the Atlanta BeltLine, as specified in the corrective action plan developed and approved by EPD. This QAPP establishes minimum requirements for the design phase, confirmatory soil sampling (if required), and waste disposal characterization.

Collection and analysis of soil samples are intended to confirm excavation has been completed to the extent necessary to achieve the required corrective actions under Georgia Brownfields. The investigations leading to the soil removal action were designed to fully delineate the vertical and horizontal limits of contamination, and therefore minimal confirmatory soil sampling is suggested at this time.

At this time, no further delineation prior to corrective action is anticipated. However, the remaining areas may require confirmation samples depending on field conditions and further requirements/coordination with Georgia EPD.

Waste disposal samples will be collected and analyzed by toxicity characteristic leachate procedure (TCLP) to prepare waste profiles. Waste profile samples will be analyzed for the constituents of concern and any other parameters required by the receiving landfill. The quantity of waste profile samples will be collected on the basis of each area, combination of similar areas, or at a rate of approximately one sample per 500 cubic yards of soil removed. Soil samples will be analyzed at a minimum for the following parameters:

- TCLP RCRA 8 metals via EPA Method 6010

Any materials generated as a result of cleanup activities may require characterization for waste profiling. Materials, such as disposable personal protection equipment, will be containerized and properly labeled until appropriate analytical tests are conducted to determine its waste characterization. Materials generated on site that are characterized as non-hazardous will be disposed of as non-hazardous waste. Any identified containerized hazardous waste that is stored on site will be manifested and shipped to a permitted treatment and/or disposal facility. All management of waste materials will be conducted in accordance with EPA Region 4 SESDPROC-202-R3 SOP, included in Appendix F.

No other samples are proposed during cleanup activities. No field parameters, critical or noncritical, are anticipated during sampling activities.

Execution of the planned cleanup activities will not commence until this QAPP is approved by the EPA.

B2.0 SAMPLING AND ANALYTICAL METHOD REQUIREMENTS

B2.1 Procedures by Matrix:

Groundwater: No groundwater samples are anticipated during cleanup activities.

Soil: The SOPs associated with soil sampling referenced below will be adhered to. Links to the SOPs are provided hereafter.

- EPA Region 4 SOP SESDPROC-205-R3 - Field Equipment Cleaning and Decontamination
  - https://www.epa.gov/sites/production/files/2016-01/documents/field_equipment_cleaning_and_decontamination205_af.r3.pdf
- EPA Region 4 SOP SESDPROC-202-R3 – Management of Investigative Derive Waste
  - https://www.epa.gov/sites/production/files/2015-06/documents/Management-of-IDW.pdf
- EPA Region 4 SOP SESDPROC-209-R2 – Packing, Marking, Labeling and Shipping of Environmental and Waste Samples
  - https://www.epa.gov/sites/production/files/2015-06/documents/Shipping-Environmental-and-Waste-Samples.pdf
- EPA Region 4 SOP SESDPROC-300-R3 – Soil Sampling criteria
  - https://www.epa.gov/sites/production/files/2015-06/documents/Soil-Sampling.pdf

A copy of the relevant EPA Region 4 SOPs are included in Appendix F.

The laboratory will provide containers for the samples; pre-preserved when applicable. The Project Manager is responsible for ensuring the laboratory provides the appropriate sampling containers. Additionally, the Project Manager and their Field Team is responsible for overseeing sample collection activities. Anticipated sample container and preservation requirements are listed in the following table:

Matrix	Parameter	Method	Container	Preservative	Hold Time	Minimum Volume
Soil	Arsenic	SW6010D	Glass	Ice	180 Days	4 oz

Precautions will be taken to prevent cross-contamination. If the field team encounters any problems or unexpected situations while in the field (e.g., access problems, safety issues, inadequate supplies, equipment failure, etc.), the United Consulting Project Manager will be notified and corrective action implemented. Corrective action required during field activities will follow the Corrective Action Flow Chart included as Appendix G.

B3.0 SAMPLE HANDLING AND CUSTODY

Field and laboratory personnel must properly maintain all samples under strict Chain of Custody protocols and in a manner to retain physical properties and chemical composition. The handling and transportation of samples will be conducted in a manner that not only protects the integrity of the sample, but also documents sample custody. In general, packing, marking, labeling, and shipping of samples will be conducted in accordance with Georgia EPD and EPA SOPs shown in Appendix F (EPA, Region 4, Field Sampling Procedures: Packing, Marking, Labeling, and Shipping of Environmental and Waste Samples, SESDPROC-209-R4, February 23, 2020). Samples will also be packaged and shipped in accordance with applicable US Department of Transportation (DOT) regulations and/or International Air Transport Association (IATA) standards. The following sections detail sample handling and custody requirements from sample collection to final disposal.

Upon collection, samples will be transferred immediately from the sampling device into the appropriate laboratory-supplied container. All samples collected will have discrete sample identification numbers. The unique sample identifications are necessary to identify and track each of the many samples collected for analysis during the duration of the project. Whenever possible, sample labeling procedures from previous investigations will be followed or continued. Samples collected during the field activities for the Work Plan will be labeled with unique sample numbers.

Samples will be packaged in a manner to prevent breakage or cross-contamination and will be shipped to the laboratory at proper temperatures. The following sample packaging guidelines will be followed:

- Sample containers will be placed in the cooler in a manner to minimize the potential for cross-contamination.
- Sample containers obtained from specific sampling locations will be placed in the same cooler when possible.
- When samples collected for volatile analysis will be shipped in several coolers on a single day, VOC vials may be consolidated into a single cooler to minimize the number of trip blanks.
- Only wet ice or blue ice will be used to cool and maintain temperatures during shipping. Ice will not be used as a packaging material.
- Coolers used for shipping will be filled with proper packaging material to prevent glass containers from shifting and minimize the potential for breakage during shipping.

A Chain of Custody record will be completed for each set of collected samples. The Chain of Custody form will be provided by the analytical laboratory. The purpose of the Chain of Custody procedure is to prevent misidentification of samples, prevent tampering of the samples during shipment and storage, allow easy identification of tampering, and allow for easy tracking of possession. If the Chain of Custody is broken at any time from sample collection through sample analysis, the Project Manager and QA/QC Officer will be notified.

When samples leave the sampler's immediate control, the sampler will sign and date the Chain of Custody record(s) to relinquish the samples. The Chain of Custody record will be placed into a sealable plastic bag and placed into the cooler. A custody seal will be placed on the shipping container. The custody seal will bear the collector's name and the date signed. The custody seal is used to ensure that the samples in the shipping container have not been tampered with. Chain of Custody procedures will be completed as outlined in Appendix F.

B4.0 ANALYTICAL METHODS AND REQUIREMENTS

The laboratory will conduct analytical analysis for the media provided. Specifically, samples collected under the scope of this project will be submitted for laboratory analysis of constituents as specified in Section B1.0 and B2.0. Once the samples are received and logged in at the laboratory, the samples will be analyzed as requested on the chain of custody.

Available laboratory information and extraction and digestion criteria are included in Laboratory QAM documents, included in Appendix E. The Laboratory Director is responsible for overseeing the success of the analysis and for implementing corrective actions if deemed necessary as set forth in Section 9.8 of this document.

Non-standard or unpublished methodologies for analysis are not anticipated. Laboratory analysis will be performed in a standard turn-around time of 5 business days for electronic data. Hardcopies will be available at request and will be provided within 5 business days of request. Constituents of concern, analytical/extraction methods, sample container, preservation, holding time requirements, are provided in the referenced EPA guidance documents.

The detection limit requirements for each analyte are typically below regulatory limits for the parameters of interest. The Project Manager has reviewed the laboratory QC samples and control limits identified in the laboratory documentation. The quality of the data generated using the laboratory QAM will provide analytical data of a known quality and precision for projects under this EPA Grant Program.

B5.0 FIELD QUALITY CONTROL REQUIREMENTS

A sufficient volume of each sample will be collected in the field to allow for re-analysis if the laboratory data quality objectives are not reached or if additional analyses are required. All consumable equipment used to conduct sampling activities will be single use and dedicated by sample. All reusable equipment will be properly decontaminated prior to collection of additional samples.

Due to the nature of the remediation work, confirmatory soil sampling is not anticipated. However, if sampling is required for unforeseen conditions during excavation work, the following quality control requirements must be included:

Field Duplicate Samples: A field duplicate is a second sample collected at the same location as the original sample and will be used to assess sampling and laboratory precision. Duplicate soil samples will be collected simultaneously or in immediate succession, following identical collection procedures, and treated in the same manner during sample shipment, storage, and analysis. The sample containers will be assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel. Field duplicate samples will be collected at a one-to-twenty ratio.

Temperature Blank Samples: Temperature blank samples will also be supplied by the laboratory and will accompany each cooler. The laboratory will utilize the temperature blank samples for measurement of the temperature within the cooler upon arrival at the laboratory.

Field Blank Samples: A field blank is a sample that is prepared in the field to evaluate the potential for contamination of a sample by site contaminants from a source not associated with the sample collected. Deionized water is poured into the appropriate sample containers in dusty environments and/or from areas where contamination is suspected as being present in the atmosphere and originating from a source other than the source being sampled. During the life of the project, a field blank samples will be collected at least once during the life of the project if confirmatory sampling is required.

Trip Blank: Trip blanks are supplied by the designated laboratory and consist of deionized water in a 40-ml vial. The trip blank will remain in each sample cooler along with the investigation samples and will be analyzed for target volatile compounds only. No VOCs are anticipated to be analyzed during this cleanup, so no trip blanks are required.

Equipment Rinsate Samples: The equipment rinsate blank is a sample of deionized water that is prepared in the laboratory, shipped to the site with other sample containers, and poured over the cleaned, decontaminated sample collection equipment in between sample collection. The equipment rinsate blank will be used to evaluate potential cross-contamination that may occur by reusing sample collection equipment if not thoroughly decontaminated between sample collection events. Equipment rinsate blank samples will be collected daily after equipment is cleaned, or between sampling of each remedial area to ensure equipment was thoroughly cleaned (if required).

Matrix Spike/Matrix Spike Duplicate (MS/MSD): A MS/MSD is a second sample collected at the same location as the original sample and is spiked with a known concentration of analytes of interest. Duplicate soil samples will be collected simultaneously or in immediate succession, following identical collection procedures, and treated in the same manner during sample shipment, storage, and analysis. The sample

containers will be assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel. MS/MSD samples will be collected at least once during the life of the project if confirmatory sampling is required.

In summary, the following Field Sampling QC Table will be followed during this cleanup:

QA/QC Sample	Matrix	Parameter	Method	Frequency
Field Duplicate	Soil	Arsenic	EPA 6010	1 per 20 samples
Temp Blank	Water	Temperature	EPA 170.1	1 per cooler
Field Blank	Water	Arsenic	EPA 6010	1
Trip Blank	Water	VOCs	EPA 8260	None
Equipment Rinsate Blank	Water	Arsenic	EPA 6010	1 per area
MS/MSD	Soil	Arsenic	EPA 6010	1

All quality control samples will be submitted for laboratory analysis of the project constituent suite if confirmatory sampling is required. Chain-of-Custody procedures will be completed as outlined in Appendix F.

B6.0 LABORATORY QUALITY CONTROL REQUIREMENTS

The following actions will be taken when control limits are exceeded or interferences or dilution problems are encountered or equipment sensitivity problem exists:

- Review data outliers with the laboratory
- Determine if reanalysis or resampling is required
- Flag data in the report and explain
- Indicate whether data can be used (as indicator), relied upon, or must be rejected

Laboratory quality control checks include:

- Laboratory Control Standard
- Laboratory Control Standard Duplicates
- Matrix Spikes
- Matrix Spike Duplicates
- Method Reagent Blanks

Each laboratory has a QC program in place to ensure the reliability and validity of the analysis performed. All analytical methods are documented in laboratory SOPs. Each SOP includes a QC section, which addresses the minimum requirements for the procedure. These SOPs will be presented upon request. The following paragraphs describe the QC samples potentially required for soil samples.

Method Blank: A method blank is a sample of ASTM Type II or organic-free (deionized) water that is carried through each step of the preparation and analytical method. A method blank sample will be prepared and analyzed with each batch of twenty or fewer samples. Method blank samples will be used to assess potential contamination attributed to laboratory operations during sample preparation and analysis.

Instrument Blank: An instrument blank is a sample of ASTM Type II or organic-free (deionized) water that is analyzed with associated calibrations of laboratory instruments. Instrument blank results will be used to assess potential contamination attributed to specific instrument calibration procedures.

Surrogate Spikes: Surrogate spikes are compounds that will be added to every blank, standard, sample, and matrix spike sample as specified in the organic analytical methodology. Surrogate compounds are generally brominated, fluorinated, or isotopically labeled compounds not expected to be in environmental samples. The results of the surrogate spike will be used to evaluate the accuracy of the analytical measurement on a sample-specific basis.

Laboratory Control Samples: Laboratory control samples (LCS) are well-characterized laboratory generated samples used to monitor the laboratory's day-to-day performance of analytical methods. The LCS is a method blank spiked with known concentrations of target analytes. The LCS is carried through each step of the preparation and analytical method. LCS will be reported in %R and used to assess the precision and accuracy of the analytical process independent of matrix effects. Controlling lab operations

with LCS (rather than surrogates or matrix spike) offers the advantage of being able to differentiate low recoveries due to procedural errors with those due to matrix effects.

Evaluation criteria for laboratory control samples are dependent upon sample matrix, analytical instrumentation, and analytical method requirements. If required by the method and if sufficient sample volume is available, the laboratory will reanalyze any samples not conforming to QC criteria. It is expected that sufficient sample volumes/weights will be collected to allow for reanalysis when necessary.

Specifically, for this project, the laboratory quality control requirements include the following:

Matrix	Parameter	Method	Laboratory Control Spike (LCS) Range	Relative Percent Different	Matrix Spike (MS) Range	Relative Percent Difference
Soil	Arsenic	SW6010D	80-120%	20%	75-125%	20%

Additional laboratory quality documentation is provided in the laboratory QAM included in Appendix E.

B7.0 FIELD EQUIPMENT AND CORRECTIVE ACTIONS

All field equipment will require testing/calibration and routine inspection, and maintenance per the manufacturer's recommendations. All equipment manufacturer literature (e.g. operator instruction/user manuals for testing and inspecting the meters, etc.) will be maintained and made available by the Project Manager and their field team leader.

An inspection checklist and initial calibration check will be completed by a field team member at the Subject Property for any equipment used during cleanup activities. A maintenance kit, which may include extra batteries, calibration standards, and commonly needed spare parts, will be made available at the Site for equipment. Any preventive or corrective maintenance completed will be documented in the field notes. If any equipment fails the initial testing and inspection, a second attempt to calibrate the equipment will be performed. If any equipment fails the second calibration attempt, alternative equipment must be obtained.

All of the field equipment will be inspected and calibrated before and after each site visit, and after every 8 hours of use. Field equipment calibration log books are maintained for each piece of equipment and project field logs are maintained for each sampling event and given to the Project Manager or Field Team Leader upon completion of the sampling event to maintain in the project file for reference. The Project Manager or QA/QC Officer may request spot checks of equipment calibration at any time. Calibration records can be traced to equipment logs by referencing project specific field notes. Equipment calibrations are completed in accordance with manufacturer specifications. This will be managed in accordance with SOP provided in Appendix F.

Given the nature of the cleanup activities proposed, no field equipment is anticipated. However, if field equipment is needed, such as a field X-Ray Fluorescent (XRF) or photoionization detector (PID), then the Project Manager and their field teams will follow applicable EPA Region 4 SOPs. In this case, a QAPP Addendum will be issued specifying the field equipment needed.

Corrective action required during field activities will follow the Corrective Action Flow Chart included as Appendix G.

B8.0 LABORATORY EQUIPMENT AND CORRECTIVE ACTIONS

The Laboratory QAM addresses the testing, inspection, and maintenance for the analytical instruments and is provided as Appendix E. Procedures include reviewing the instrument log for any notations regarding problems experienced during previous use and verifying that scheduled preventative maintenance has been conducted in accordance with the manufacturer's recommendations. The lab will document any preventative or corrective maintenance conducted on laboratory equipment /instrumentation. The Laboratory Director is responsible for overseeing the testing, inspection, and analytical instruments in accordance with their provided QAM.

B9.0 ANALYTICAL SENSITIVITY AND PROJECT CRITERIA

Analytical method sensitivity and project criteria for the analytical methods within the scope of this project will be determined by the remedial action goals and with the consideration of the selected laboratory. Minimum detection limits for soil samples will comply with the Georgia Comparison of Existing Contamination to Risk Reduction Standards (Rule 391-3-19.07), and the site-specific non-residential RRS approved by the Georgia EPD.

The following table provides the required method detection limit and reporting limits:

Matrix	Parameter	Analytical Reporting Limit Range	Analytical Detection Limit Range	Project Criteria
Soil	Metals	0.5 – 2 ug/Kg	0.0282 – 0.37	Georgia EPD Approved RRS

B10.0 DATA MANAGEMENT AND DOCUMENTS

Data for this project will be produced in the laboratory. Information collected on-site will be recorded on field data worksheets and into field logbooks. Copies of the field log pages will become part of the project file. These documents and records are also maintained in general accordance with the requirements set forth in the USEPA Region 4, Science and Ecosystem Support Division (SESD), "Field Branches Quality System and Technical Procedures." Some of the required documentation includes:

- Field crew signatures or initials on all records/notes with a waterproof pen.
- Use of field sampling and decontamination supplies and equipment are tracked with an in-house system.
- Sampling containers are prepared by the laboratory and shipped with a packing list documenting contents.
- Preservatives used by the laboratory are traceable by preparation date, vendor, and lot number.
- Sampling containers are pre-cleaned at the laboratory.
- All equipment is maintained and calibrated in accordance with manufacturers' specifications.

Field logs will include weather observations at the Subject Project when field activities were conducted. All relevant observations or digressions from the procedures in this QAPP, deemed notable by any field team member, will also be recorded in the field logbook. The United Consulting Project Manager will submit copies of the field data worksheets and logbooks with the field activity report as a periodic deliverable, or as part of the final report.

The laboratory provides electronic copies of the analytical results generally within five days of sample receipt. Paper copies will be supplied by the laboratory upon request or will be printed from the electronic copy by the Project Manager. The Project Manager and QA/QC Officer will be responsible for reviewing the data to verify its usability, ensuring the analytical report meets requirements, and for forwarding it to the appropriate persons, when applicable.

After the laboratory report is reviewed by the Project Manager and QA/QC Officer, data is then formatted into tables and compared to regulatory limits to determine if contamination is present at the Subject Property. Upon completion of formatting of the Analytical Data Table, data is reviewed for accuracy by the QA/QC Officer. Site figures and maps including analytical results and sample locations are frequently prepared for submittal with final reports. These figures and maps are also reviewed for accuracy by the QA/QC Officer.

The laboratory will manage the original raw data and data validation report for projects in both hard copy and electronic format. This information will be made available to the Project Manager or QA/QC Officer upon request. The Laboratory Director will maintain information on where the records are stored, will identify who will be responsible for records management, and how long specific types of records or documents will be maintained.

All records and reports and checklists from the USEPA Region 4 Designated Approving Official can be found in the electronic project file located at United Consulting's offices. The project file will be kept for a minimum period of five years.

C1.0 ASSESSMENT AND OVERSIGHT

The Brownfield corrective actions will require oversight by experienced personnel. The Field Team Leader will select appropriate personnel to assist in performing the scope of work. The field personnel will report directly to the Field Team Leader. The Field Team Leader will be responsible for communicating the needed corrective action approach to the field team. The Field Team Leader, in conjunction with the Project Manager, will be responsible for the preparation of the reports, with review of the QA/QC Officer and Program Manager.

C1.1 Assessments/Oversight and Response Actions

The needed corrective actions will include removal of the defined hotspots followed by backfill operations. This is driven by the previously conducted soil assessments, which determined the general subsurface conditions of the Subject Property, and delineated horizontal and/or vertical extent of contamination.

The verification and validation of all reported data will be conducted by the QA/QC Officer, and QA review of all reports will be conducted by the Project Manager or similar senior technical staff (as appropriate). The QA/QC Officer may conduct an on-site field audit at the time(s) when samples are being collected for both field and laboratory analysis. The QA/QC Officer will have the authority to halt the on-site work if they believe the findings from the audit justify such action. In the event discrepancies are identified during an audit, the QA/QC Officer will discuss findings with the United Consulting Project Manager and Remediation Project Manager. The United Project Manager will be responsible for corrective actions related to field activities. Audit findings will be included in the final reports. In the event the Remediation Project Manager hires a subcontractor to perform a specialized task, they will provide oversight of the work by an experienced Field Team Technician, Field Team Leader, or Project Manager.

The laboratory will provide a narrative report with the analytical results referencing the project, associated chain-of-custody, quality control issues, and the validity and integrity of the results. Section D2 of this QAPP discusses the verification and validation process.

Communicating and resolving problems that arise in the field, via corrective actions implementation, will be addressed and overseen by the Project Manager. Corrective action for detecting and correcting errors in records will follow the Corrective Action Flow Chart included as Appendix G.

C2.0 PROJECT REPORTS

All reports will be reviewed for technical accuracy and data quality by the Project Manager, project QA/QC Officer, or similar senior technical staff (as appropriate). The final report will include a description of project activities, a summary of data, results drawn from the data quality assessment, the field activity reports, details of any problems encountered during the project and the corrective actions taken, and conclusions from the results and the rationale for those conclusions. The final report will be distributed to the project team and reviewed for conformance with internal document standards. Final reports will be forwarded to the EPA Project Officer and the Georgia EPD Brownfields Coordinator, as applicable.

D1.0 DATA REVIEW AND USABILITY

D1.1 Field Data Evaluation

The Field Team Leader and/or the project QA/QC Officer will validate the field data and discuss any problems identified during the project with the Project Manager. Data will be reviewed for integrity by checking all field entries for errors and consistency. Data validation will be accomplished through a series of checks and reviews intended to assure that the reported results are of a verifiable, reproducible, and acceptable quality. The validation process will include:

- Quality control blanks meet criteria
- Quality control data (spikes, duplicates) are acceptable
- Surrogate spike recoveries are acceptable

A data usability review that includes an assessment of field procedures (including field notes, boring logs, field screening results, and field analytical data) completeness, comparability, representativeness, precision, and bias (accuracy) of the data will be performed by the Project Manager or the project QA/QC officer. The findings of this review will be documented and presented in the final report.

If verification or validation indicates that samples have been collected and/or analyzed out of compliance with the QAPP, resampling may be required. The Project Manager must contact the EPA Project Manager and EPD Brownfield Unit Manager in the event that there are any deviations from the QAPP and they will determine if the data is acceptable or if resampling is required. If data is accepted that deviates from the QAPP, the data will be used for screening purposes only and annotated as such.

D2.0 LABORATORY DATA EVALUATION

The Laboratory Director will review and verify the laboratory data generated under their corrective action system for accuracy according to the laboratory's QAM, as detailed in Section B8 of this document. All sample results will be reviewed and correlated to field measurements and observations. The validation process will include:

- Narrative review;
- Determination if quality control blanks meet criteria;
- Determination if quality control data (spikes, duplicates) are acceptable;
- Determination if surrogate spike recoveries are acceptable;
- Determination if unacceptable data are identified and corrective actions are initiated; and
- Data qualifiers are assigned, as necessary.

In addition to evaluating data qualifiers associated with laboratory analyses, a comparison of the sample duplicate(s) and the corresponding sample result(s) will be made to evaluate the reproducibility of the sample results based on the laboratory analysis and sample collection and transportation procedures. For this comparison, if the duplicate or sample result is less than five times the reporting limit then the comparison is made by the absolute difference between the results (S-D).

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

An evaluation of laboratory analysis procedures and review of the chain-of-custody, holding times, blanks, control samples, duplicate analysis, detection limits, holding times, laboratory controls, and overall assessment of data will be conducted by the Laboratory Director.

The QA/QC Officer will perform verification and validation of laboratory data for conformance with the data objectives stated in this QAPP. Data verification will include completeness, correctness, and conformance evaluations. Data validation will be performed to assess the quality and usability of the data generated. Data verification and validation will be performed in accordance with EPAs "Guidance on Environmental Data Verification and Validation." Results of the data verification and validation, including potential influence on the data quality, will be summarized in the final report.

Typical validation activities include:

Item	Activity
Data Deliverables and QAPP	Ensure that all required information on sampling and analysis was provided (including planning documents).
Analytes	Ensure that required lists of analytes were reported as specified.
Chain-of-Custody	Examine the traceability of the data from time of sample collection until reporting of data. Examine chain-of-custody records against contract, method, or procedural requirement.

Item	Activity
Holding Time	Identify holding time criteria, and either confirm that they were met or document any deviations. Ensure that samples were analyzed within holding times specified in method, procedure, or contract requirements. If holding times were not met, confirm that deviations were documented, that appropriate notifications were made (consistent with procedural requirements), and that approval to proceed was received prior to analysis.
Sample Handling	Ensure that required sample handling, receipt, and storage procedures were followed, and that any deviations were documented.
Sampling Methods and Procedures	Establish that required sampling methods were used and that any deviations were noted. Ensure that the sampling procedures and field measurements met performance criteria and that any deviations were documented.
Analytical Methods and Procedures	Establish that required analytical methods were used and that any deviations were noted. Ensure that the QC samples met performance criteria and that any deviations were documented.
Data Qualifiers	Determine that the laboratory data qualifiers were defined and applied as specified in methods, procedures, or contracts.
Deviations	Determine the impacts of any deviations from sampling or analytical methods and SOPs. Consider the effectiveness and appropriateness of any corrective action.
Sampling Plan	Determine whether the sampling plan was executed as specified (i.e., the number, location, and type of field samples were collected and analyzed as specified in the QAPP).
Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support (e.g., techniques, equipment, decontamination, volume, temperature, preservatives, etc.).
Co-located Field Duplicates	Compare results of collocated field duplicates with criteria Established in the QAPP.
Project Quantitation Limits	Determine that quantitation limits were achieved, as outlined in the QAPP and that the laboratory successfully analyzed a standard at the QL.
Confirmatory Analyses	Evaluate agreement of laboratory results.
Performance Criteria	Evaluate QC data against project-specific performance criteria in the QAPP (i.e., evaluate quality parameters beyond those outlined in the methods.).
Data Qualifiers	Determine that the data qualifiers applied were those specified in the QAPP and that any deviations from specifications were justified.
Validation Report	Summarize deviations from methods, procedures, or contracts. Include qualified data and explanation of all data qualifiers.

D3.0 DATA USABILITY AND PROJECT VERIFICATION

In general, the objective of the Brownfield Program is to remedy environmental contamination so there is no impact to human health and the environment for the eventual redevelopment of BeltLine corridor. Analytical data generated in accordance with approved methodologies will be considered definitive and quantitative based on the results and findings of the validation process.

The Project Manager or QA/QC Officer will validate the field data and discuss any problems identified during the project with the Program Manager. Any problems and associated corrective actions will be documented in the field logs and the final report. The Project Manager will discuss any problems along with proposed corrective actions with the QA/QC Officer.

Because data generated with significant deviations from the requirements of the QAPP will be rejected and because of the nature of the work (biased sampling), all data will have the same expected uncertainties and there will be no limitations on data use. The following is a list of considerations for data usability assessment:

Item	Assessment Activity
Data Deliverables and QAPP	Ensure that all necessary information was provided, including but not limited to validation results
Deviations	Determine the impact of deviations on the usability of data.
Sampling Locations, Deviations	Determine if alterations to sample locations continue to satisfy the project objectives.
Chain-of-Custody, Deviation	Establish that any problems with documentation of custody procedures do not prevent the data from being used for the intended purpose.
Holding Times, Deviation	Determine the acceptability of data where holding times were exceeded.
Damaged Samples, Deviation	Determine whether the data from damaged samples are useable. If the data cannot be used, determine whether resampling is necessary.
PT Sample Results, Deviation	Determine if the implications of any unacceptable analytes (as identified by the PT sample results) on the usability of the analytical results. Describe any limitations on the data.
SOPs and Methods, Deviation	Evaluate the impact of deviations from SOPs and specified methods on data quality.
QC Samples	Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of blank contamination.
Matrix	Evaluate matrix effects (interference or bias).
Meteorological Data and Site Conditions	Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and Site conditions on sample results. Review field reports to identify whether any unusual conditions were presented and how the sampling plan was executed.
Comparability	Ensure that results from different data collection activities achieve an acceptable level of agreement.

Item	Assessment Activity
Completeness	Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be useable (completeness as defined in PWOs documented in the QAPP.
Background	Determine if background levels have been adequately established (if appropriate).
Critical Samples	Establish that critical samples and critical target analytes/COCs, as defined in the QAPP, were collected and analyzed. Determine if the results meet criteria specified in the QAPP.
Data Restrictions	Describe the exact process for handling data that do not meet PQOs (i.e., when measurement performance criteria are not met). Depending on how those data will be used, specify the restrictions on the use of those data for environmental decision-making.
Usability Decision	Determine if the data can be used to make a specific decision considering the implications of all deviations and corrective action.
Usability Report	Discuss and compare overall precision, accuracy, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of the project if criteria for data quality indicators are not met.

Field modifications regarding sampling analysis may be necessary for circumstances such as auger refusal, limited access areas, or when enough sample volume could not be collected for various reasons. Re-sampling may be necessary if results are deemed unacceptable for various reasons such as exceeding laboratory holding times or to confirm previous sampling and/or excavation activities. Upon receipt of the laboratory data, the data is reviewed to verify its usability.

Upon determination, data is then formatted into tables and compared to regulatory limits to determine if concentrations of COCs exceed RRS at the Subject Property. Concentrations which exceed the RRS will be highlighted for easy identification. The QA/QC Officer and/or Project Manager will compare and review the laboratory data to the table for completeness, correctness, and accuracy. Usable data will be provided on site figures and other graphical representations and reviewed for completeness, correctness, and accuracy.

The United Consulting Project Manager will conduct an overall project evaluation using the field and laboratory data evaluations, tabular and graphical data presentations, and analytical sensitivity criteria to determine its value in developing the site conceptual model and assist with the decision making process.

The QA/QC Officer will evaluate the usability of individual sample results at the parameter level. Analytical results will be evaluated based on sensitivity criteria described throughout this QAPP. Data limitations will be documented along with how the data should be used. Conclusions and recommendations drawn from all assessment information will be documented in the final report.

Most laboratories provide their data formatted in tables directly from their laboratory information management system software; this lessens the required manipulation of data and therefore also reduces the potential for errors. Upon completion of formatting the Analytical Data Table; data is reviewed for accuracy by the QA/QC Officer.

E1.0 REFERENCES

I. U.S. Environmental Protection Agency. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4 240/B-06/001. February.

II. U.S. Environmental Protection Agency. 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5. EPA 240/R-02/009. December.

III. U.S. Environmental Protection Agency. 2006. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. EPA 240/B/01/003. Reissued May.

IV. U.S. Environmental Protection Agency. 2006. Data Quality Assessment: Statistical Methods for Practitioners. EPA QA/G-9S. EPA 240-B-06-003. February.

V. U.S. Environmental Protection Agency Region 4, Science and Ecosystem Support Division (SESD), Field Branches Quality System and Technical Procedures, http://www.epa.gov/region4/sesd/fbqstp/index.html.

VI. US Environmental Protection Agency Region 4, Brownfields Quality Assurance Project Plans Interim Instructions, Generic QAPP and Site Specific QAPP Addendum for Brownfield Site Assessments and/or Cleanup, Revision No. 3, July 2010.

UNITED CONSULTING

APPENDIX A

USEPA Region 4 Brownfield QAPP Review Checklist

USEPA REGION 4 BROWNFIELDS QAPP REVIEW CHECKLIST

QAPP Title: Atlanta BeltLine – Southside Trail
Cooperative Agreement Recipient: Atlanta BeltLine, Inc.
Grant Number: BF-01D11520
QAPP Preparer: Spencer Cox
QAPP Date: June 24, 2021
Transmittal Date: June 24, 2021

DAO Reviewer: Camilla Warren

*This is not an exhaustive list of requirements and is not intended as guidance for developing a QAPP. Refer to the Preparation of Quality Assurance Project Plans for EPA Brownfields Projects in the Southeast for comprehensive requirements.

**For DAOs, mark each element in the right-hand column with one of the following abbreviations:
P = Present & Acceptable; NP = Not Present; I = Incomplete; NA = Not Applicable

ELEMENT	Page Number; Section	EPA Use
A1. Title and Approval Sheet	Pg. 1	
Title (Including CAR's name and revision #)	Pg. 1	
Grant Number	Pg. 1	
Name of organization that prepared the QAPP	Pg. 1	
Dated signature of approving officials: printed names, titles, organizations, date, and signatures	Pg. 1	
Other signatures, as needed	Pg. 1	
A2. Table of Contents	Pg. 2-3	
A3. Distribution List	Pg. 4-6	
A4. Project/Task Organization	Pg. 7-9	
Key individuals, technical disciplines, and responsibilities	Pg. 7-9	
Organizational chart/table depicting lines of authority and reporting responsibilities	Appendix B	
A5. Problem Definition/Background	Pg. 10-15	
Provide historical and background information	Pg. 11; A5.4	
Clearly state the problem or decision to be resolved	Pg. 14-15; A5.6	
A6. Project/Task Description	Pg.16-18	
List measurements to be made	Pg. 16	
Cite applicable technical, regulatory, or program-specific quality standards, criteria, and/or objectives	Pg. 16	
Note special personnel or equipment requirements	Pg. 16	
Provide work schedule	Pg. 17; A6.4	
Note required project and QA records/reports	Pg. 17; A6.4	
A7. Quality Objectives and Criteria for Measurement Data	Pg. 19	

ELEMENT	Page Number; Section	EPA Use
State project objectives and limits, both qualitatively and quantitatively	Pg. 19	
State and characterize measurement quality objectives to applicable action levels or criteria	Pg. 19	
A8. Special Training /Certification	Pg. 20-21	
State trainings, date of trainings, expirations, and where applicable records are maintained	Pg. 20-21	
A9. Documentation and Records	Pg. 22-25	
List information and records to be included for this project	Pg. 22	
State requested lab turnaround time	Pg. 23; A9.3	
Give retention time and location for records and reports	Pg. 22	
B1. Sampling Process Design and Site Figures	Pg. 26-27	
Type and number of samples required	NA	
Sampling design and rationale	NA	
Sampling locations and frequency	NA	
Sample matrices	Pg. 26	
Classification of each measurement parameter as either critical or needed for information only	Pg. 26	
Describe/list SOPs used to characterize and dispose of IDW	Pg. 27	
B2. Sampling and Analytical Procedures	Pg. 28	
Describe the sampling methods and procedures or cite the specific SOPs to be used to guide the sample collection	Pg. 28	
Describe how problems (lost samples, broken equipment, etc.) will be resolved and documented	Pg. 28	
If SOPs are referenced, include a table listing all field sampling SOPs that will be used. Include the title of SOP, date, revision number and organization that wrote the SOP. Describe any modifications to the SOPs that are necessary for your project.	Pg. 28	
B3. Sample Handling and Custody	Pg. 29	
Sample handling requirements	Pg. 29	
Chain-of-custody procedures	Pg. 29	
B4. Analytical Methods and Requirements	Pg. 30	
Identify the extraction, digestion, analytical methodologies to be followed	Pg. 30; Appendix E	

ELEMENT	Page Number; Section	EPA Use
Specify the turnaround time for hardcopy/electronic laboratory data deliverables	Pg. 30	
Provide the laboratory SOPs as appropriate	Pg. 30; Appendix E	
Identify the individual(s) responsible for overseeing the analysis and implementing corrective actions	Pg. 30	
B5. Field Quality Control Requirements	Pg. 31-32	
Design the field QC program that will be routinely performed, and provide a corresponding field sampling QC table in the QAPP	Pg. 31-32	
Include field duplicate samples for each matrix and parameter, trip blanks for VOC samples, temperature blanks, and QA/QC samples as necessary	Pg. 31-32	
B6. Laboratory Quality Control Requirements	Pg. 33-34	
Determine the laboratory QC data to be routinely included with the laboratory's data package, and provide a corresponding laboratory analytical QC table.	Pg. 33-34; Appendix E	
B7. Field Equipment Calibration and Corrective Action	Pg. 35	
If contained in SOPs, reference that appendix in this section of the QAPP. Otherwise, provide a field equipment calibration table for the types of field equipment routinely used	Pg. 35; Appendix F	
Discuss the corrective actions taken in the field when the control limits are not met	Pg. 35; Appendix G	
B8. Laboratory Equipment Calibration and Corrective Action	Pg. 36	
If contained in laboratory SOPs, reference that appendix in this section. Otherwise, provide a laboratory equipment calibration table for each analytical method	Pg. 36	
Note responsible individuals	Pg. 36	
B9. Analytical Sensitivity and Project Criteria	Pg. 37; Appendix E	
Provide an analytical method sensitivity and project criteria table for the analytical methods that will be routinely performed	Pg. 37	
If the laboratory provides only one analytical method limit, note in the table whether it is the MDL or the QL/RL that is being reported	Pg. 37	
B10. Data Management and Documentation	Pg. 38	
Describe standard record-keeping, data storage, and retrieval requirements for digital and hard copies of field data, laboratory data, and manipulated data; Include any checklists used for data management	Pg. 38	
Describe the control mechanism for detecting and correcting errors, and ensuring accuracy	Pg. 38	

ELEMENT	Page Number; Section	EPA Use
Include the name, title, and organization of the person(s) responsible for these activities	Pg. 38	
C1. Assessments and Corrective Actions	Pg. 39	
Assessments/oversight that will be performed and Frequency	Pg. 39; C1.1	
The person(s) responsible for performing the assessments/oversight, and where the results will be Documented	Pg. 39; C1.1	
Identify who will receive the assessment/ oversight report; who will be responsible for dealing with corrective actions; and follow up on assessments/oversight	Pg. 39; C1.1; Appendix G	
C2. Project Reports	Pg. 40	
Identify the types of reports that will be routinely generated	Pg. 40	
Provide a detailed description of the contents of project final reports to establish expectations between report preparer and client	Pg. 40	
D1. Field Data Evaluation	Pg. 41	
Describe the final data evaluation process that will be routinely performed on the field data	Pg. 41	
Indicate how the results of the evaluation will be documented, and what will be presented the final report(s). Indicate the position(s) of the person(s) who will be performing the field data evaluation	Pg. 41	
D2. Laboratory Data Evaluation	Pg. 42-43	
Describe the final data evaluation process that will be routinely performed on the laboratory data	Pg. 42-43	
Perform a completeness check of the laboratory data package to ensure it is compliant with the requirements in the QAPP	Pg. 42-43	
Document the presence or absence of any problems with the data, and note any relevant sample data that may be impacted.	Pg. 42-43	
Evaluate the field QC sample results including data qualifiers for sample results	Pg. 42-43	
D3. Evaluating Data in Terms of User Needs	Pg. 44-45	
Describe the overall project evaluation process that will be routinely performed to determine the usability of the data, update the conceptual site model, and determine if the objectives of the project have been met	Pg. 44-45	

ELEMENT	Page Number; Section	EPA Use
Tabulate the field sample data together with the state/federal standards for presentation in the final report	Pg. 44-45	
Using the summary tables and graphical presentations, evaluate the usability of the individual field sample results at the parameter level. Document any limitations	Pg. 44-45	
Document observations, trends, anomalies, or data gaps that may exist. Evaluate how the results have impacted the conceptual site model, and if the objectives of the project have been met. Draw conclusions and recommendations from all the information	Pg. 44-45	

Final QAPP disposition:
___ Approved, no comments
___ Approved with comments, resubmittal not required
___ Conditionally approved, comments must be addressed, resubmittal required
___ Not approved, comments must be addressed, resubmittal required

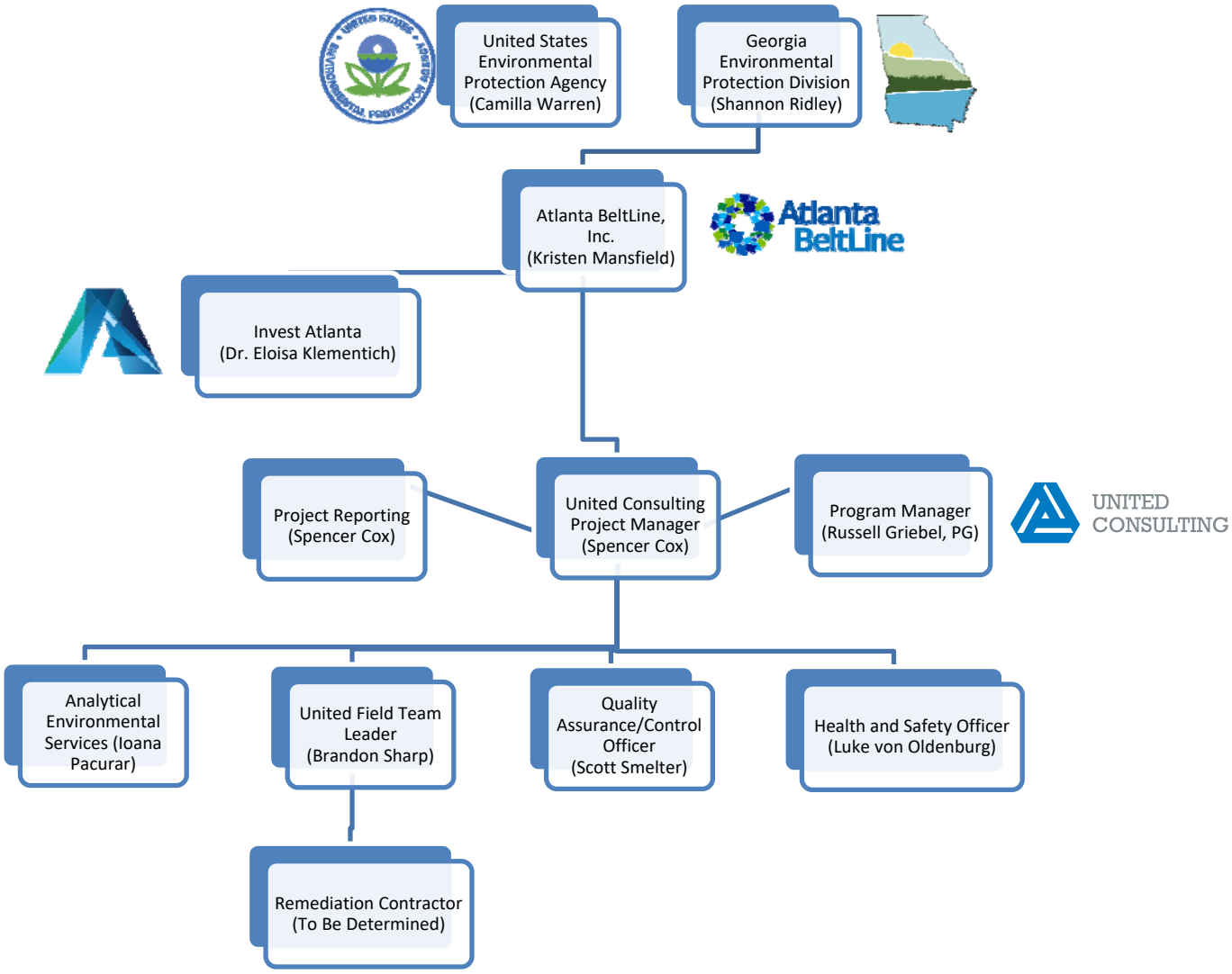
References

EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, March 2001, EPA/240/B-01/003, Guidance for Quality Assurance Project Plans, EPA QA/G-5, December 2002, EPA/240/R-02/009 (Available from EPA's Website: http://www.epa.gov/quality)

APPENDIX B

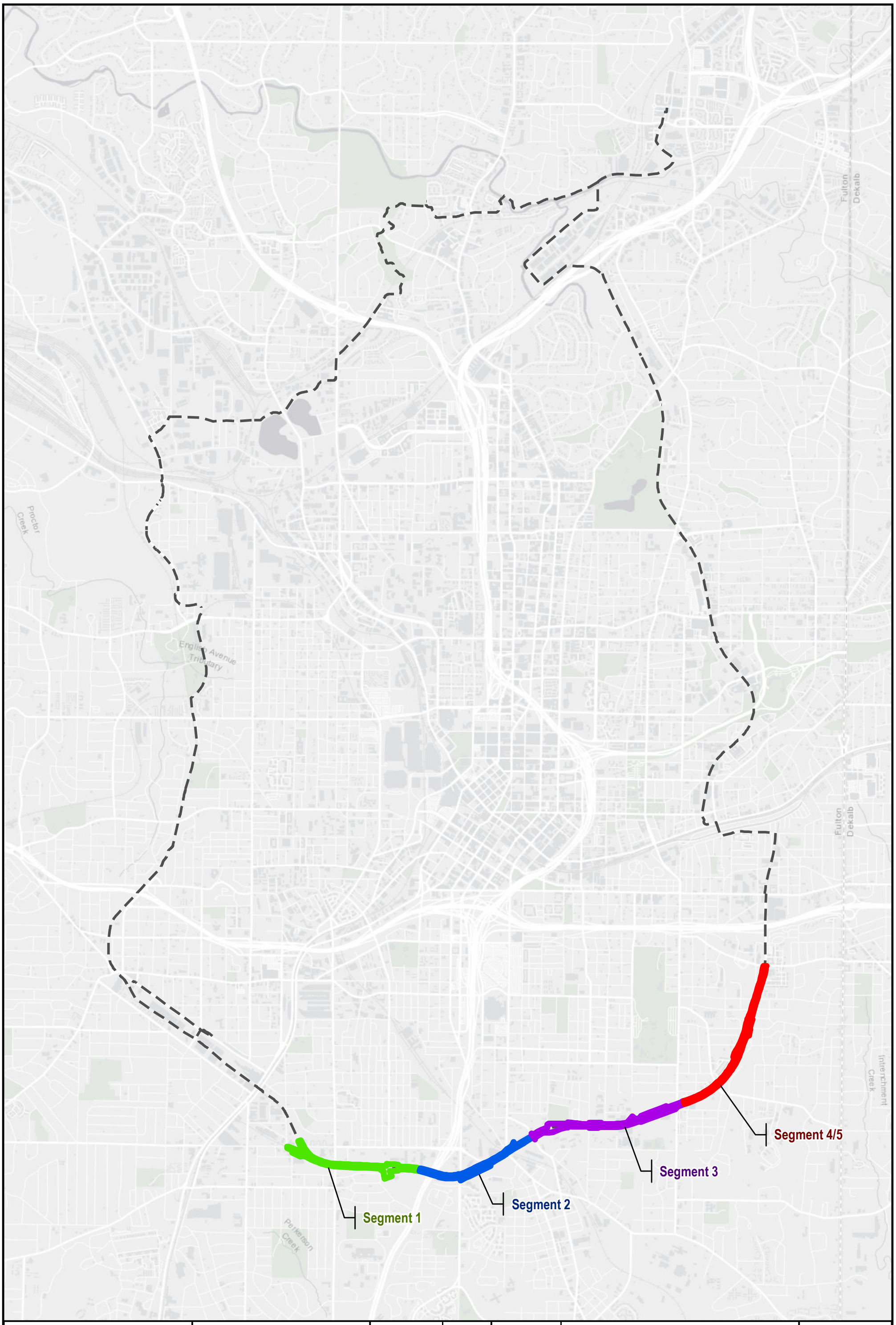
Project Organization Chart

Site Specific Quality Assurance Project Plan Organization Chart



APPENDIX C

Figures and Exhibits



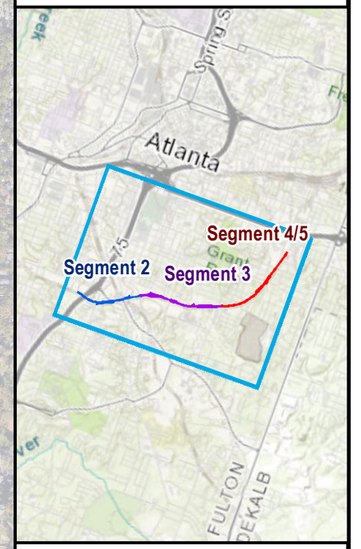
UNITED CONSULTING	**Figure Scale** N 0 1,500 3,000 1 inch = 3,000 feet	**Prepared:**	SCC	**Title:**	Segment Location Overview - Street Map
		Checked:	BWS	**Project:**	Atlanta BeltLine – Southside Trail
				Project No.	20-GA-01192-13
		Date:	1/14/21	**Client:**	Kimley-Horn

FIG. 1

Remediation Area 62
Remediation Area 61
Segment 4/5
Remediation Area 60
Remediation Area 59
Remediation Area 58
Remediation Area 57
Remediation Area 56
Remediation Area 55
Remediation Area 54
Remediation Area 53
Remediation Area 52
Remediation Area 50
Remediation Area 48
Remediation Area 46
Remediation Area 7
Remediation Area 41
Remediation Area 42
Remediation Area 43
Remediation Area 40
Remediation Area 39
Remediation Area 5
Remediation Area 44
Remediation Area 45
Segment 3
Remediation Area 47
Remediation Area 49
Remediation Area 51
Remediation Area 6
Remediation Area 37
Remediation Area 3
Remediation Area 2
Remediation Area 38
Remediation Area 32
Remediation Area 31
Remediation Area 35
Remediation Area 29
Remediation Area 35
Remediation Area 36
Segment 2
Remediation Area 34
Remediation Area 33
Remediation Area 30

References: ESRI, Google Earth dated 2019, and Trimble Geo X7.

Map Index



Legend

- Segment 2
- Segment 3
- Segment 4-5
- Proposed Remedial Area

UNITED CONSULTING

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Project:
Atlanta BeltLine – Southside Trail

Client:
Kimley-Horn

Sheet Title: Remediation Areas Overview Aerial

Scale: N 0 250 500 1,000
1 inch = 1,000 feet

Prepared:	S. Cox
Checked:	B. Sharp
Date:	Jan 14, 2021
Project No.	20-GA-01192-11

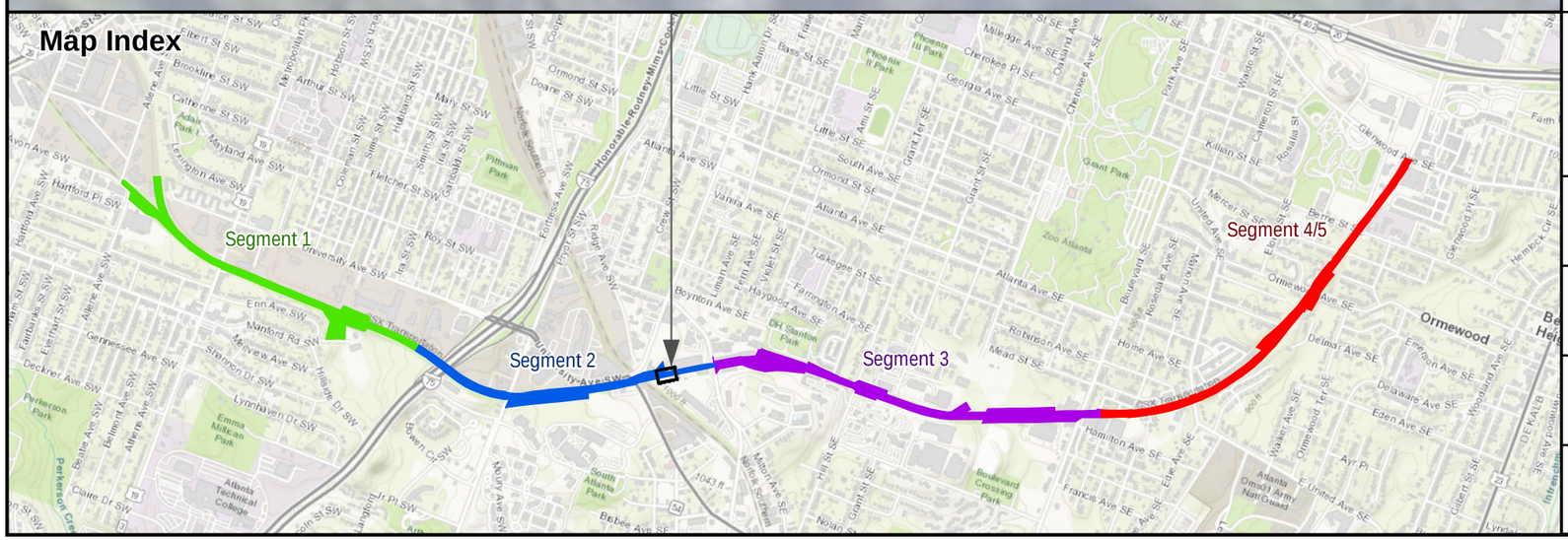
Figure 2

Extent View

Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Remedial Photograph

Map Index



Summary Notes & Legend

Estimated Cubic Yards (Proposed): 42.4 yd³

Approx. Station Number: 182+95

Constituents of Concern: Arsenic, B[a]P, B[b]F

Proposed Depth of Excavation: 3.00 ft bgs

Measured Depth of Excavation (Center): 3.12 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Actual Remedial Limits
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

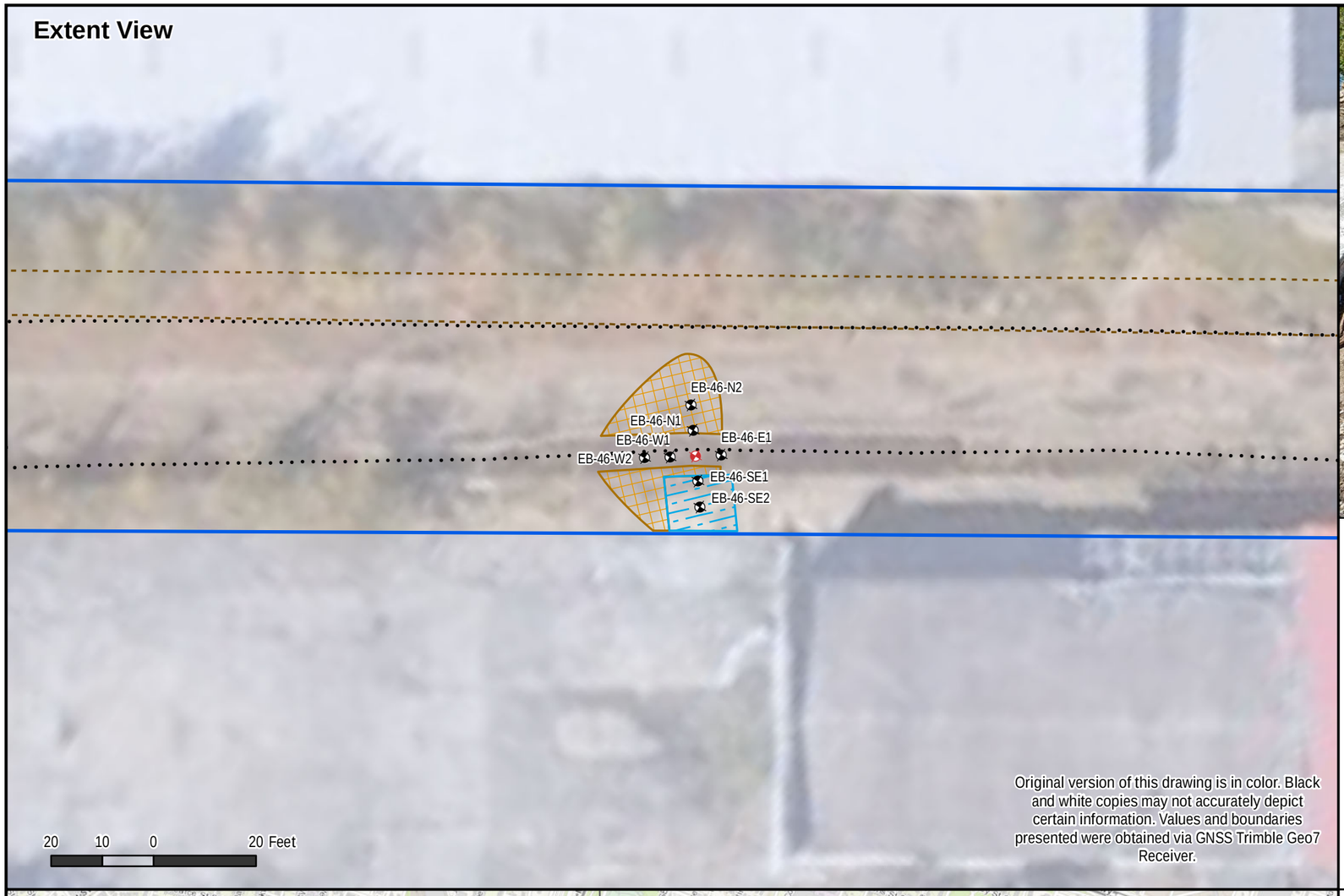
Remediation Area 2

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 1

Extent View



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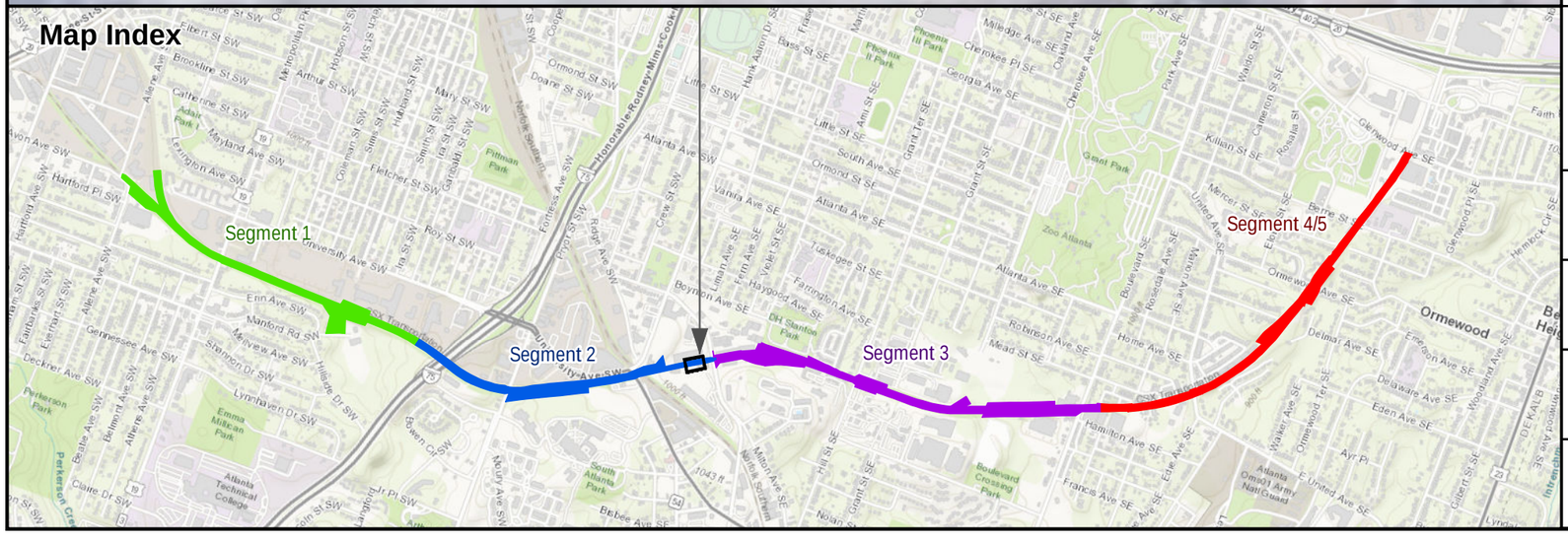
Remedial Photograph

Map Index



Summary Notes & Legend

Estimated Cubic Yards (Proposed): 34.4 yd³

Approx. Station Number: 187+00

Constituents of Concern: Arsenic, B[a]P

Proposed Depth of Excavation: 2.50 ft bgs

Measured Depth of Excavation (Center): 2.64 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Actual Remedial Limits
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

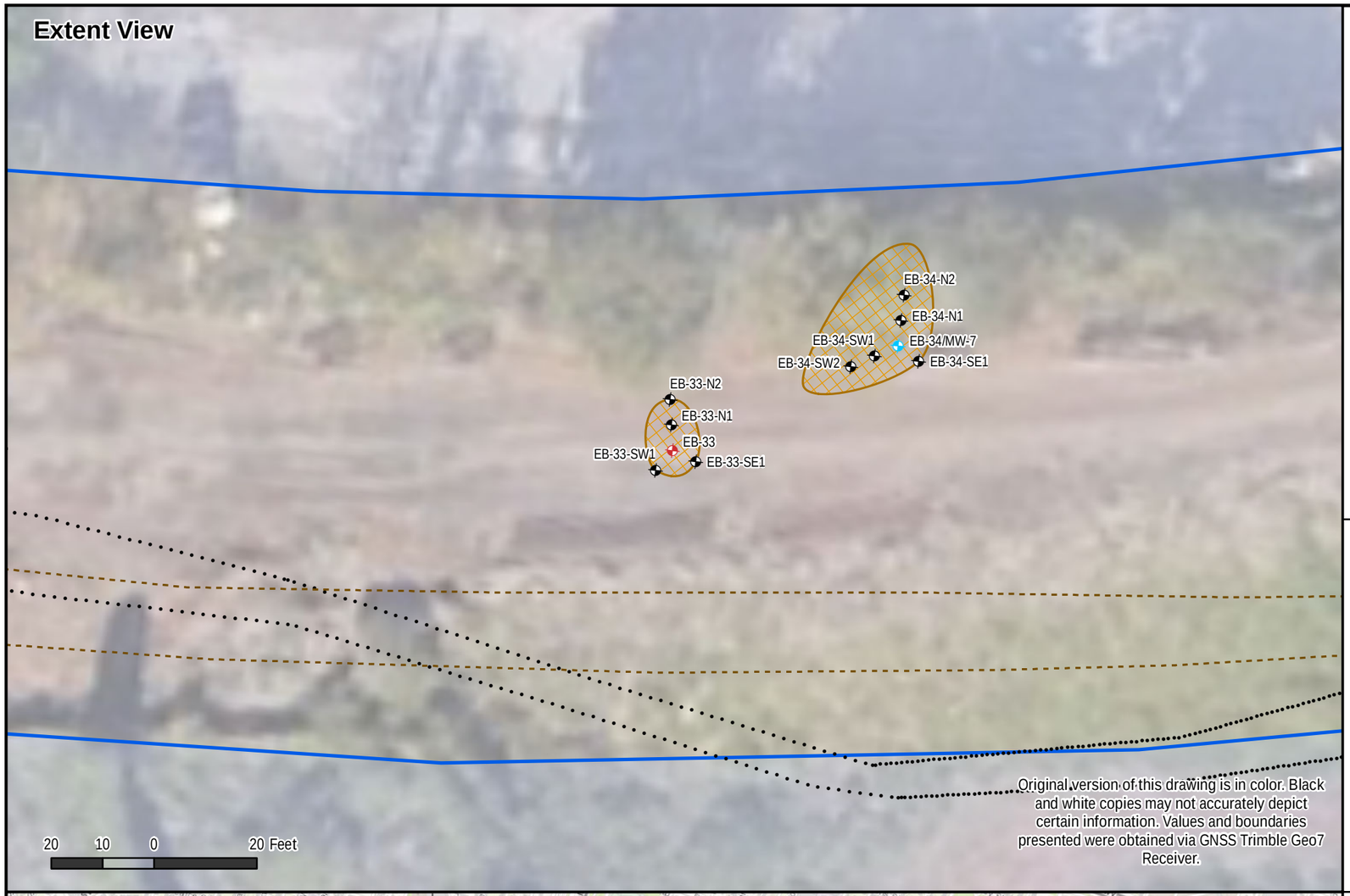
Remediation Area 3

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 2

Extent View



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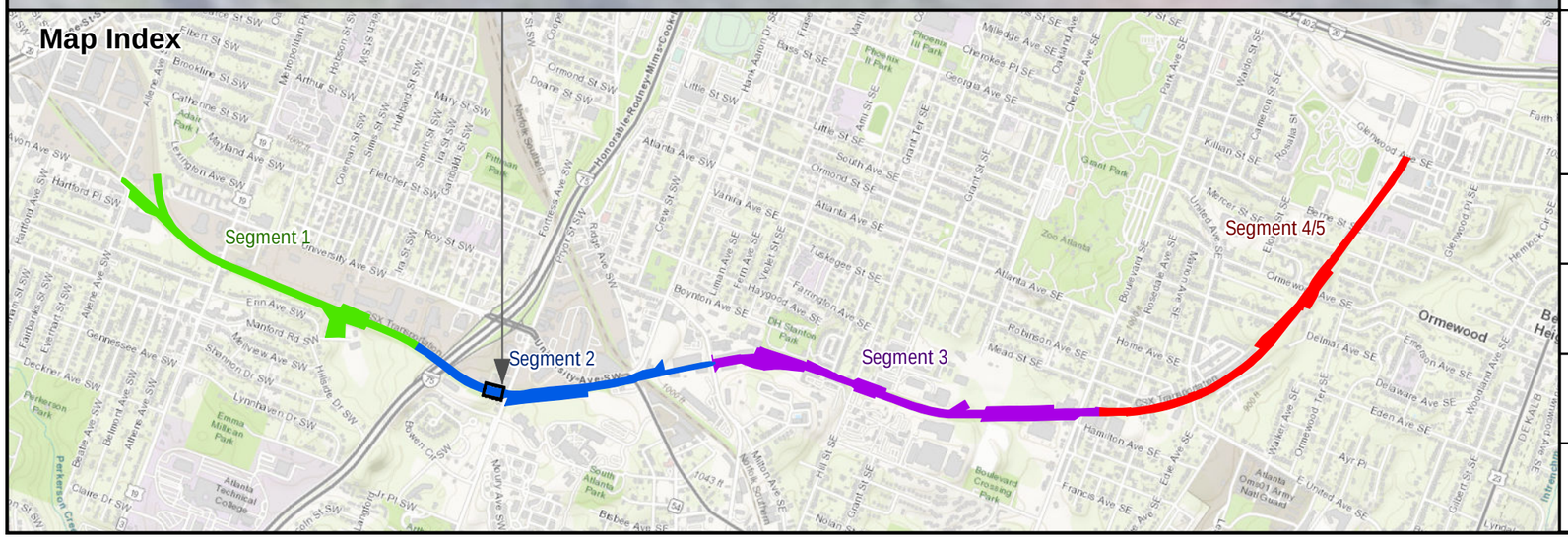
Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 14.1 yd³

Approx. Station Number: 158+77

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 3.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

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770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

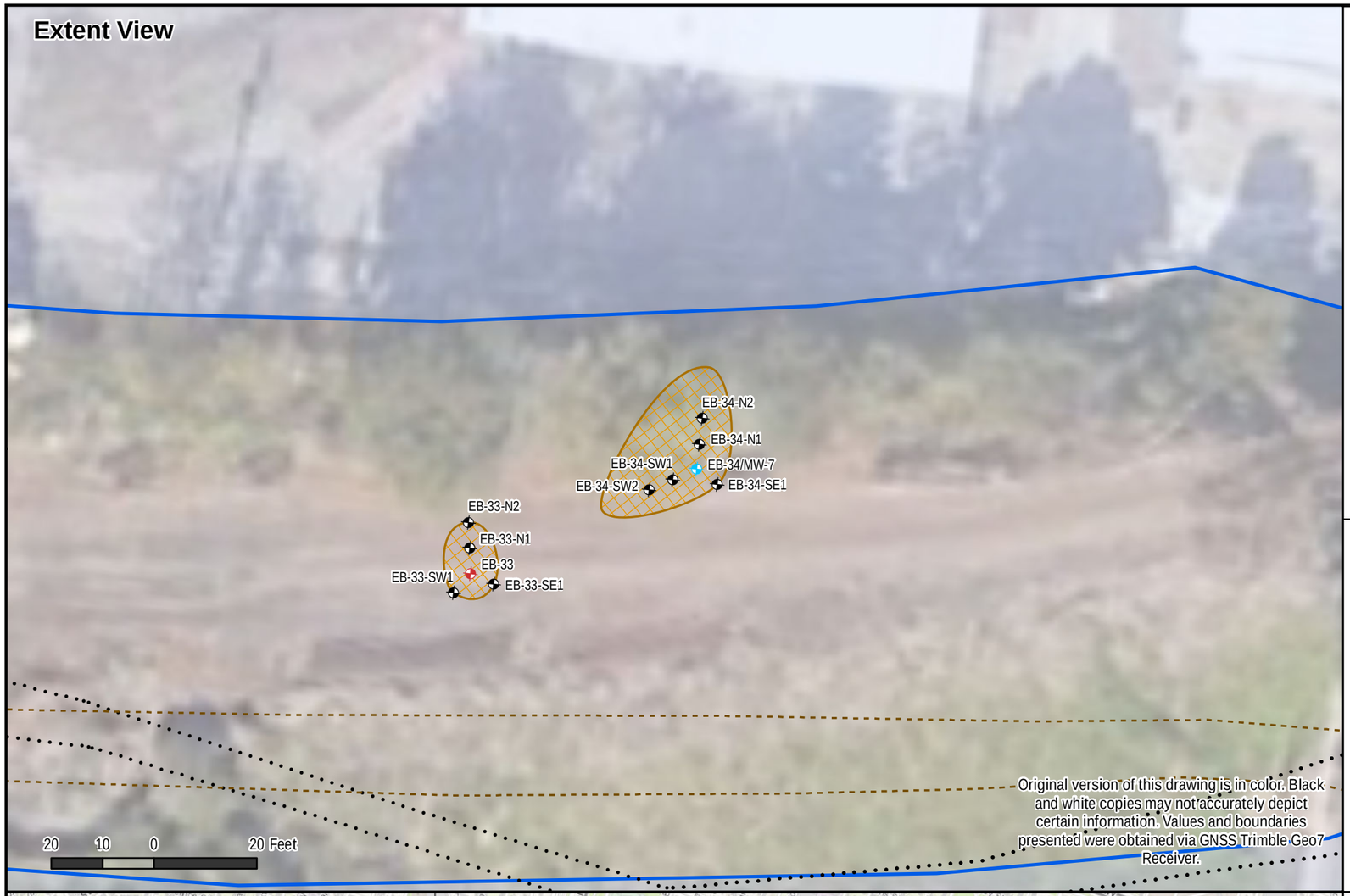
Remediation Area 29

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

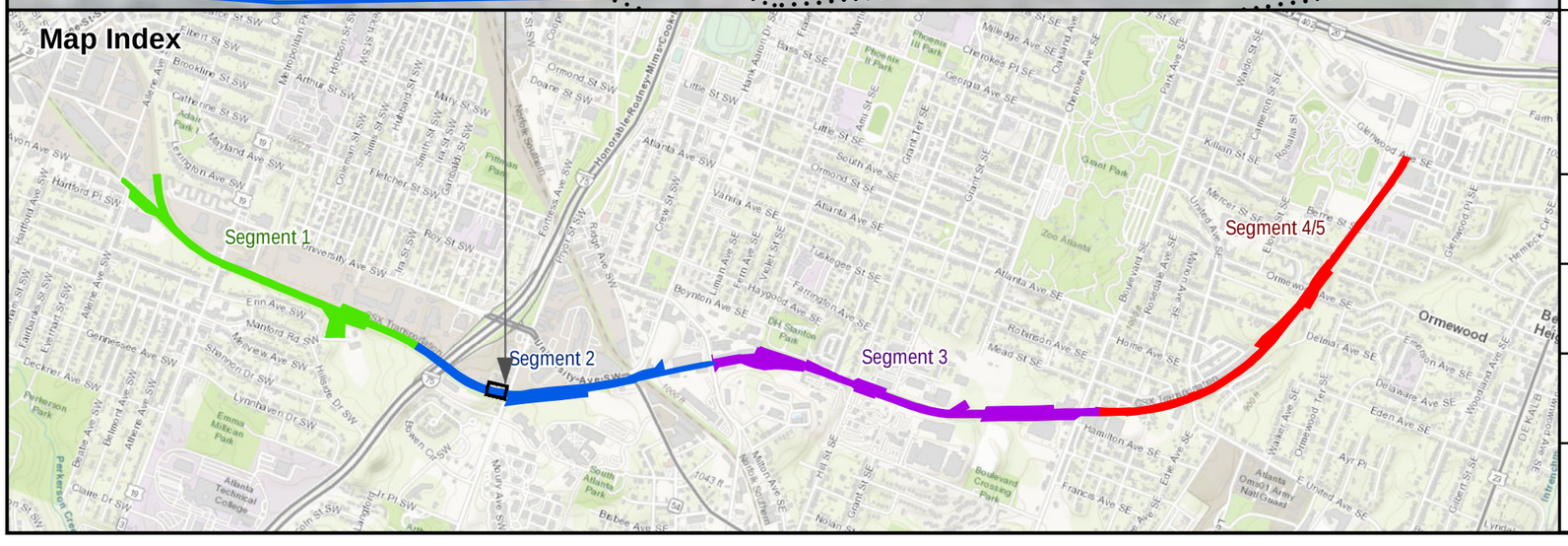
Exhibit 3

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 36.3 yd³

Approx. Station Number: 159+14

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

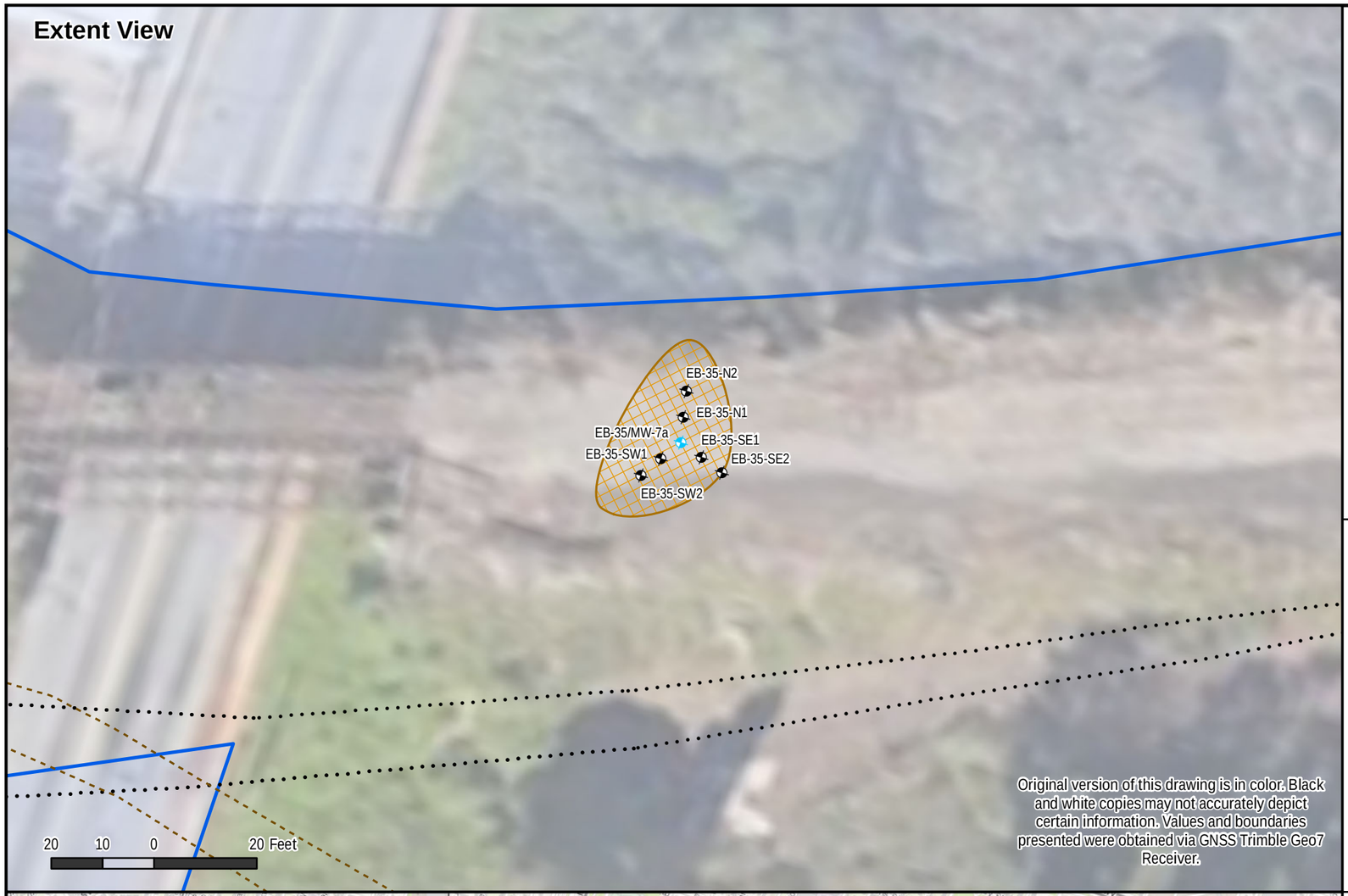
Remediation Area 30

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

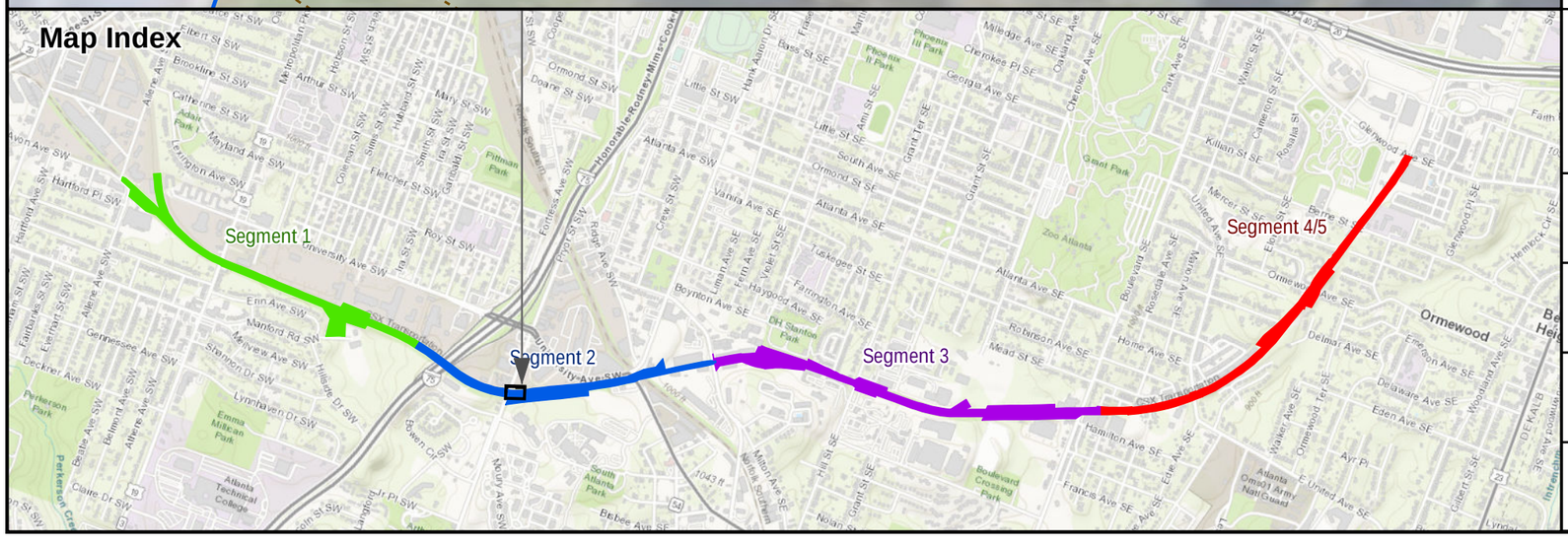
DRAWING NUMBER

Exhibit 4

Extent View



Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 45.9 yd³

Approx. Station Number: 161+69

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

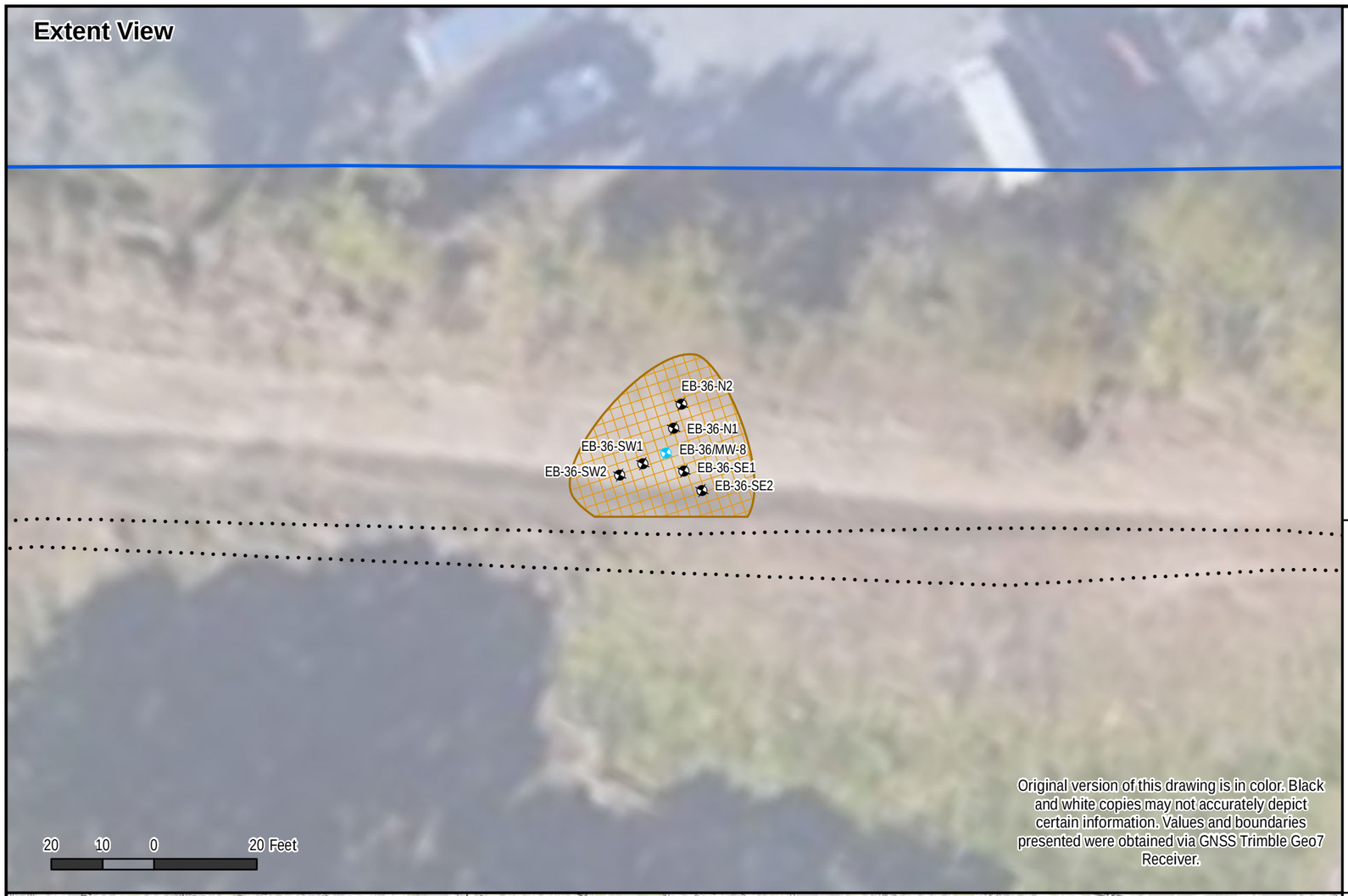
Remediation Area 31

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 5

Extent View



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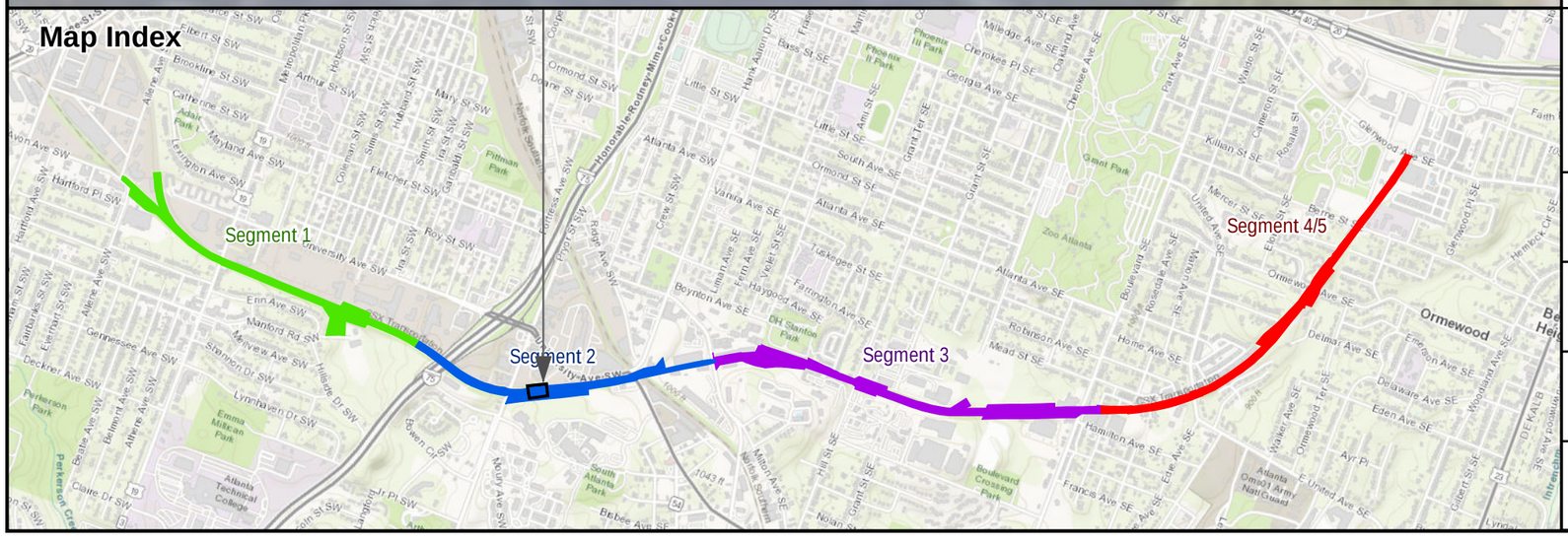
Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 63.3 yd³

Approx. Station Number: 164+80

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

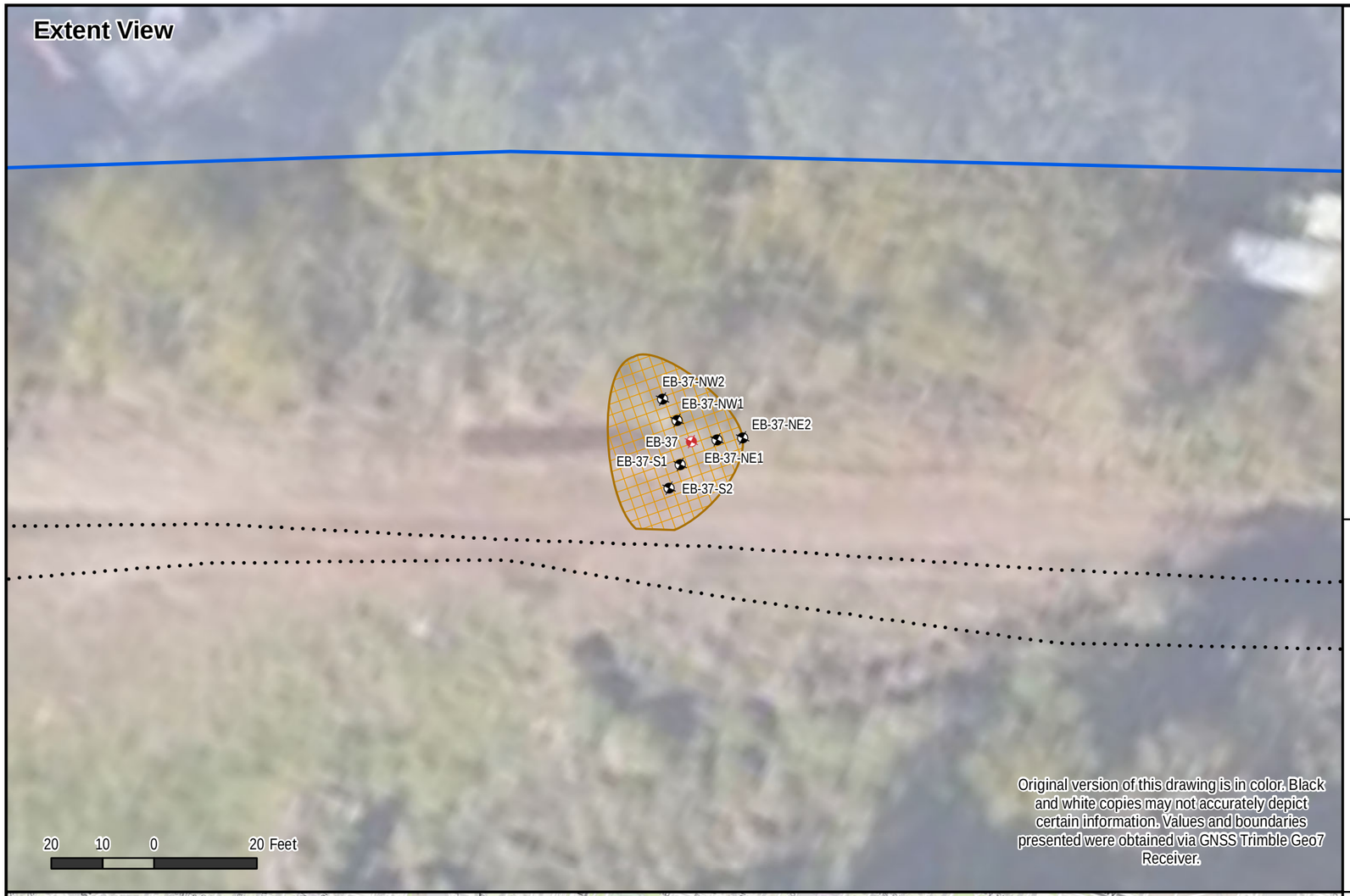
Remediation Area 32

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

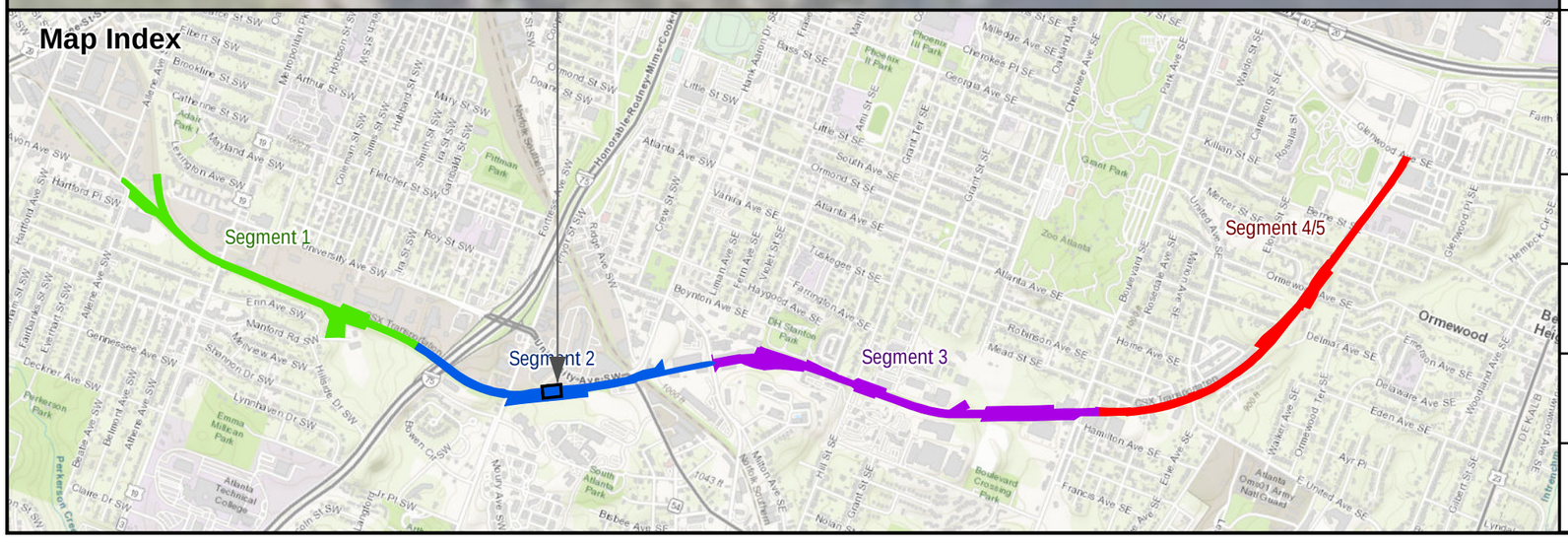
DRAWING NUMBER

Exhibit 6

Extent View



Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 75.1 yd³

Approx. Station Number: 166+94

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 3.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 33

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 7

Extent View

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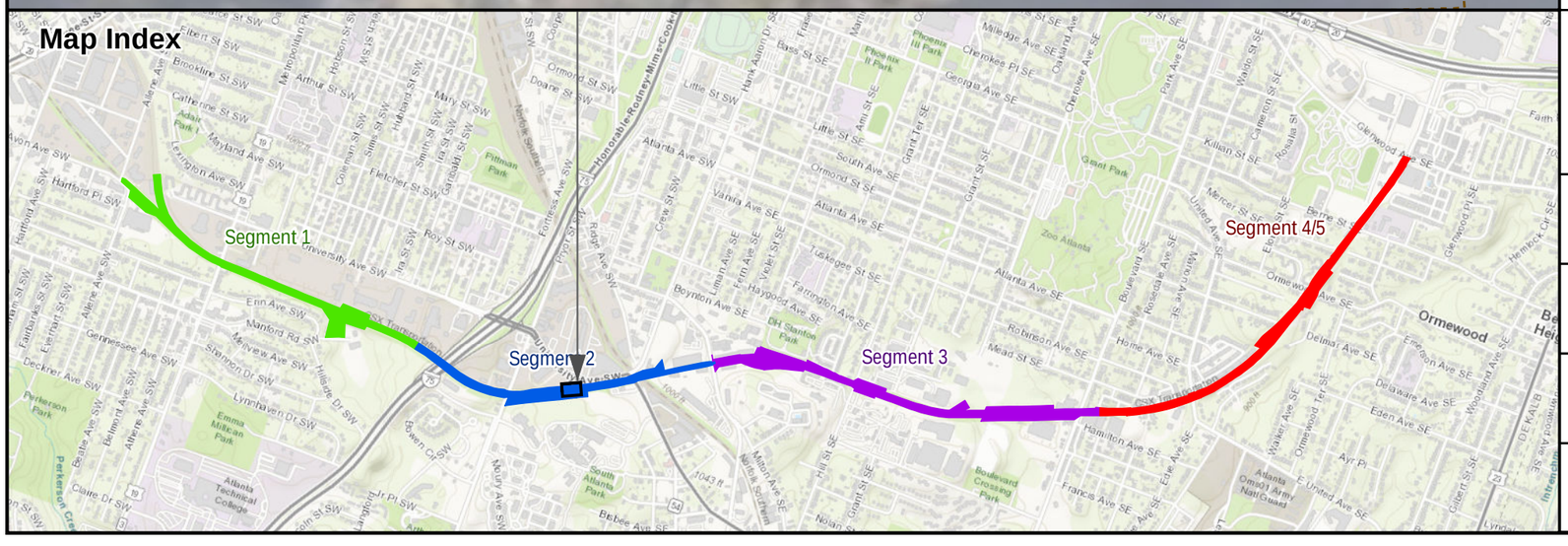
Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 22.5 yd³

Approx. Station Number: 169+63

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

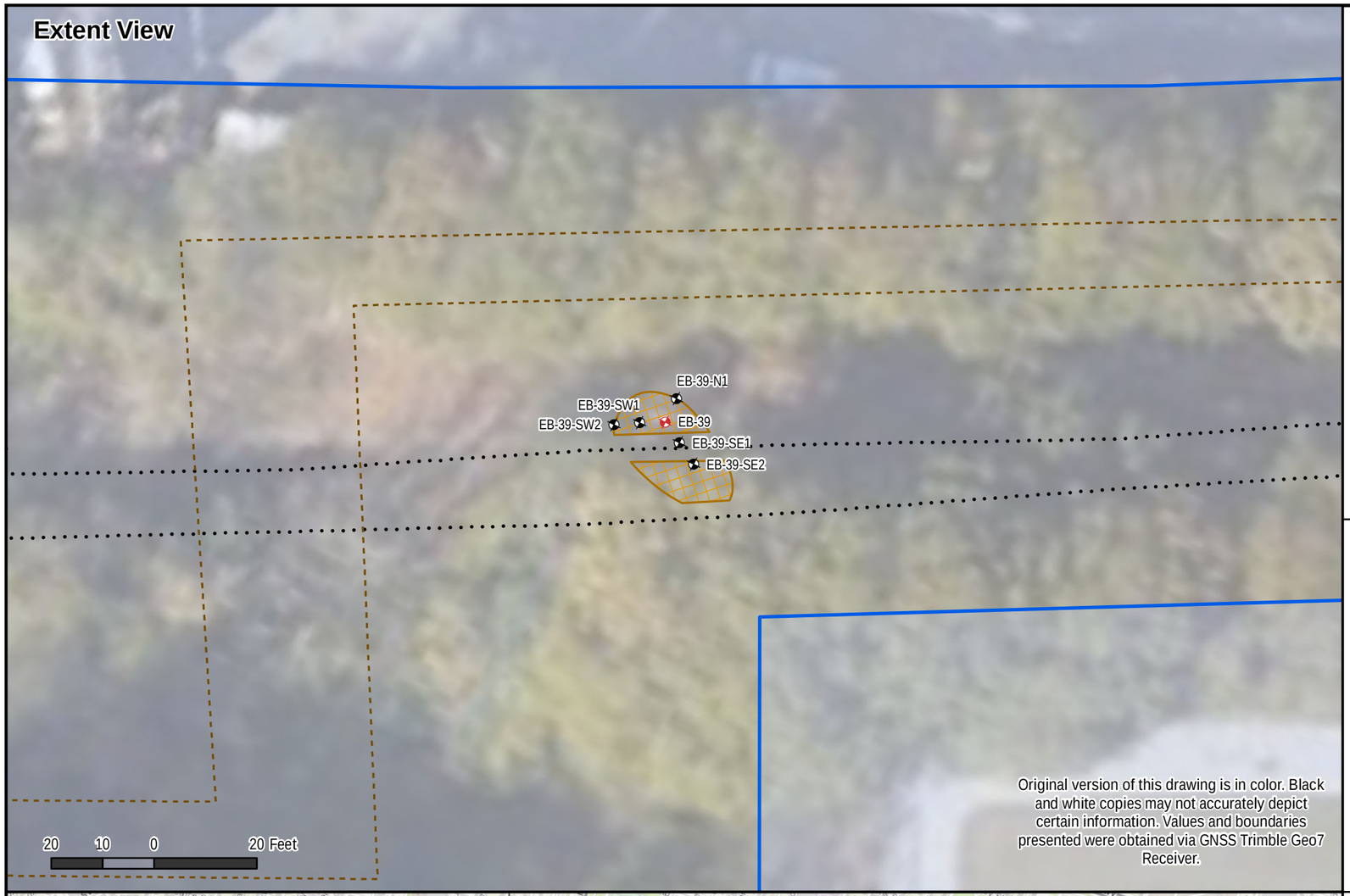
Remediation Area 34

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 8

Extent View



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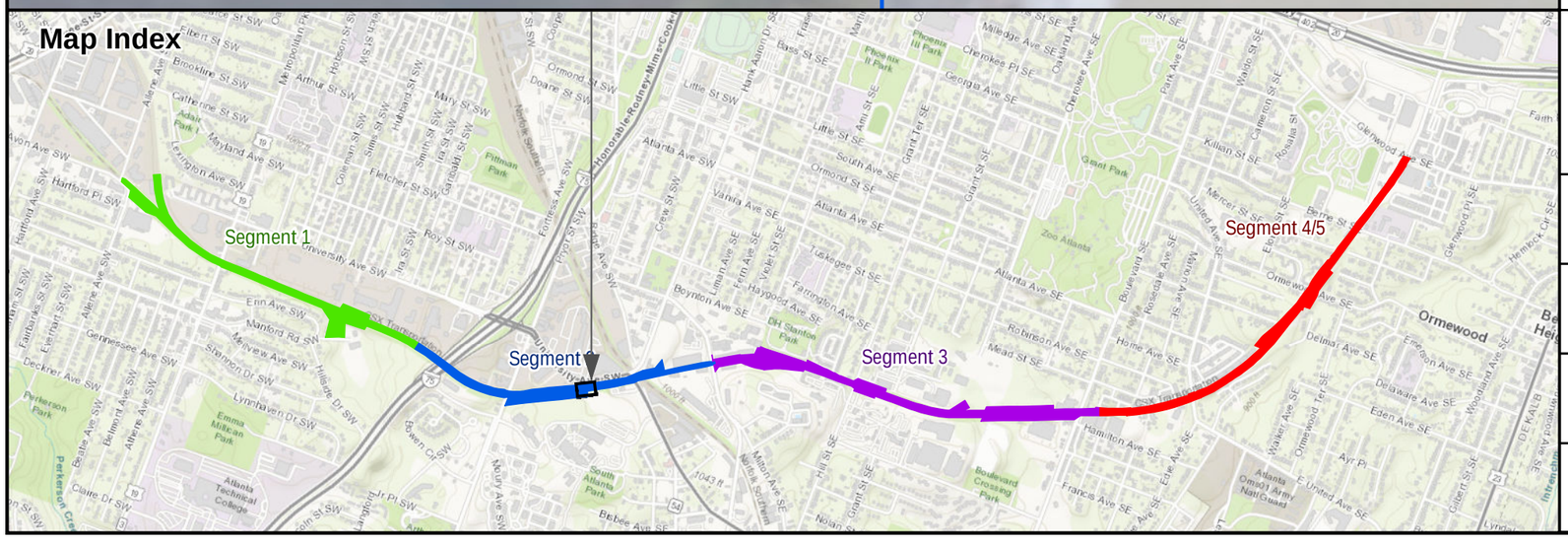
Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 30.1 yd³

Approx. Station Number: 171+65

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 3.50 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

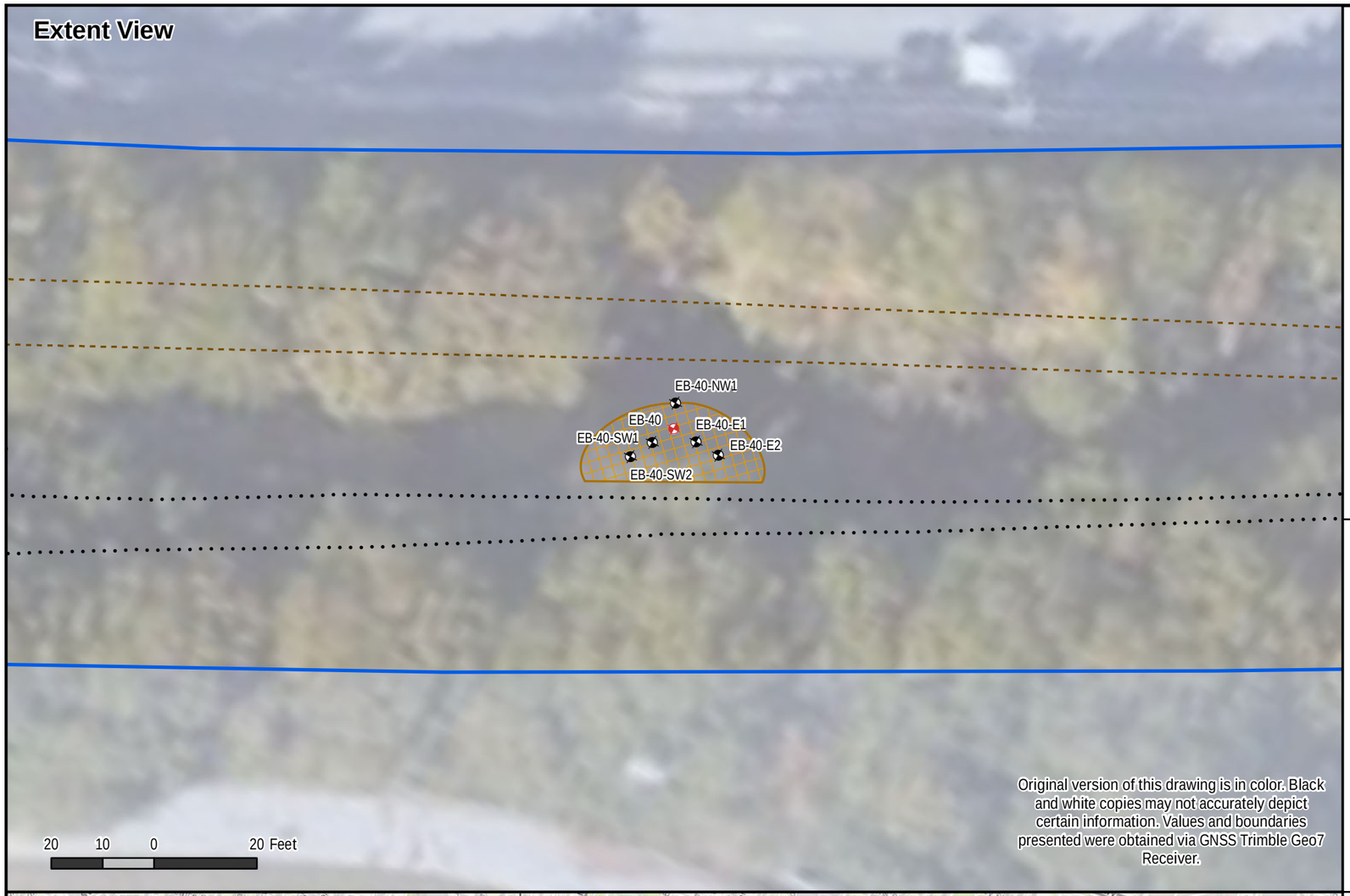
Remediation Area 35

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

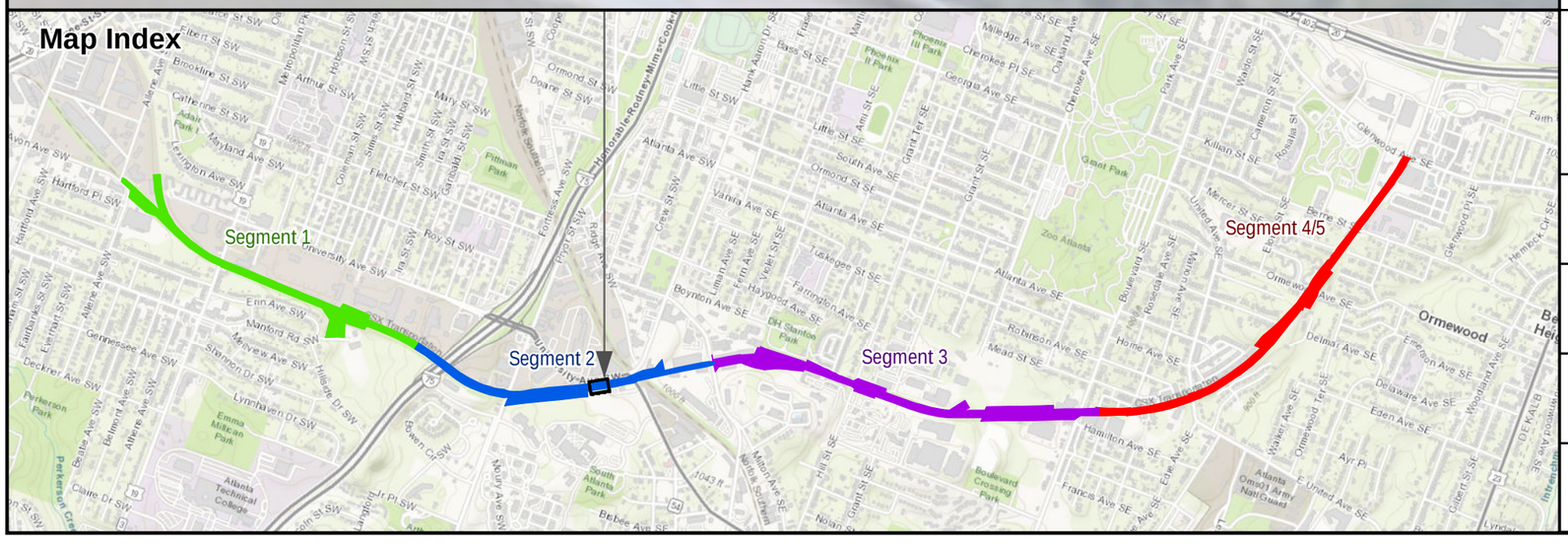
Exhibit 9

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 16.3 yd³

Approx. Station Number: 173+48

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 36

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

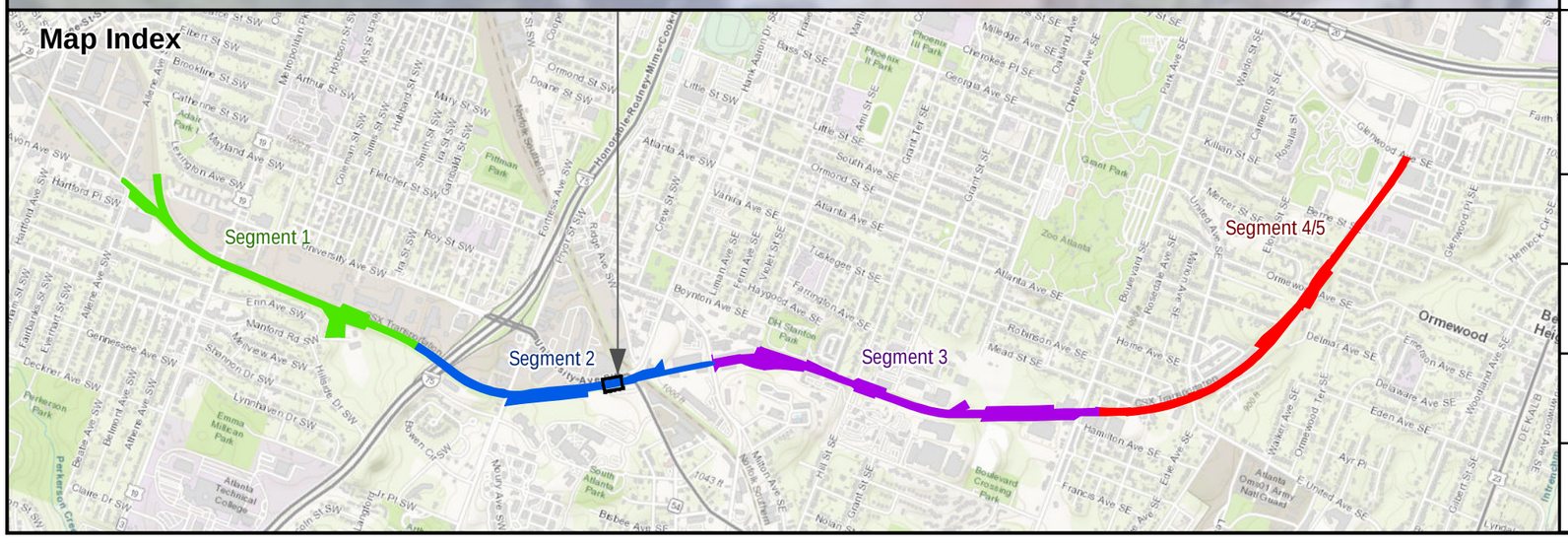
DRAWING NUMBER

Exhibit 10

Extent View

Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 3.7 yd³

Approx. Station Number: 175+42

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

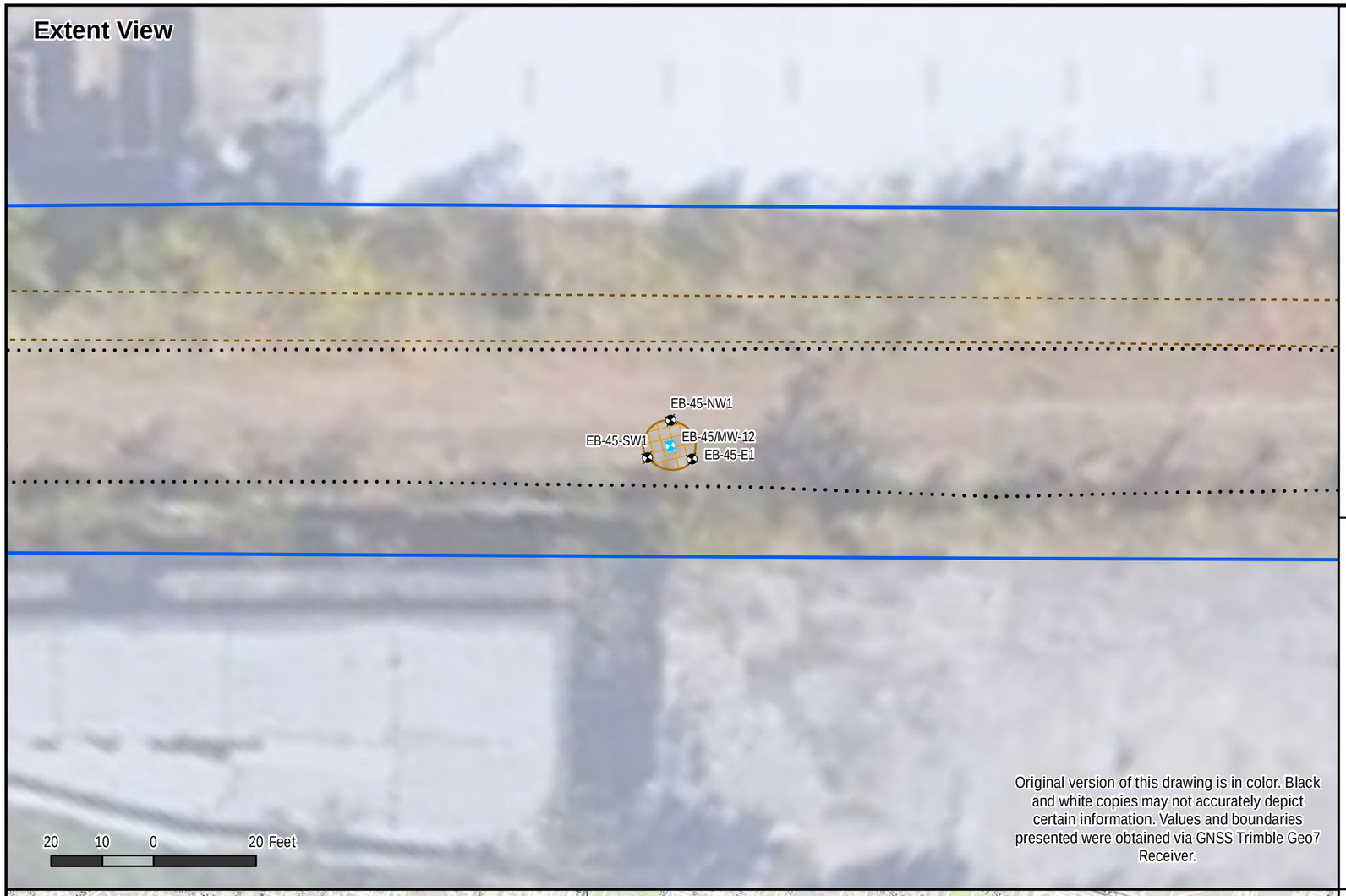
Remediation Area 37

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

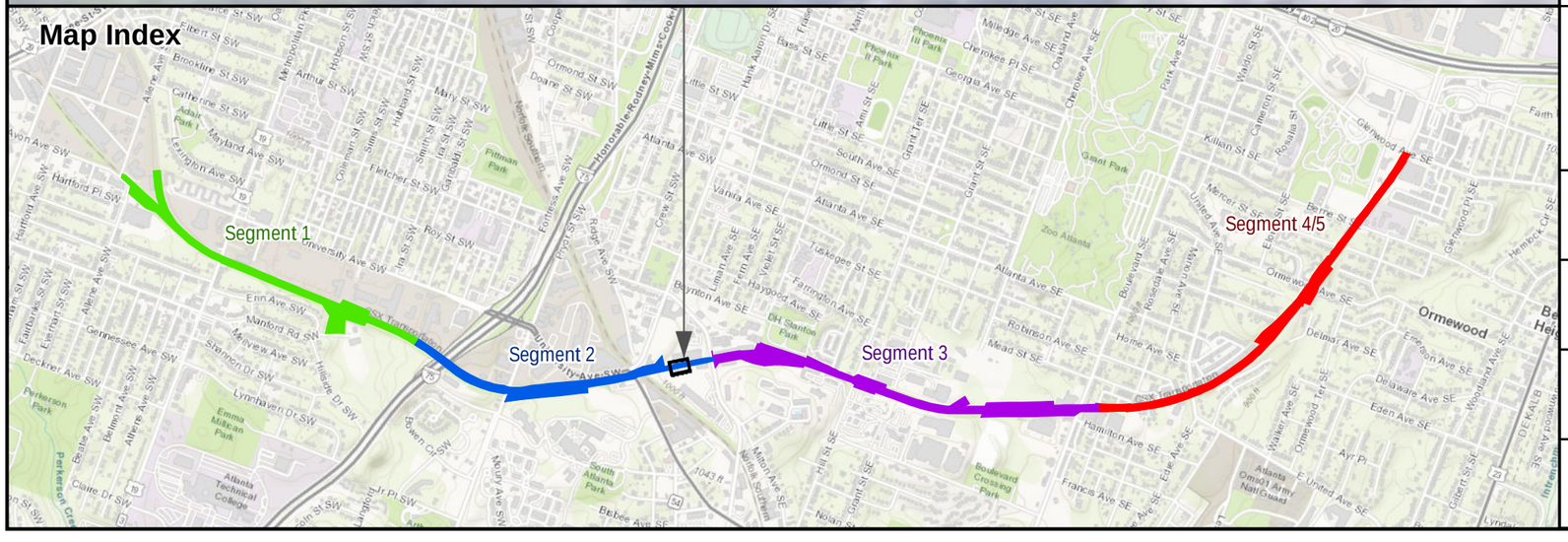
Exhibit 11

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 5.7 yd^3

Approx. Station Number: 184+94

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 2 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 2

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 38

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

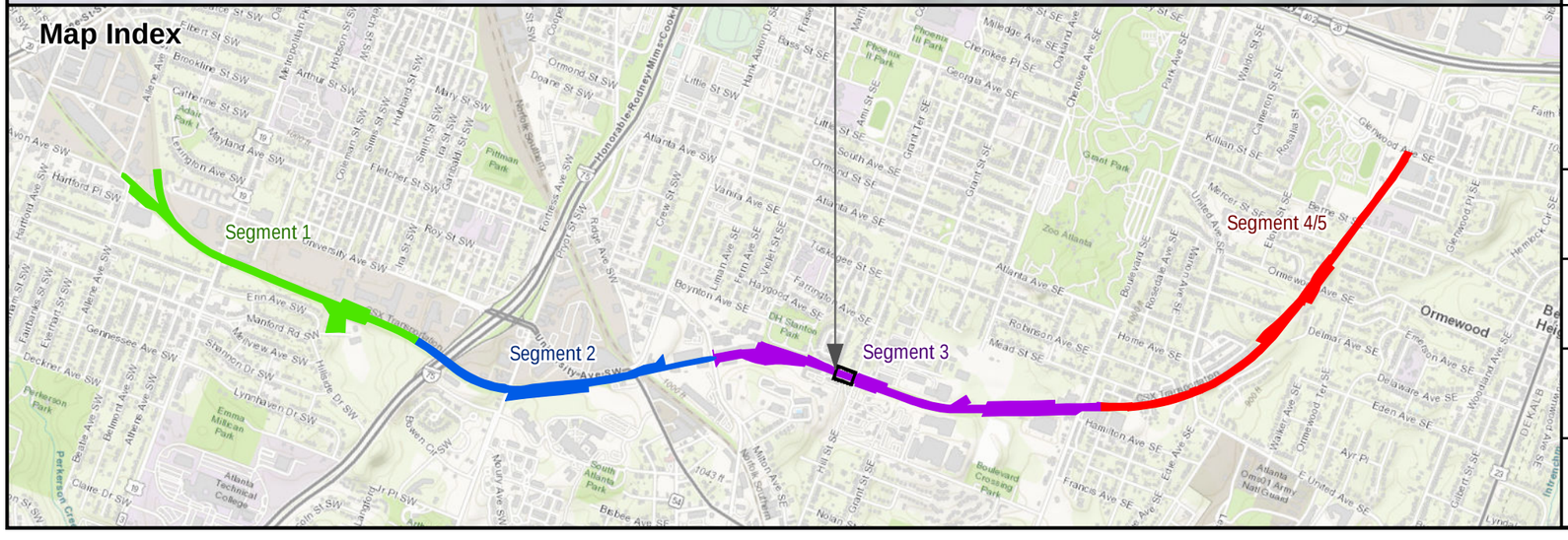
Exhibit 12

Extent View

Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Remedial Photograph

Map Index



Summary Notes & Legend

Estimated Cubic Yards (Proposed): 3.1 yd³

Approx. Station Number: 208+70

Constituents of Concern: Arsenic, Benzene

Proposed Depth of Excavation: 2.50 ft bgs

Measured Depth of Excavation (Center): 2.52 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Actual Remedial Limits
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

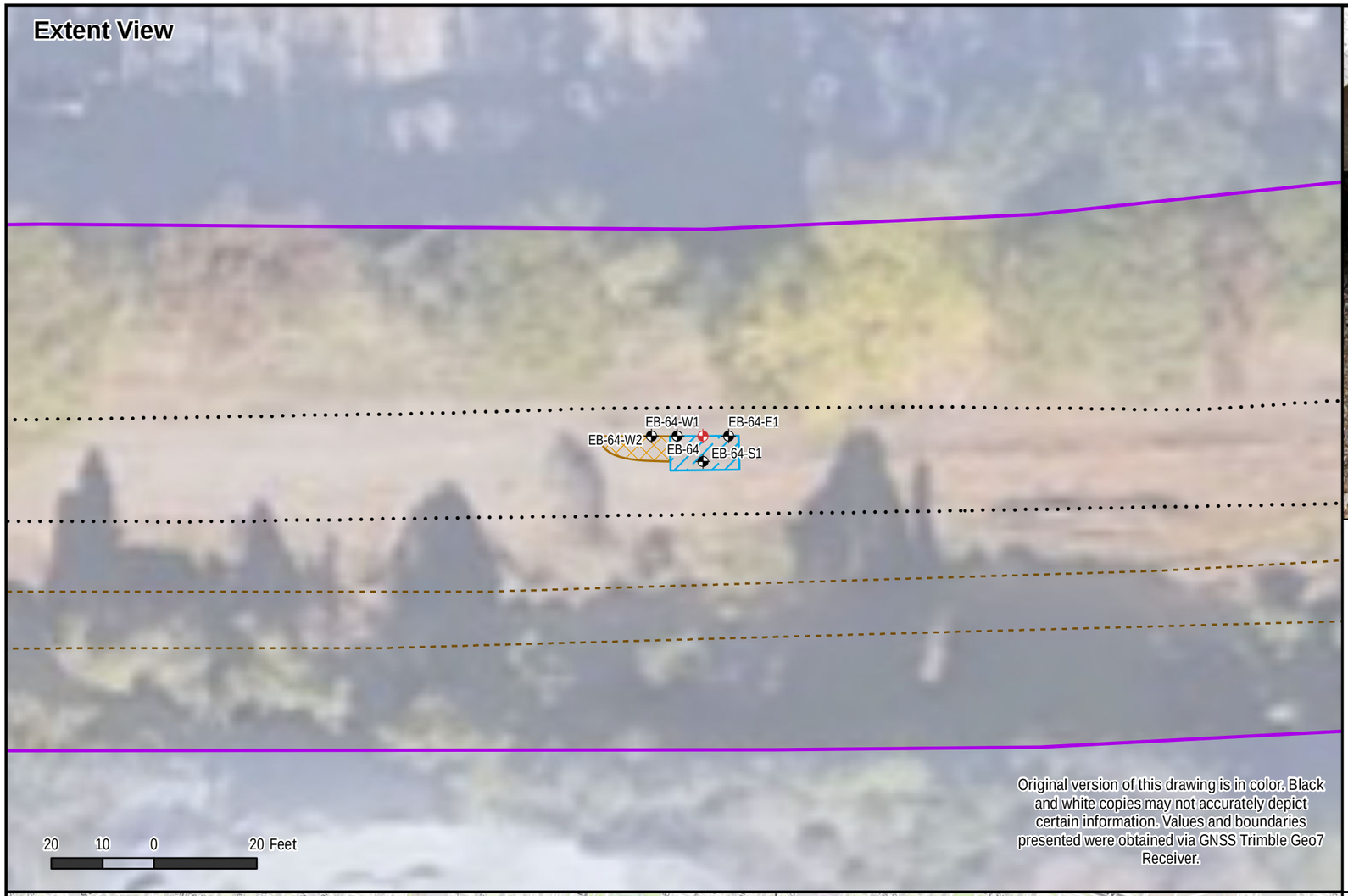
Remediation Area 5

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 13

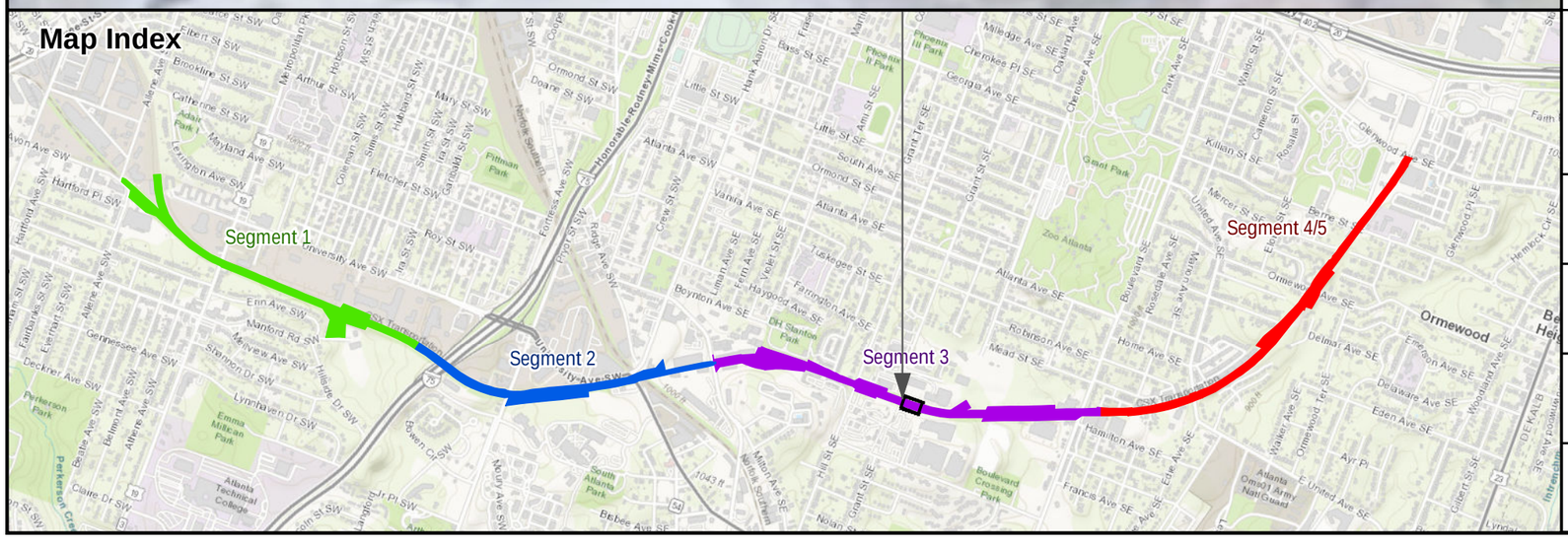
Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Remedial Photograph

Map Index



Summary Notes & Legend

Estimated Cubic Yards (Proposed): 5.4 yd³

Approx. Station Number: 218+65

Constituents of Concern: Arsenic, Benzene

Proposed Depth of Excavation: 2.50 ft bgs

Measured Depth of Excavation (Center): 2.80 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Actual Remedial Limits
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

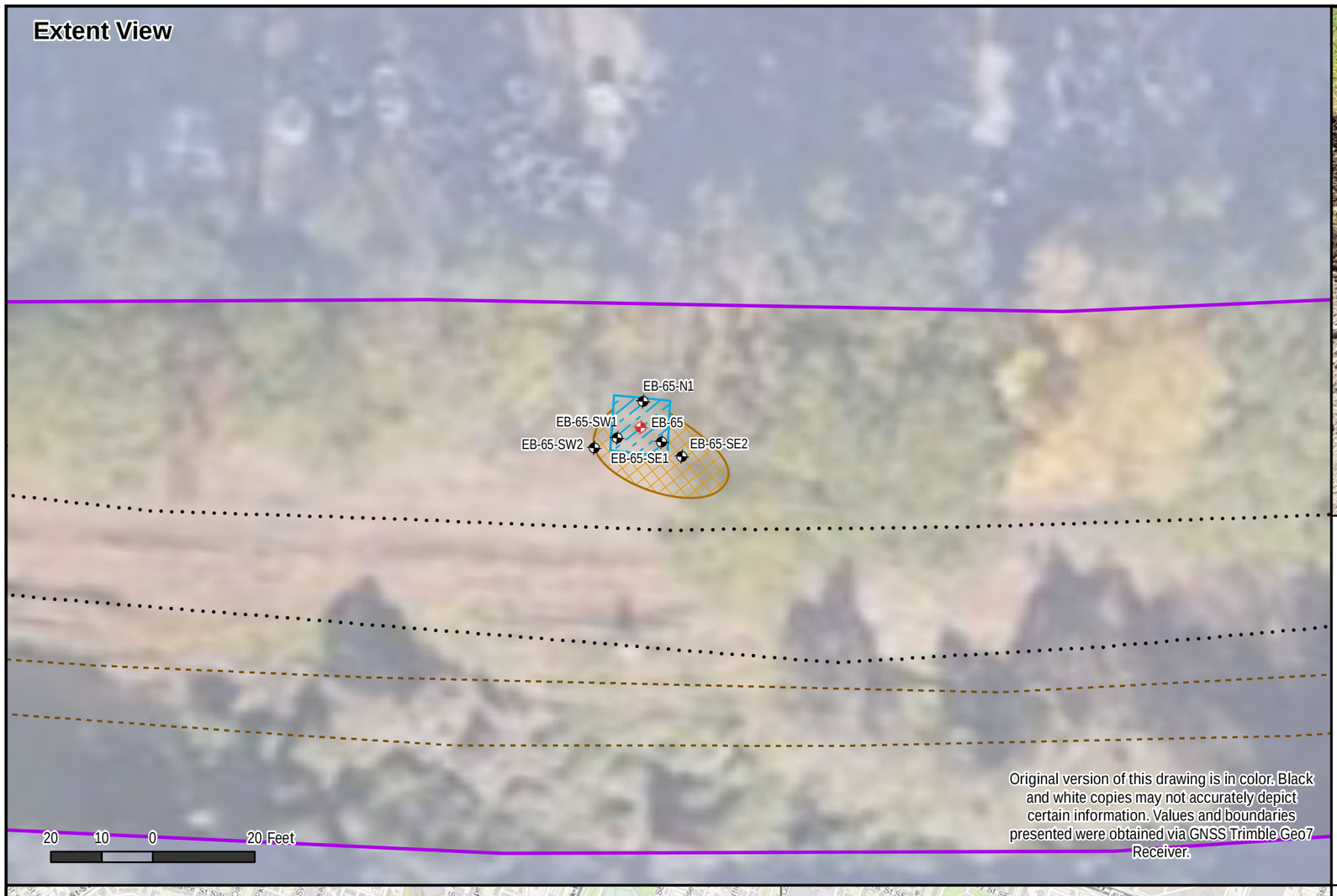
Remediation Area 6

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

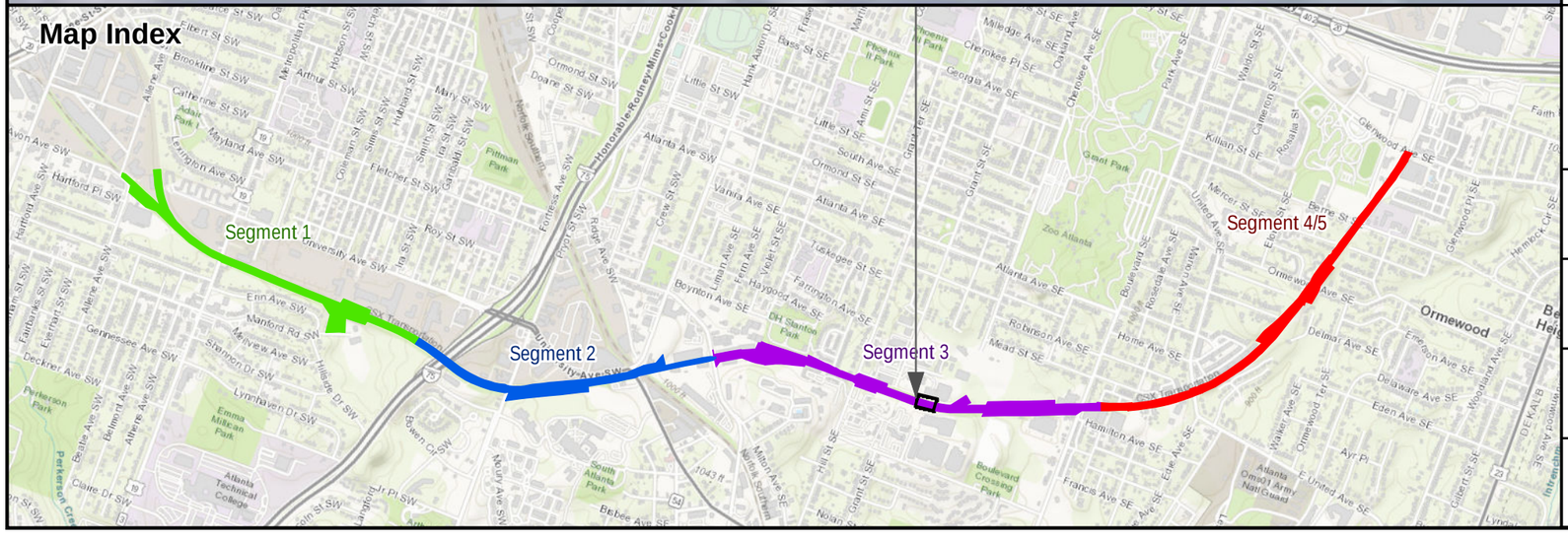
Exhibit 14

Extent View



Remedial Photograph

Map Index



Summary Notes & Legend

Estimated Cubic Yards (Proposed): 21.9 yd³

Approx. Station Number: 220+55

Constituents of Concern: Arsenic, B[a]P, B[b]F

Proposed Depth of Excavation: 2.50 ft bgs

Measured Depth of Excavation (Center): 2.82 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Actual Remedial Limits
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

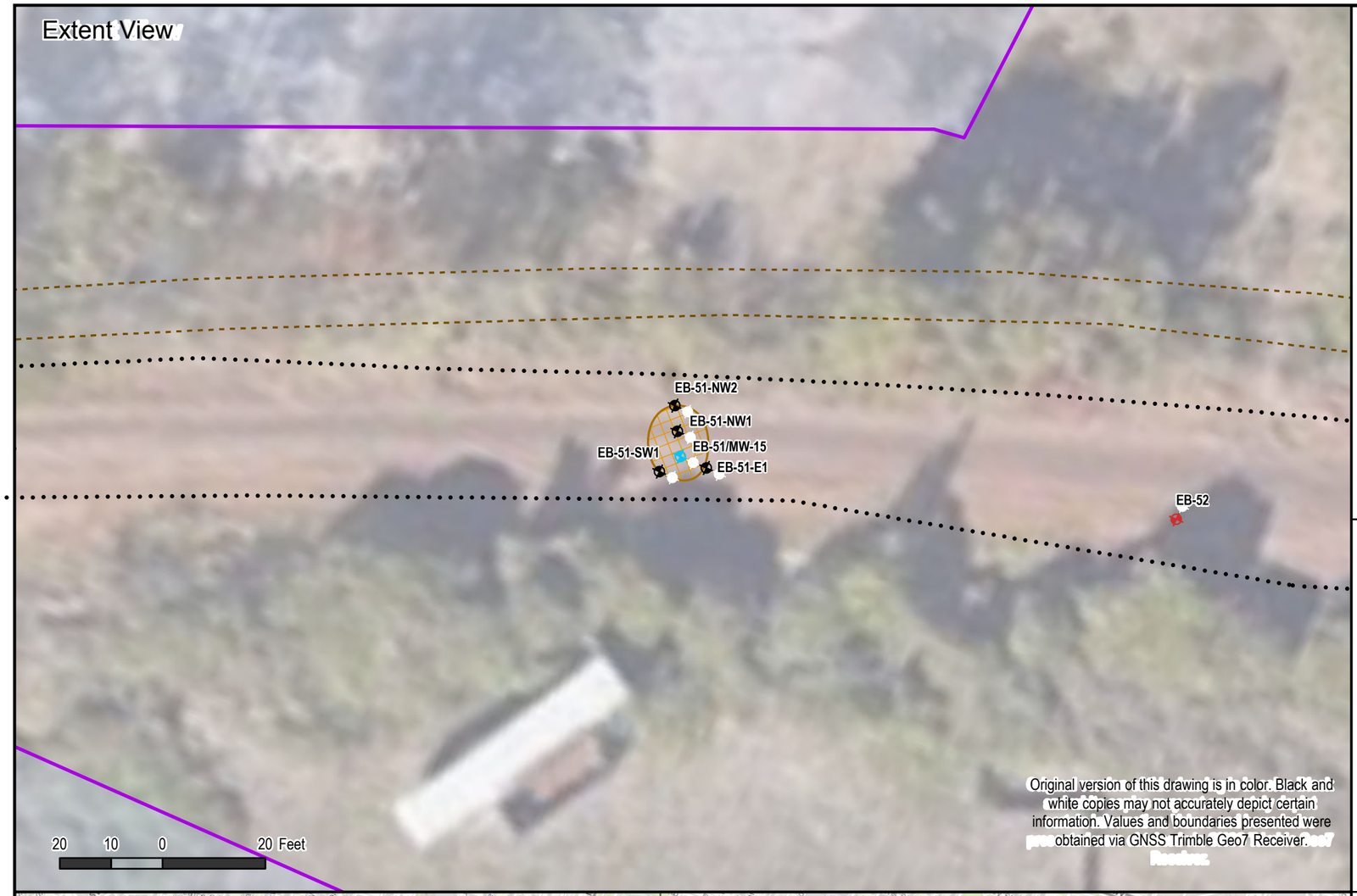
Kimley-Horn / BeltLine

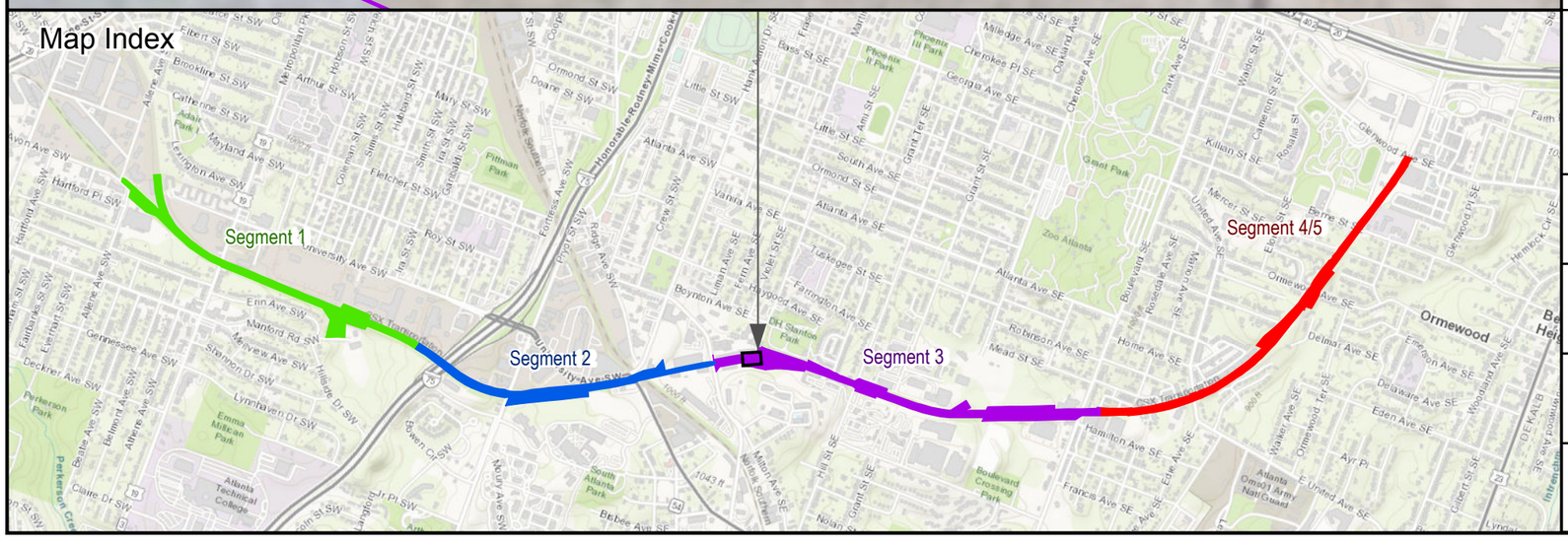
SHEET TITLE

Remediation Area 7

DRAWING NUMBER

Exhibit 15





Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 5.1 yd³ Approx.

Station Number: 194+05

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Temporary Monitoring
- Well Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber MCI/
- Verizon Utility Segment 3
- Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 39

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

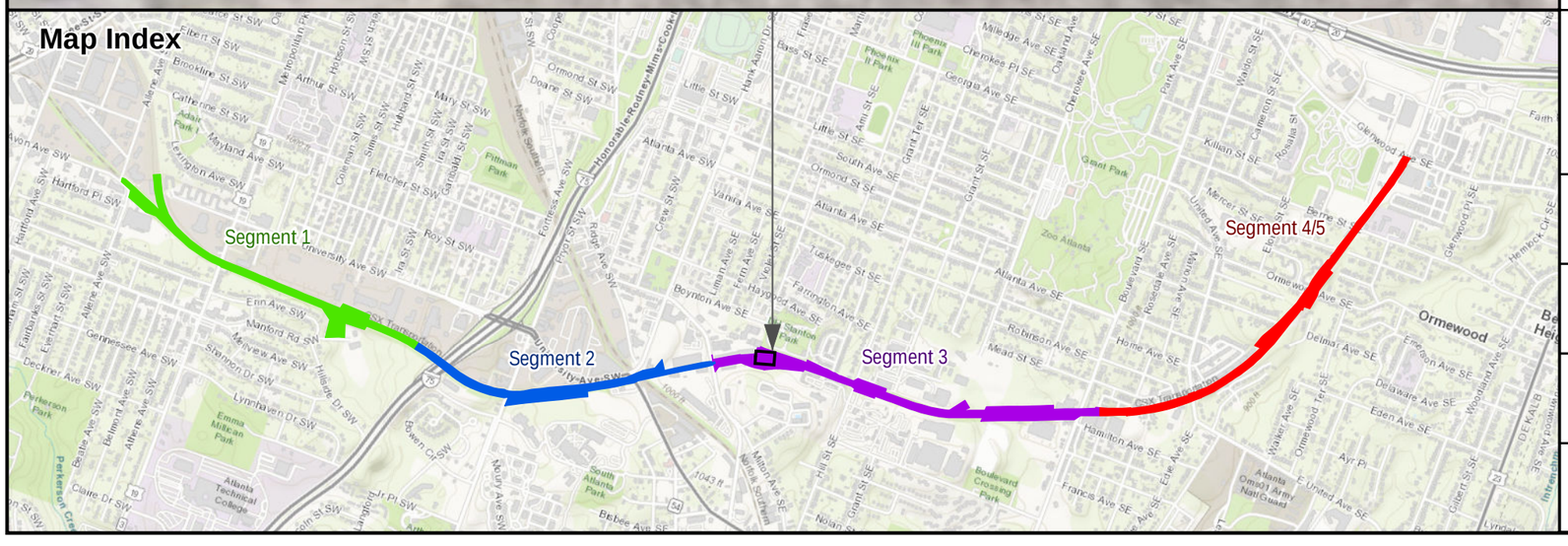
DRAWING NUMBER

Exhibit 16

Extent View

Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 19.4 yd³

Approx. Station Number: 197+05

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 3.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

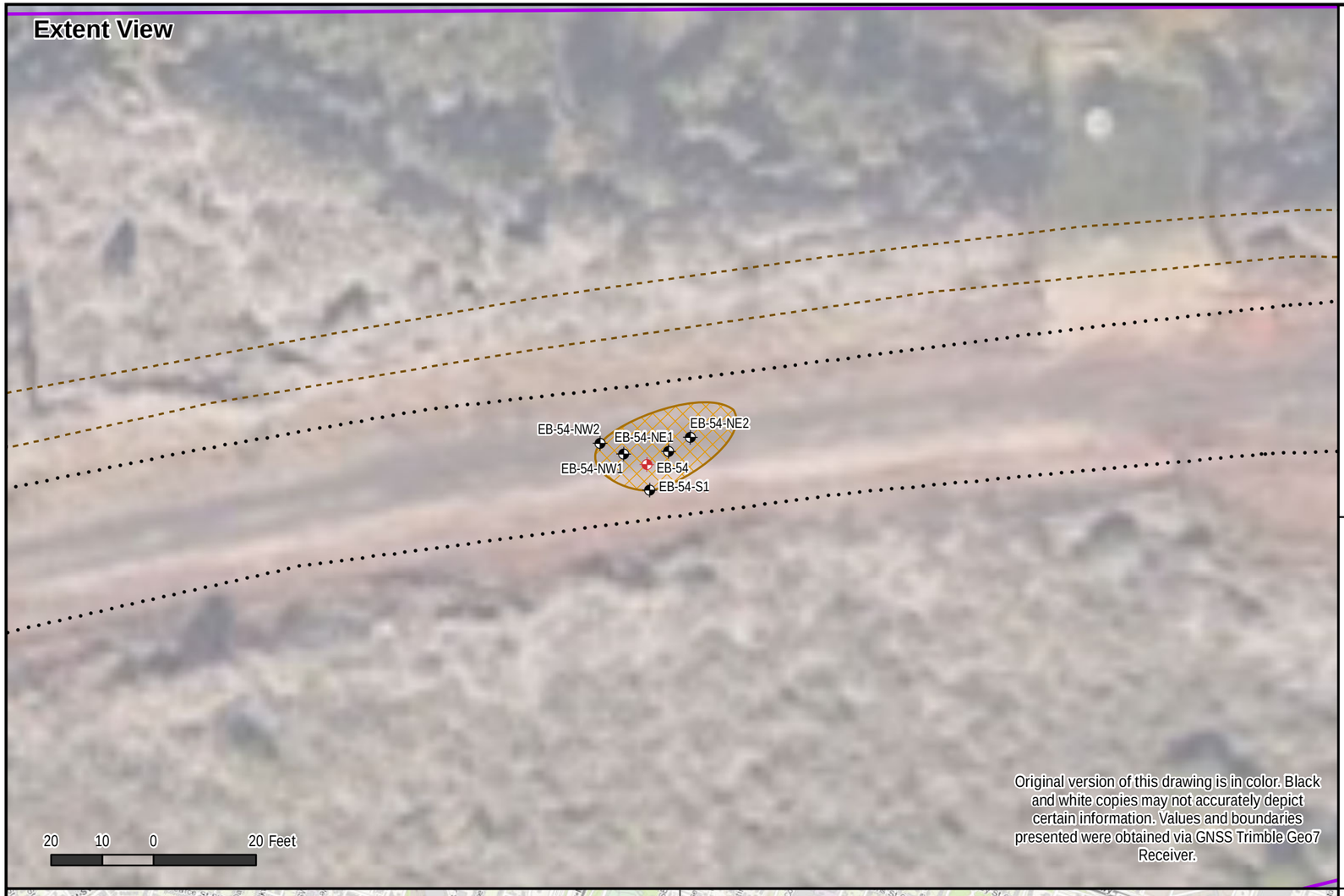
Remediation Area 40

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

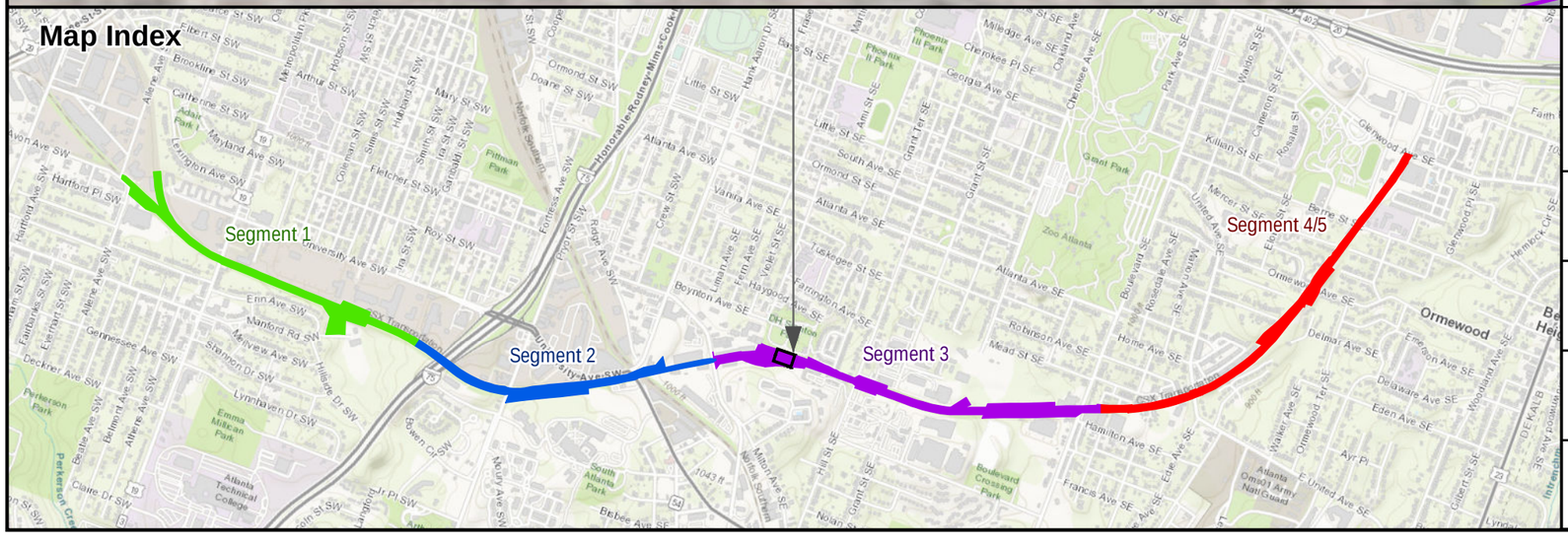
Exhibit 17

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 11.9 yd^3

Approx. Station Number: 199+70

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

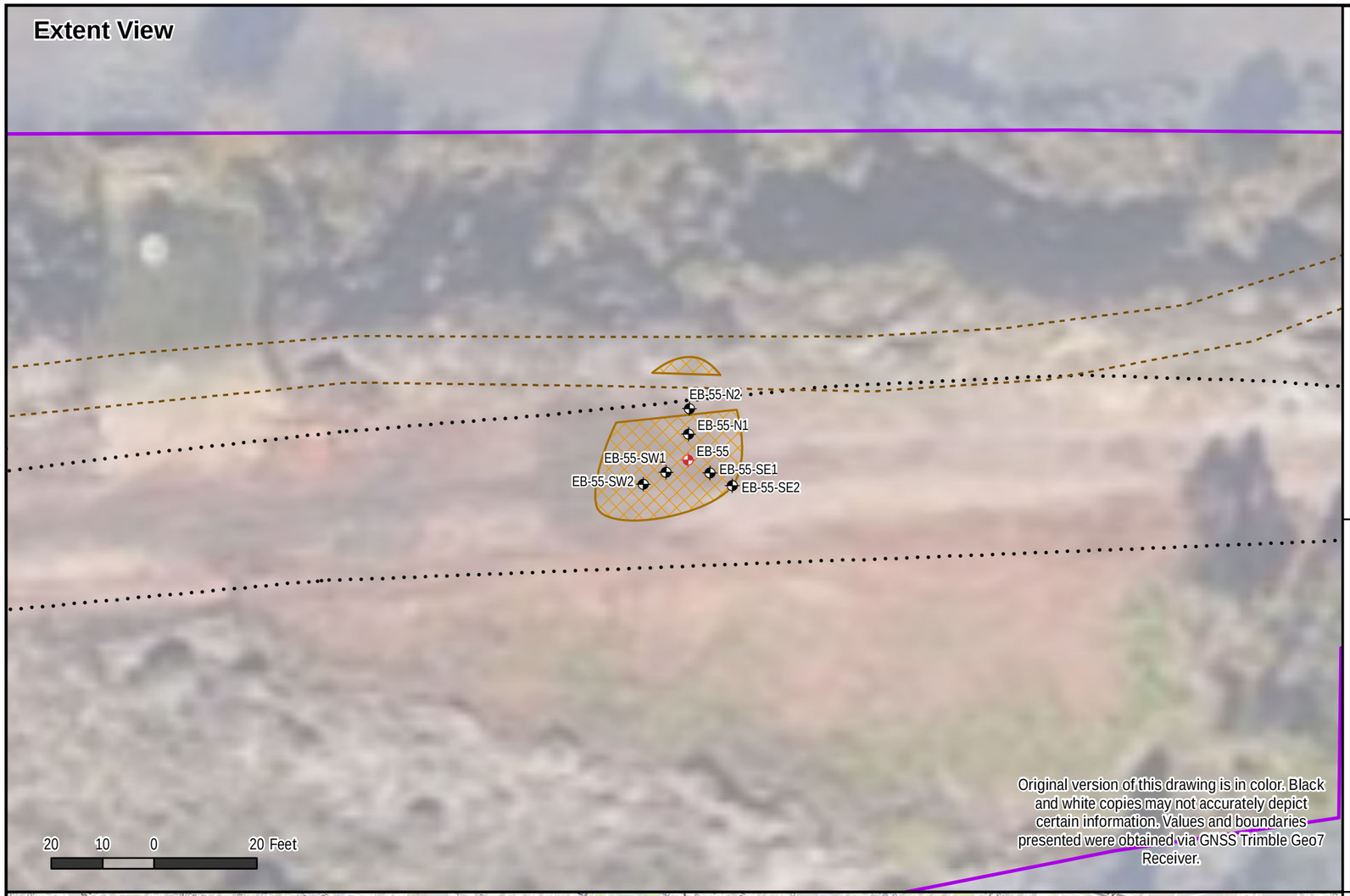
Remediation Area 41

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

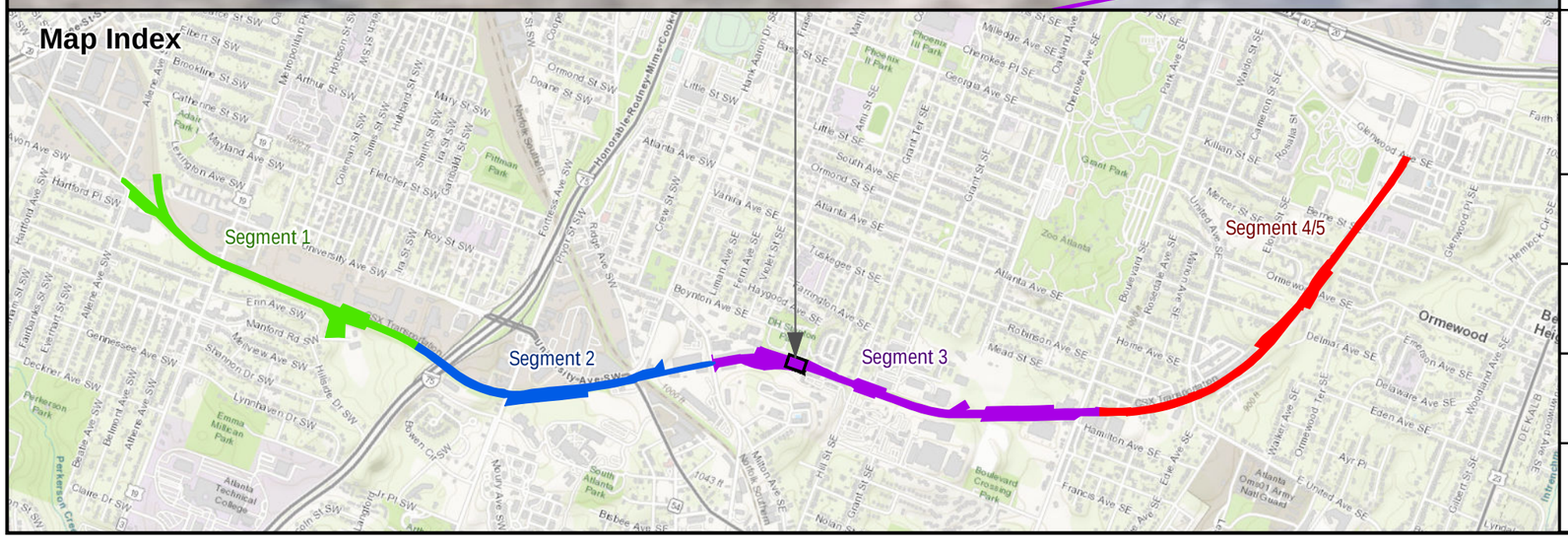
Exhibit 18

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 48.2 yd³

Approx. Station Number: 201+65

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.50 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

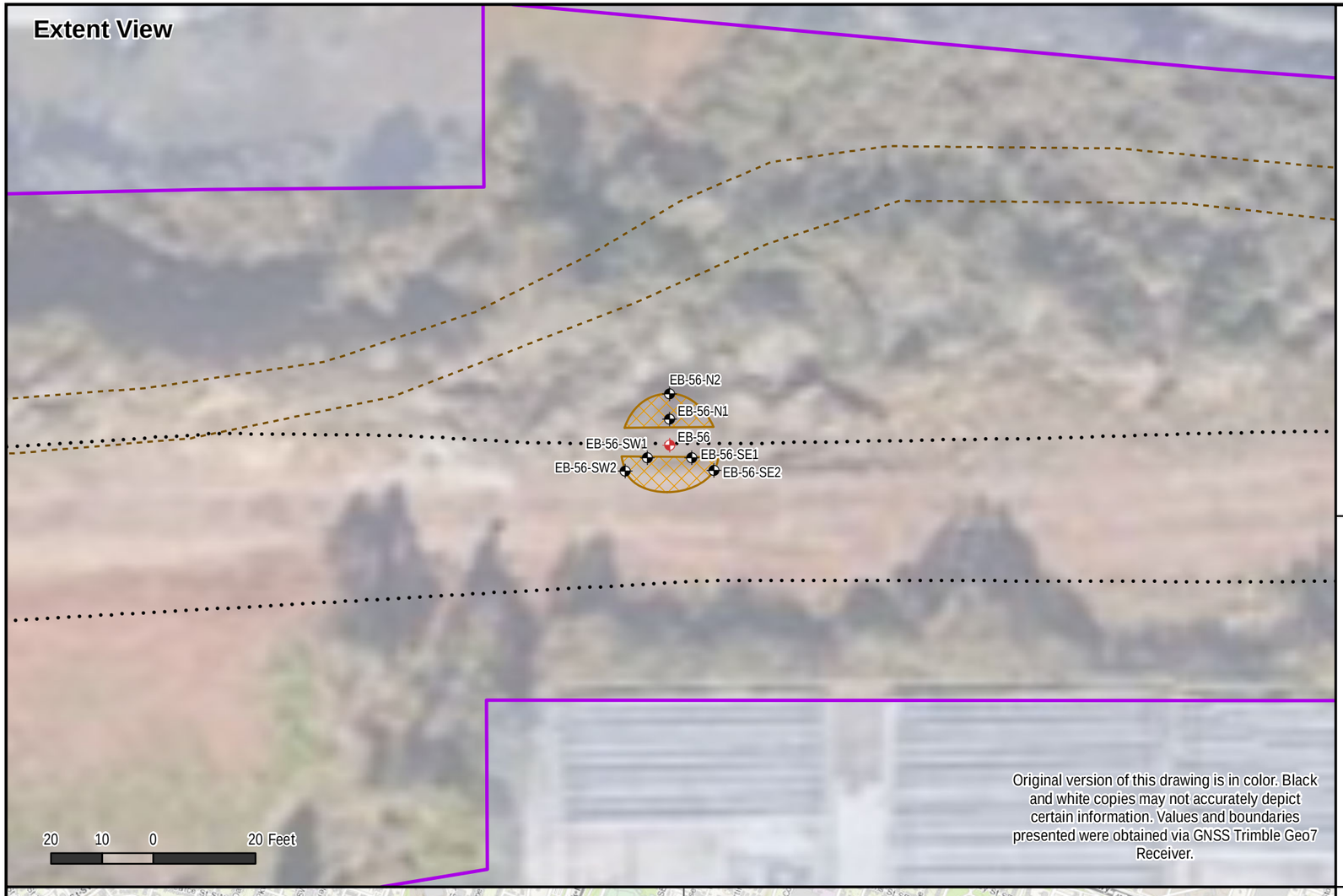
Remediation Area 42

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

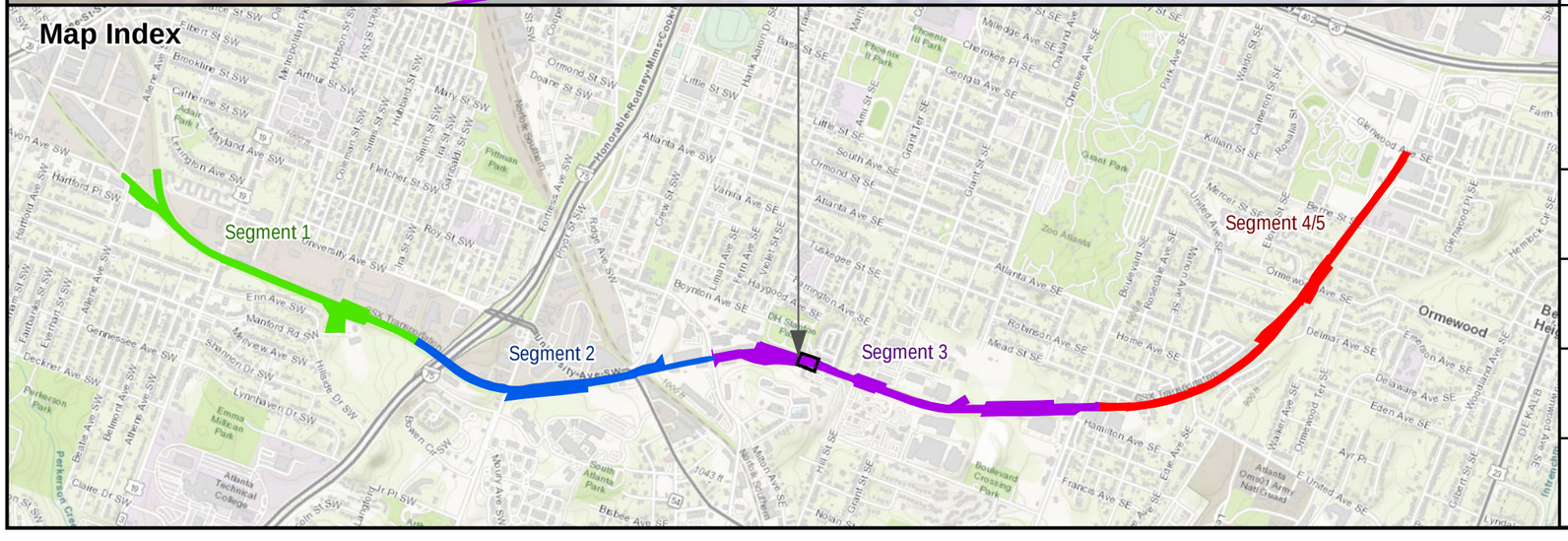
Exhibit 19

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 17 yd³

Approx. Station Number: 203+30

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.50 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
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MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

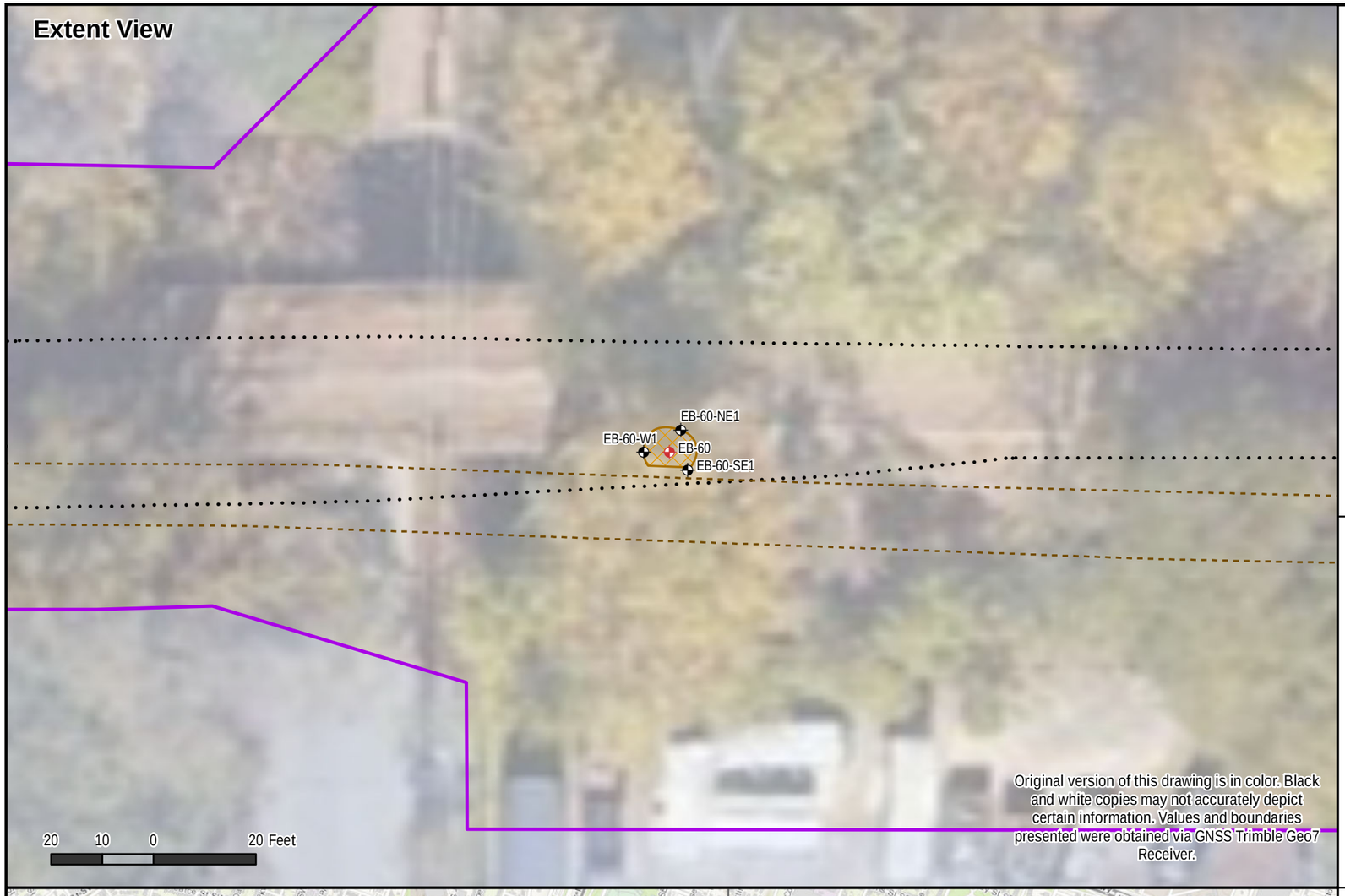
Remediation Area 43

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

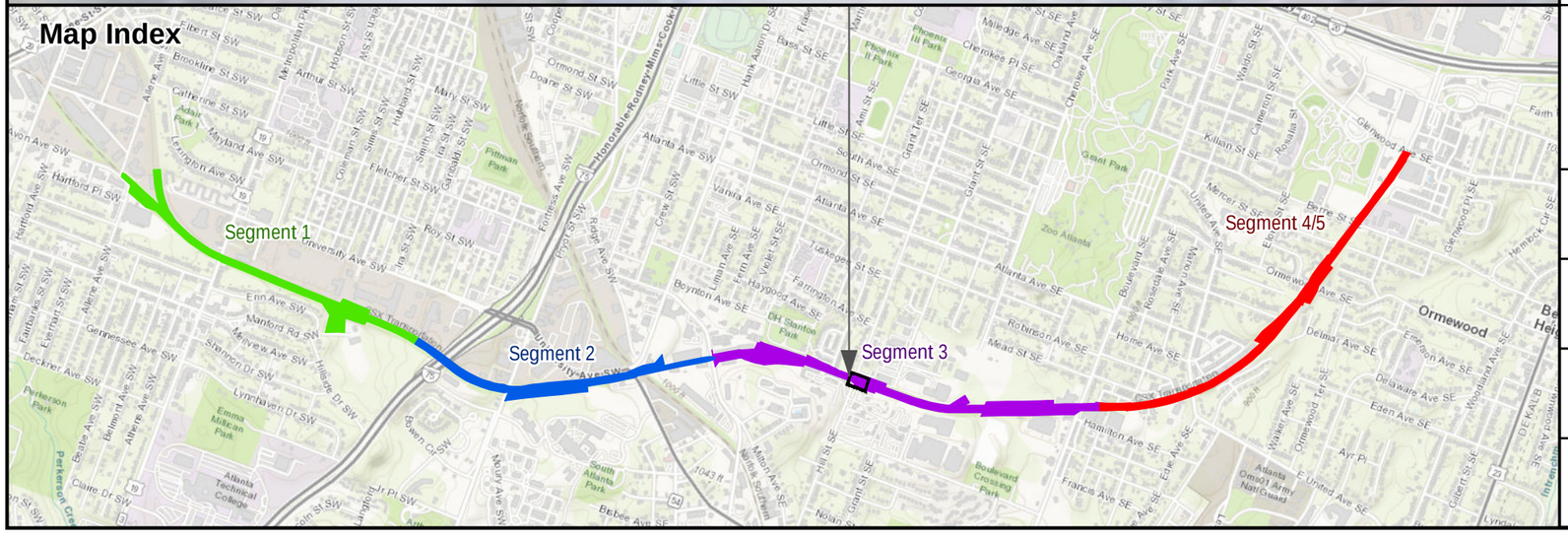
Exhibit 20

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 5.2 yd^3

Approx. Station Number: 211+80

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

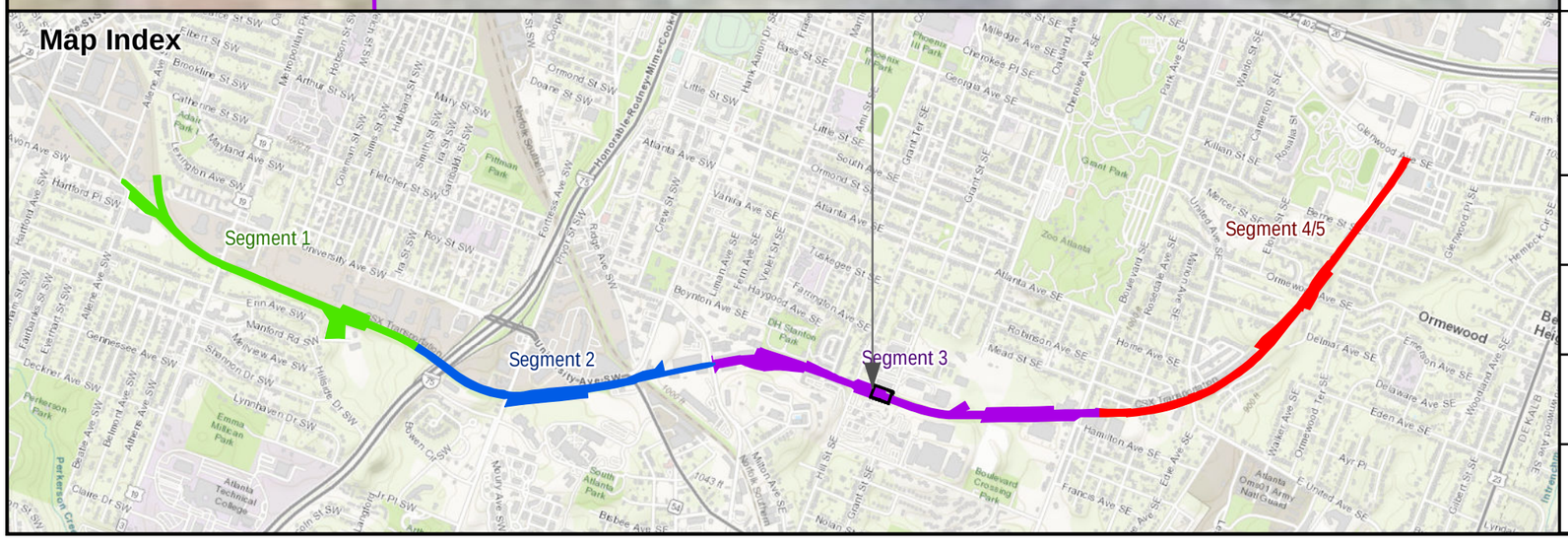
SHEET TITLE

Remediation Area 44

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 21



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 38.9 yd³

Approx. Station Number: 214+30

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 6.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

N

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

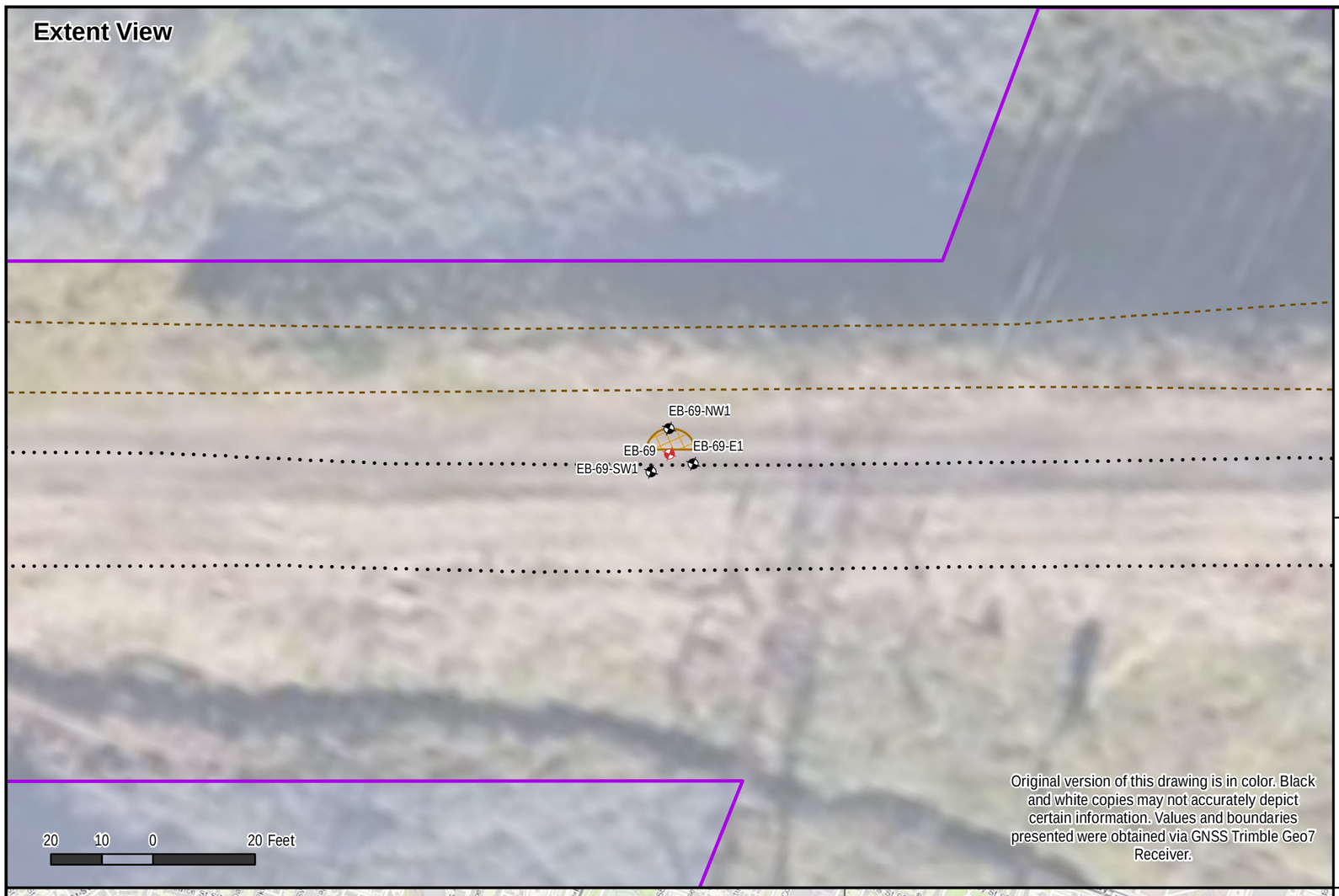
SHEET TITLE

Remediation Area 45

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 22



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 1.1 yd³

Approx. Station Number: 228+55

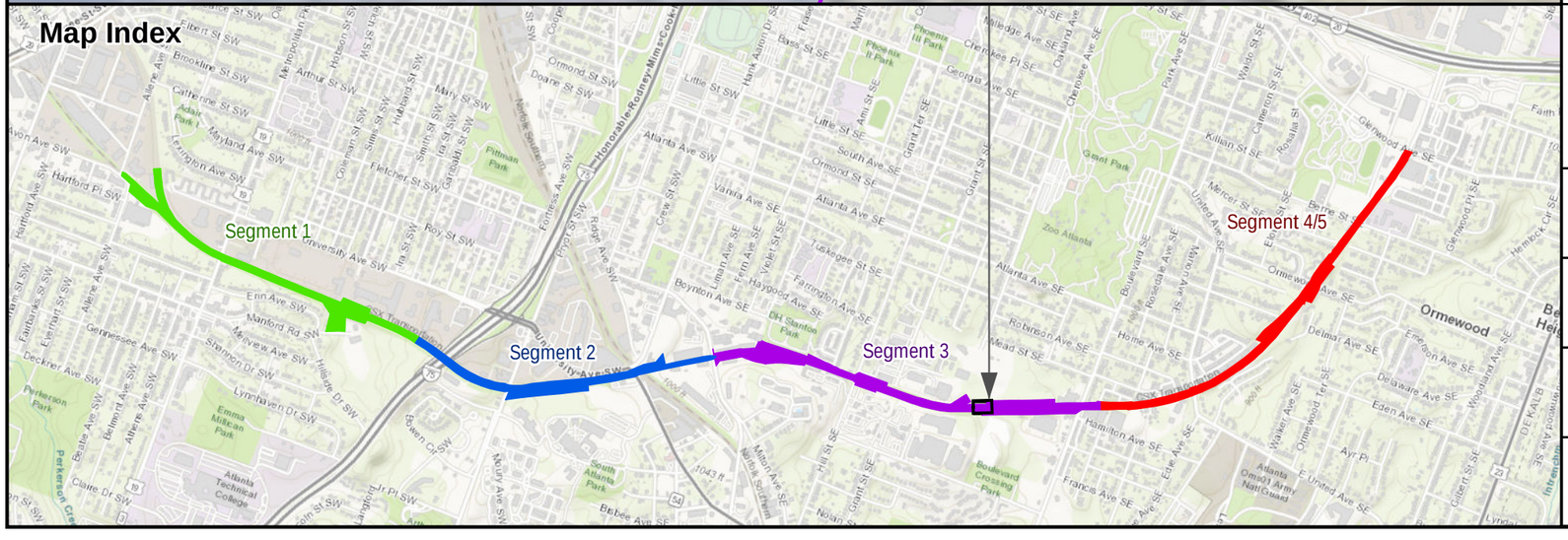
Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary



REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 46

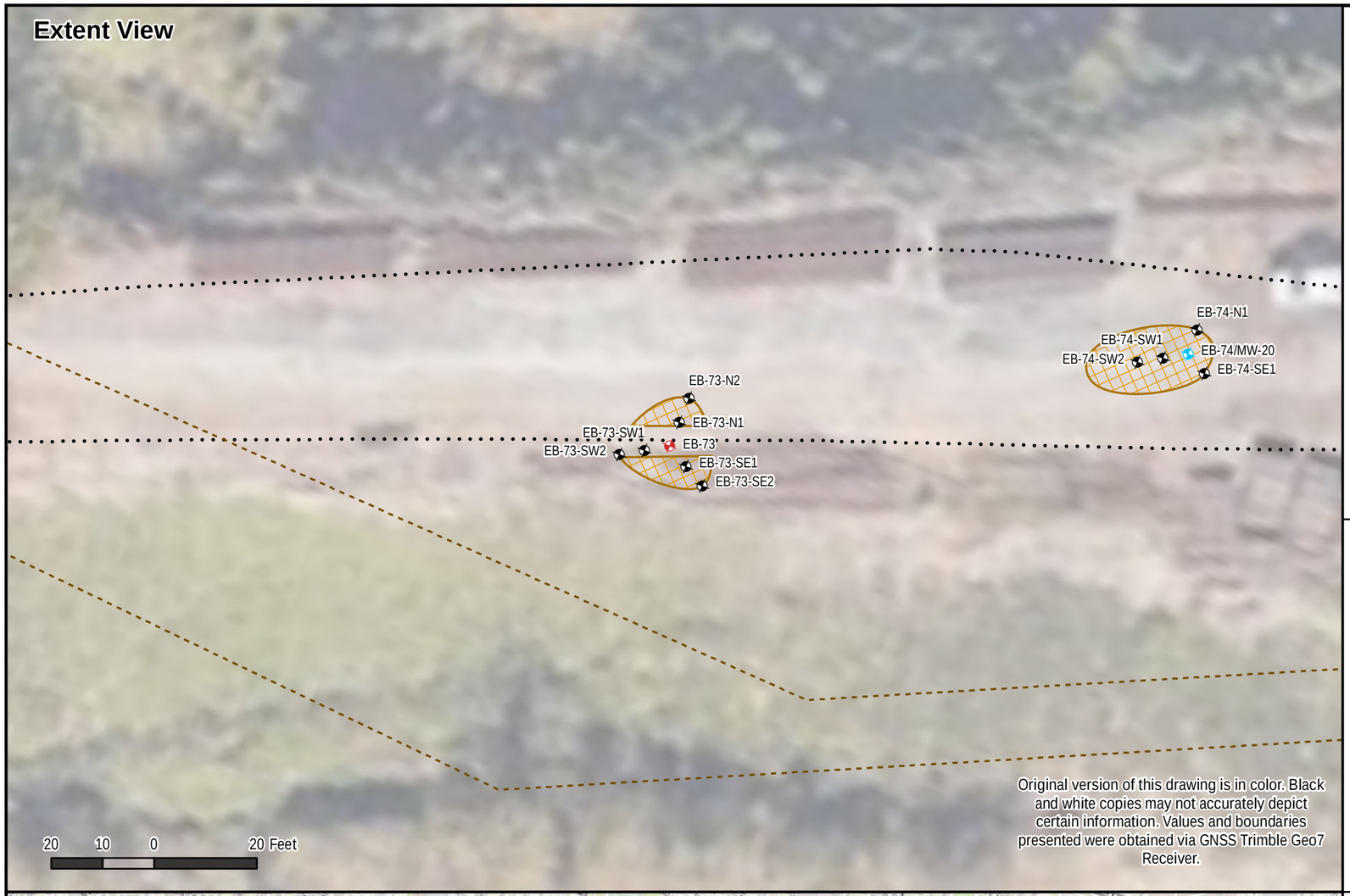
UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

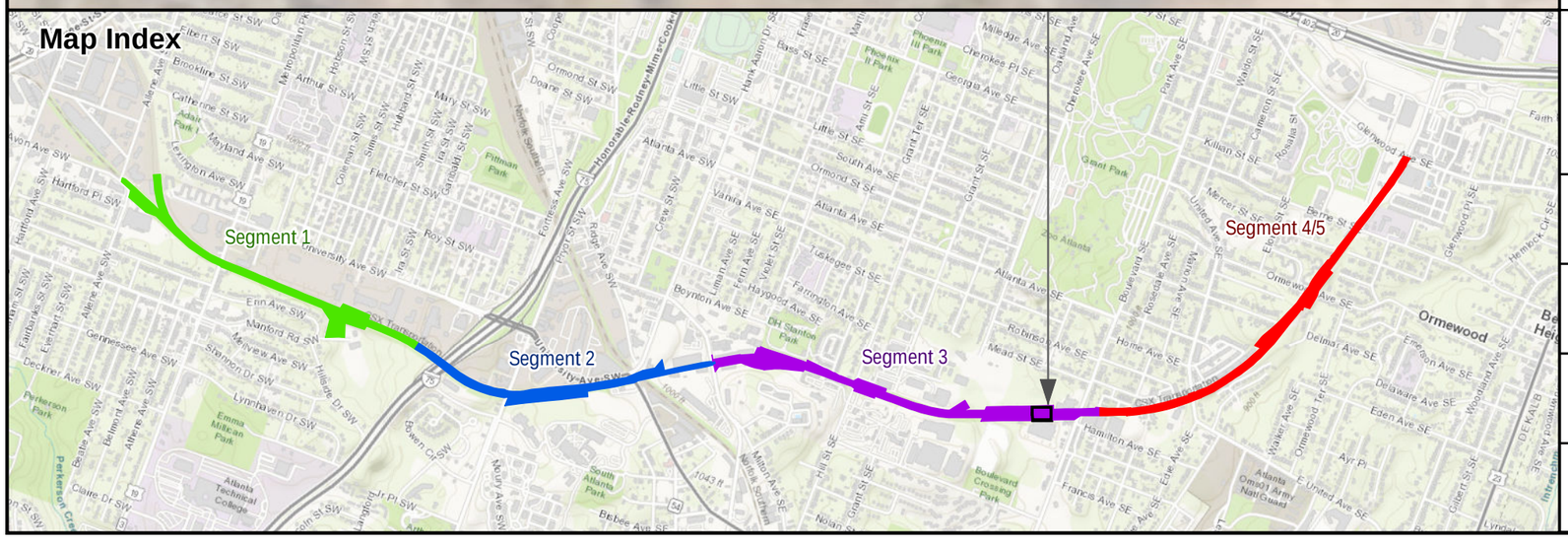
Exhibit 23

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 25.9 yd³

Approx. Station Number: 236+92

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 5.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

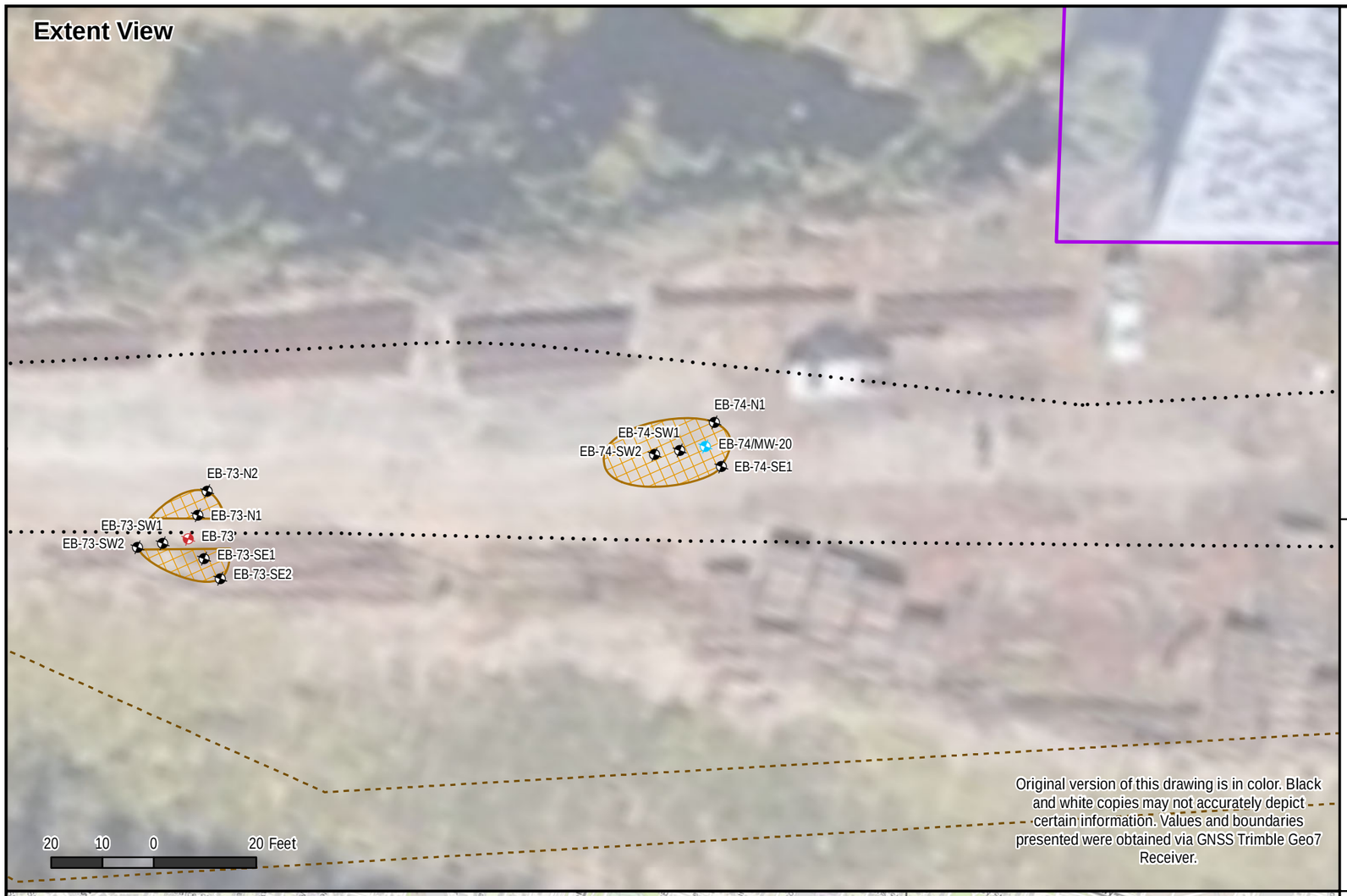
Remediation Area 47

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

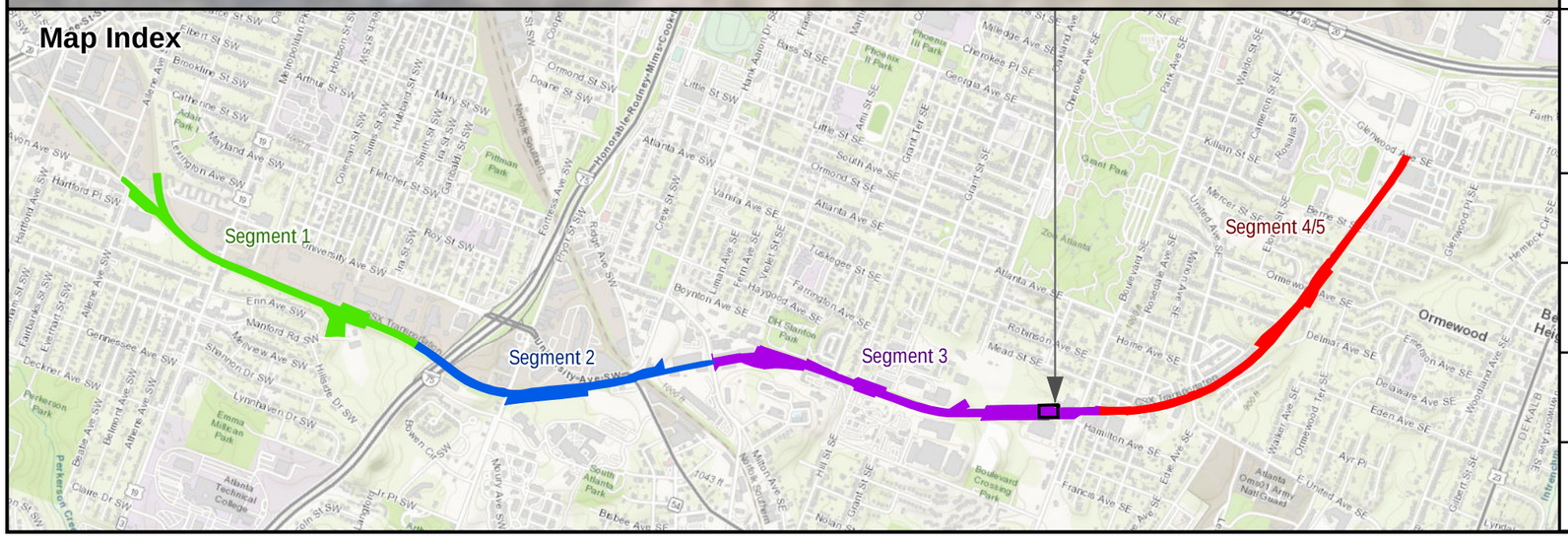
Exhibit 24

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 29 yd³

Approx. Station Number: 237+95

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 3.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 3 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 3

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

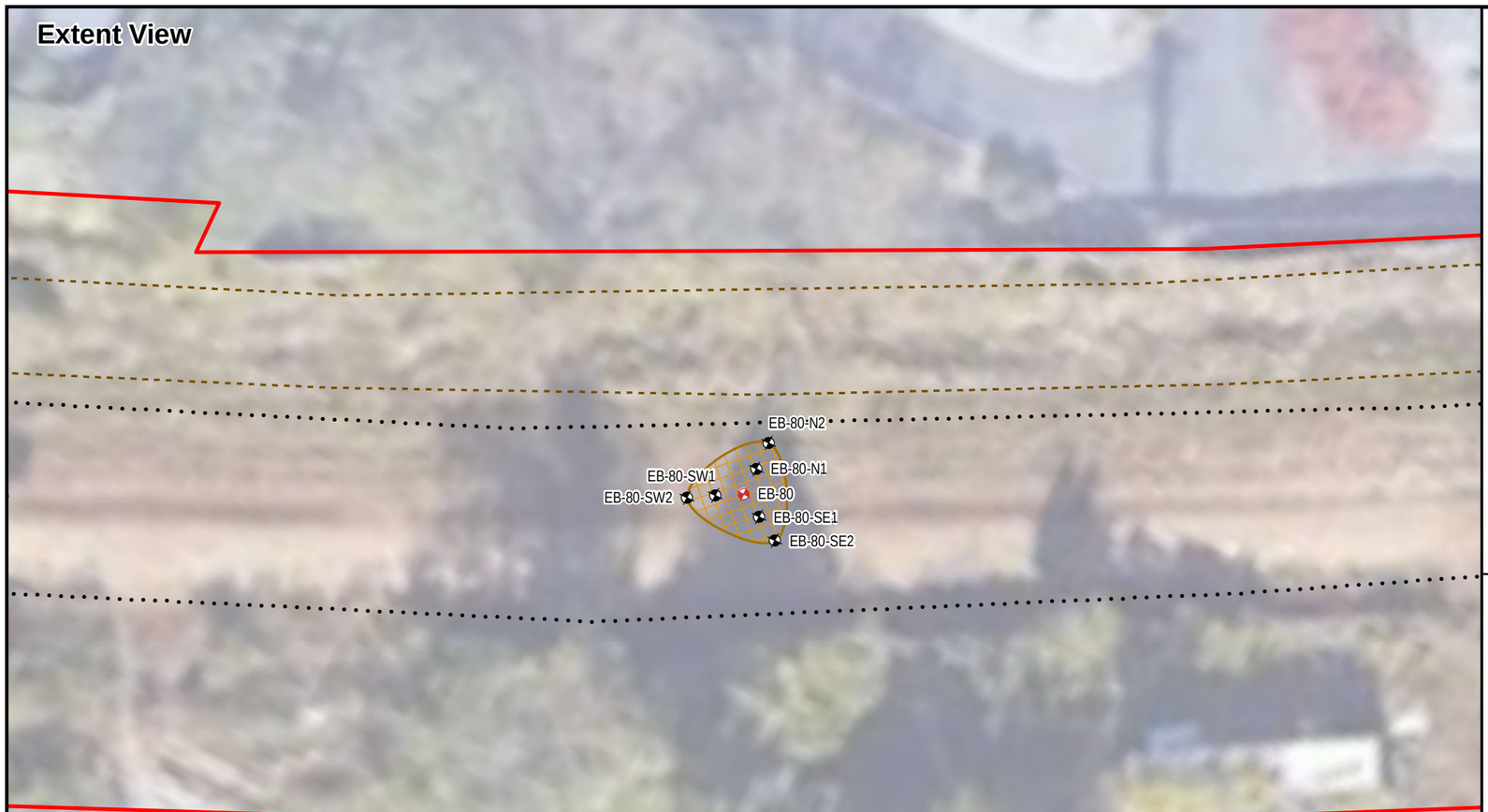
Remediation Area 48

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 25

Extent View



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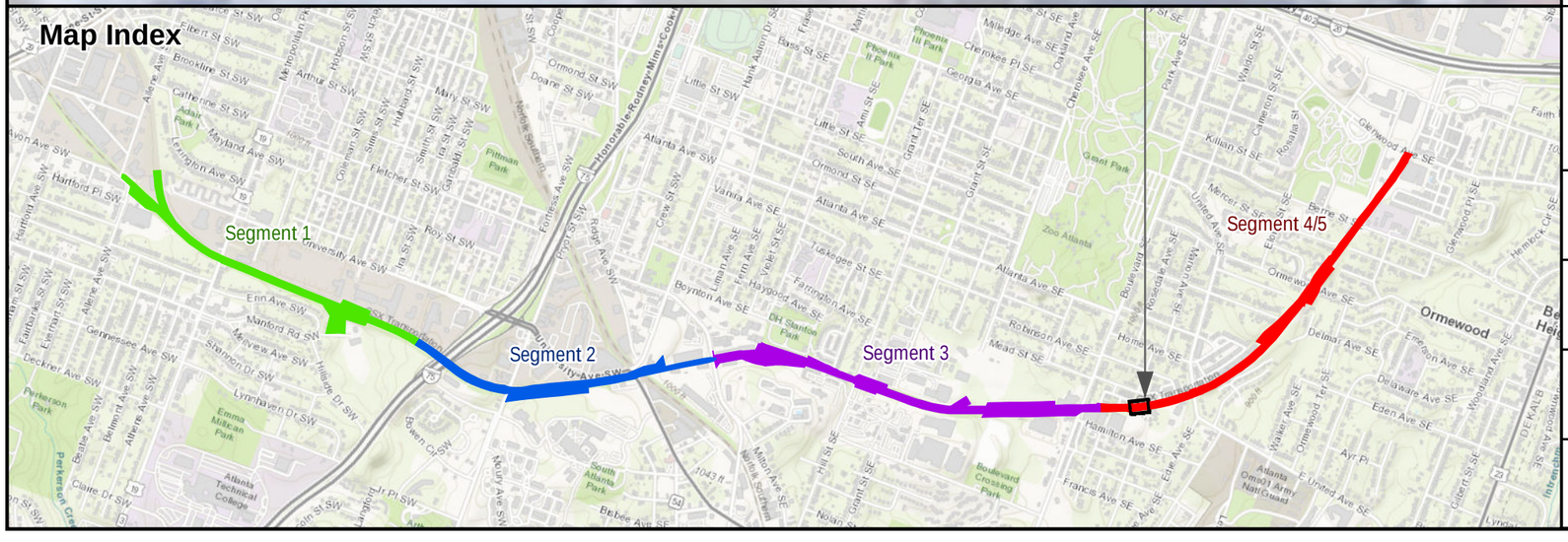
Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 25.6 yd³

Approx. Station Number: 250+50

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 3.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

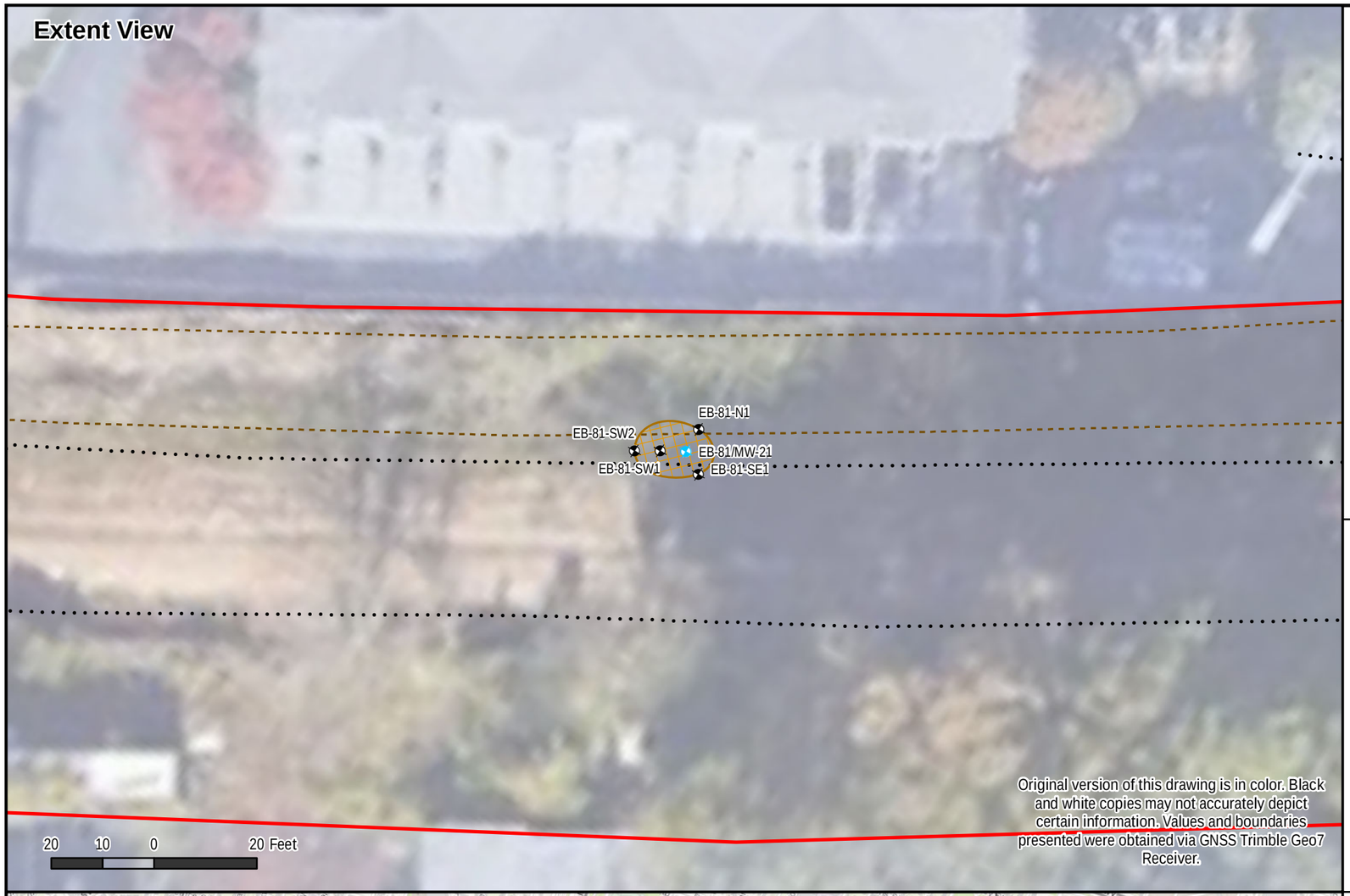
Remediation Area 49

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

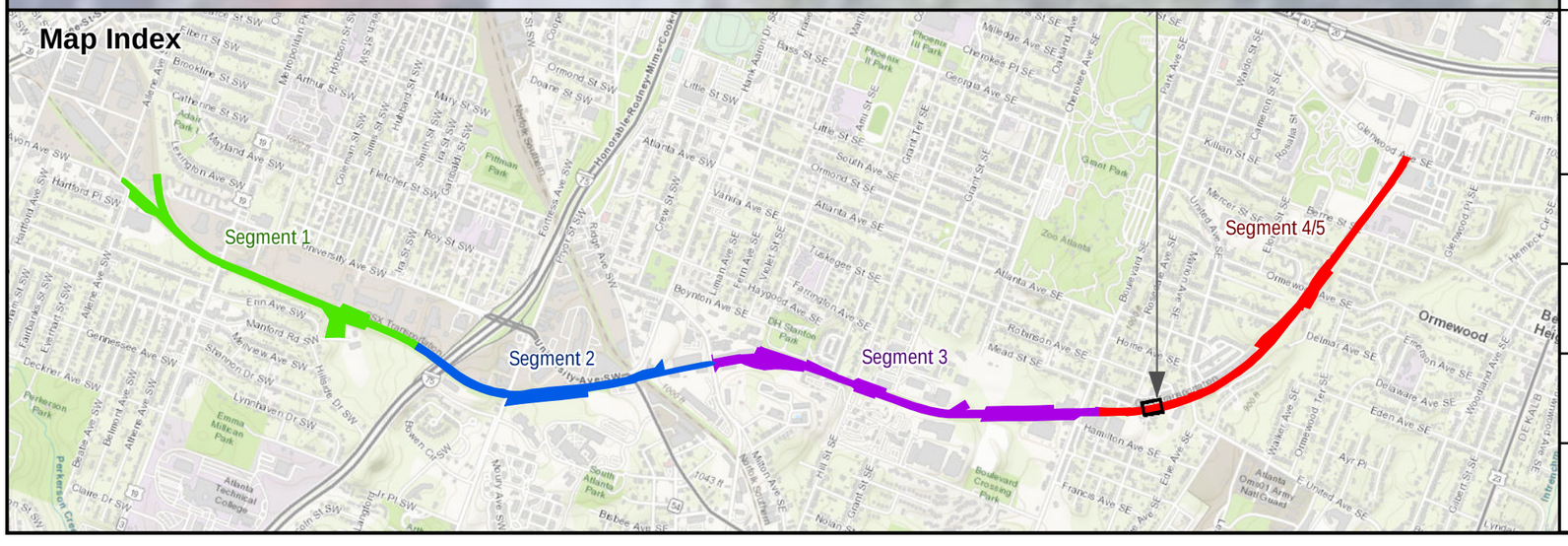
DRAWING NUMBER

Exhibit 26

Extent View



Map Index



Remedial Photograph

Pending Remediation

(Utility Conflict)

Summary Notes & Legend

Estimated Cubic Yards (Proposed): Not Applicable

Approx. Station Number: 252+50

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Temporary Monitoring Well
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 50

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

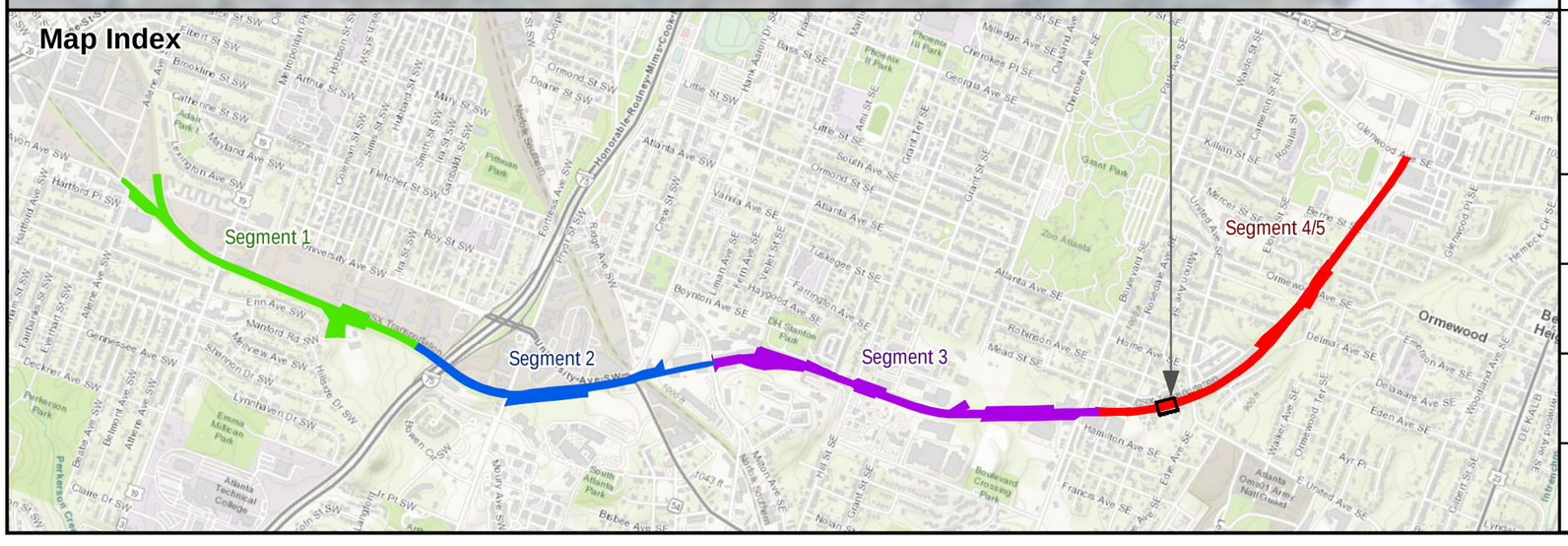
DRAWING NUMBER

Exhibit 27

Extent View

Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 2.4 yd³

Approx. Station Number: 254+50

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

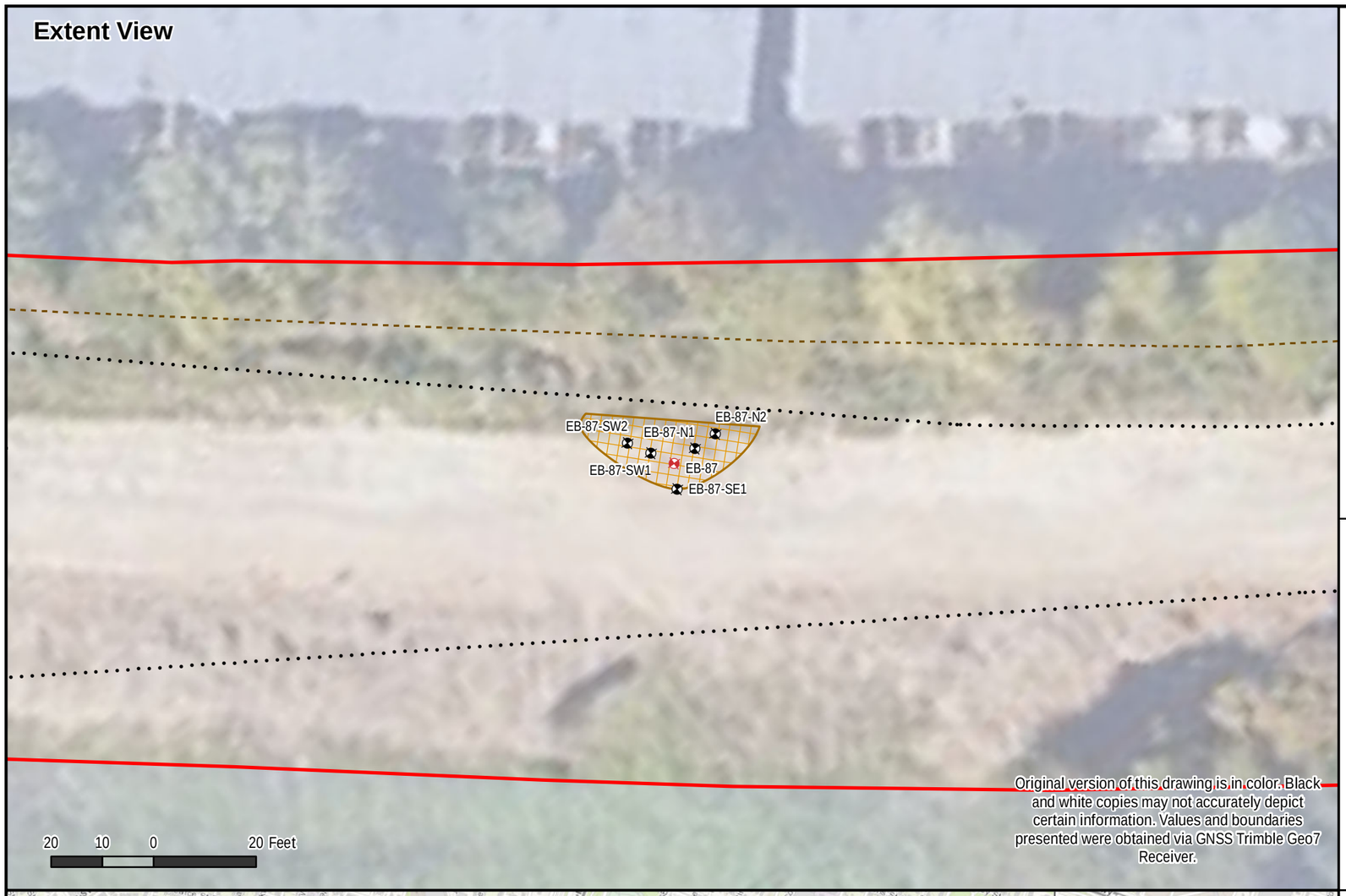
Remediation Area 51

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 28

Extent View



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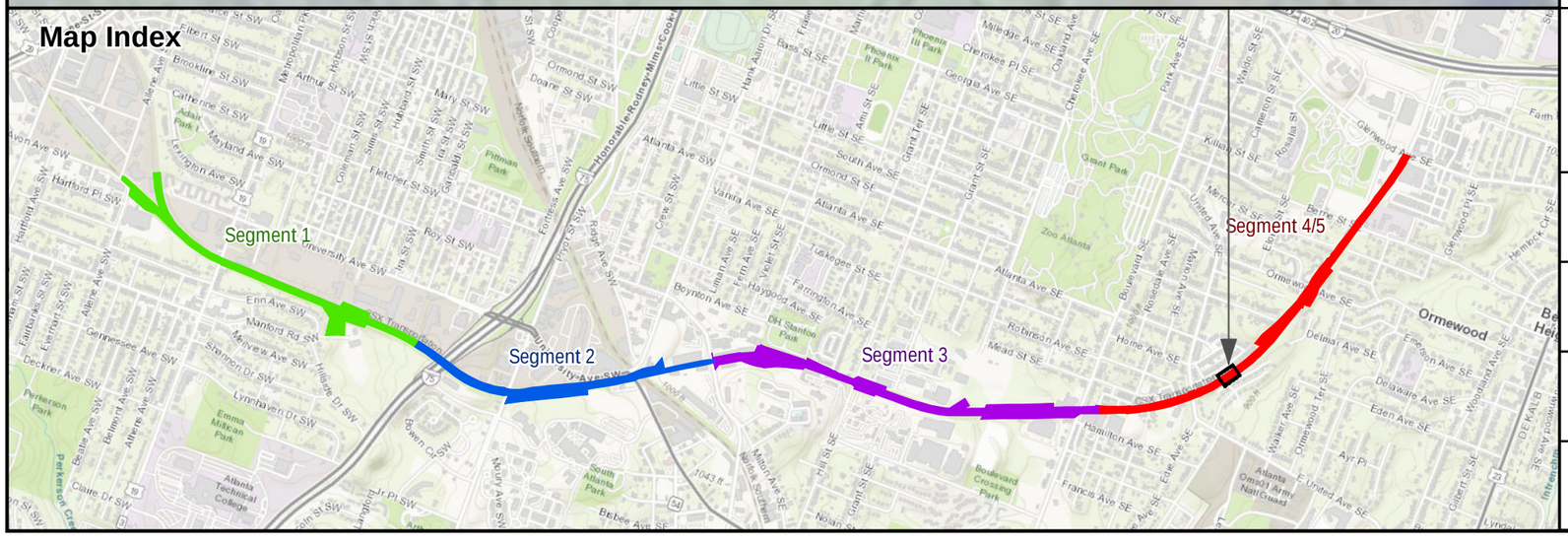
Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 42.8 yd³

Approx. Station Number: 263+95

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 3.50 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

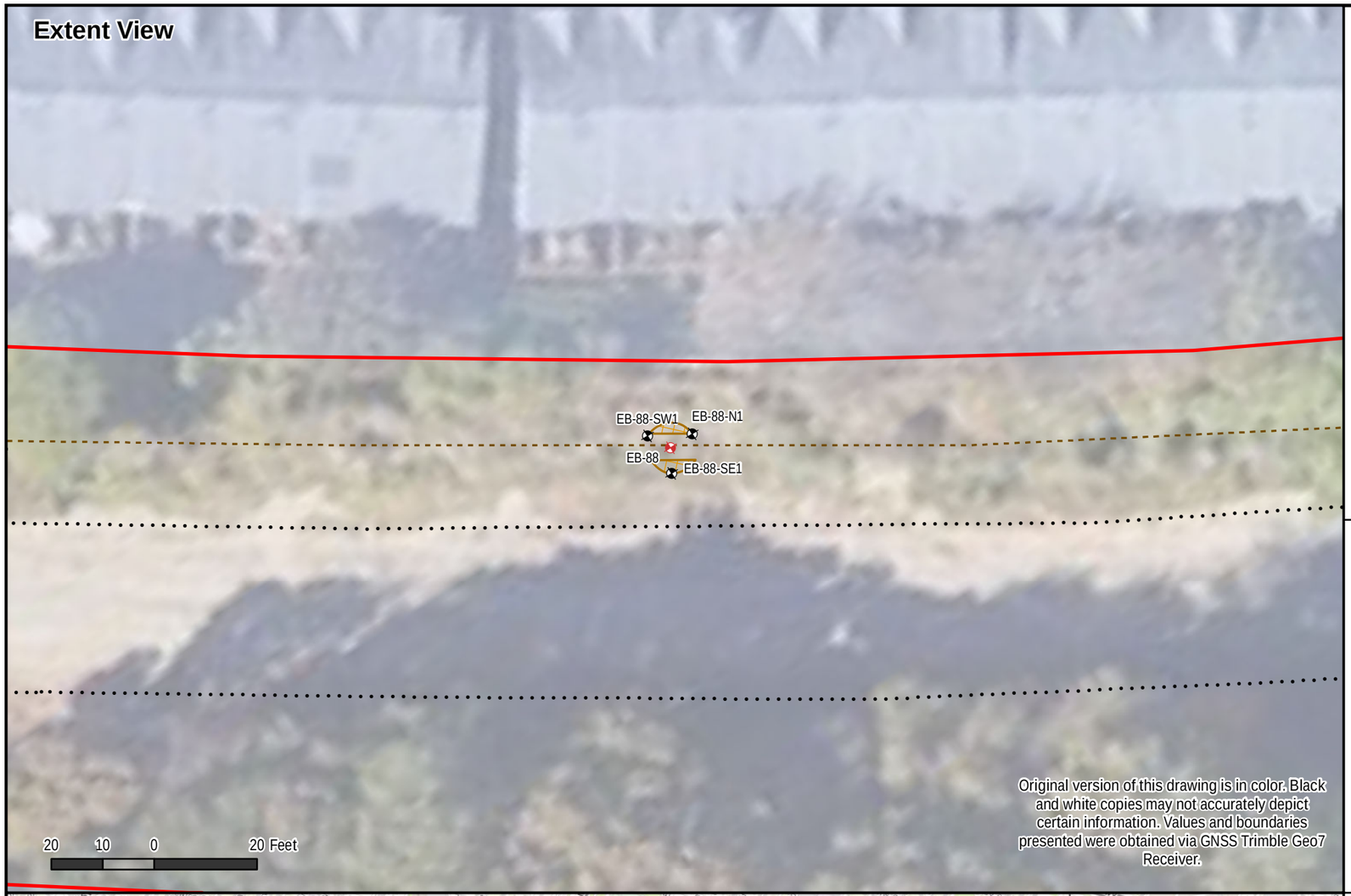
Remediation Area 52

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

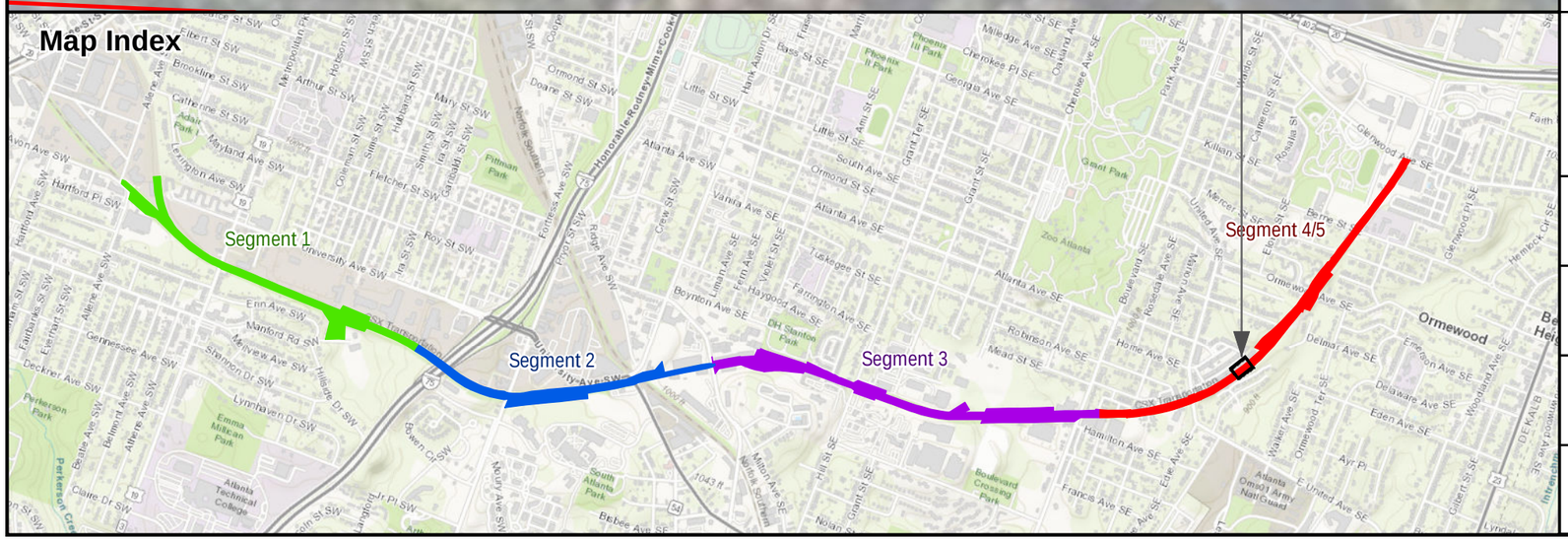
Exhibit 29

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 1.2 yd^3

Approx. Station Number: 266+35

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

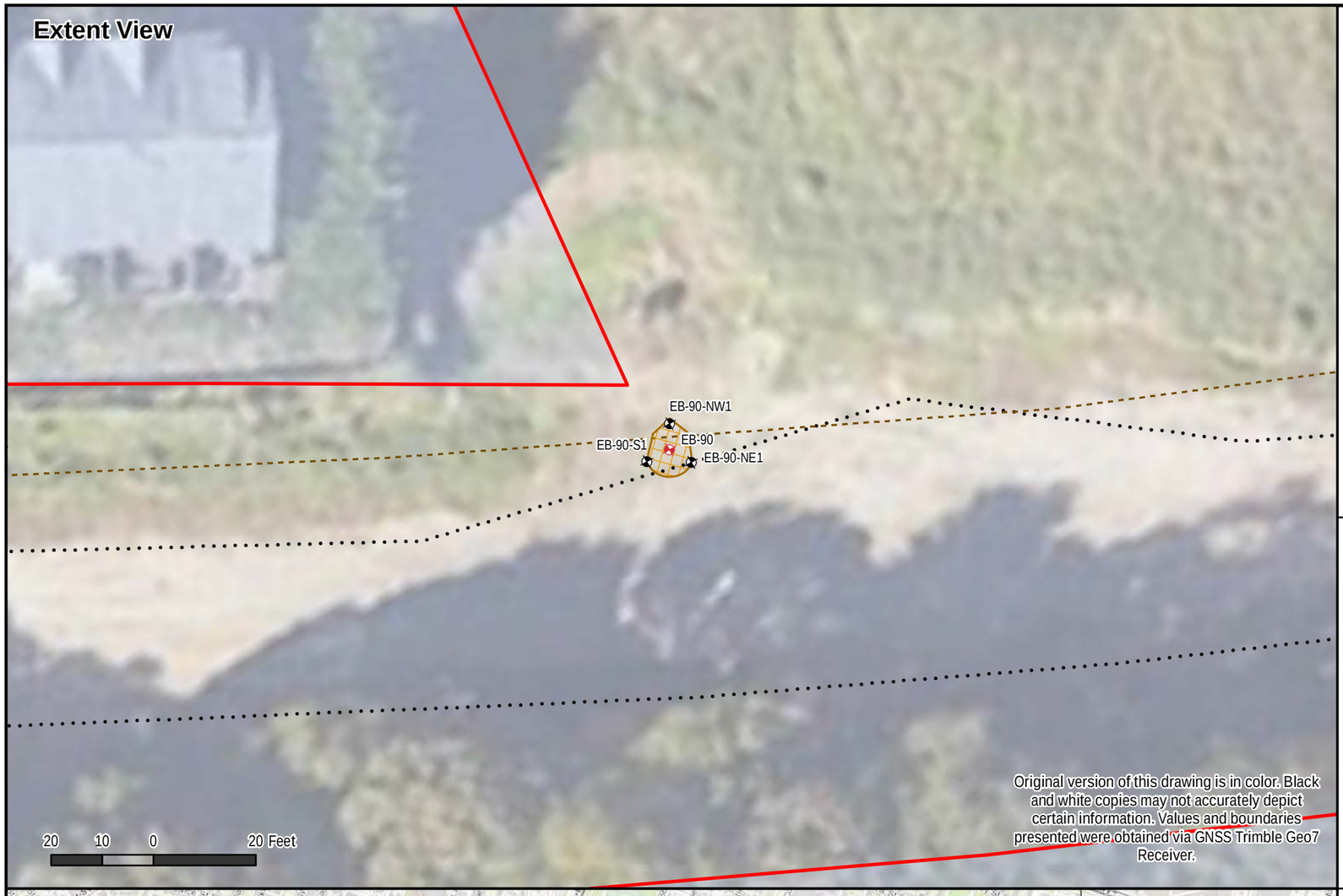
SHEET TITLE

Remediation Area 53

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 30



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): Not Applicable

Approx. Station Number: 270+10

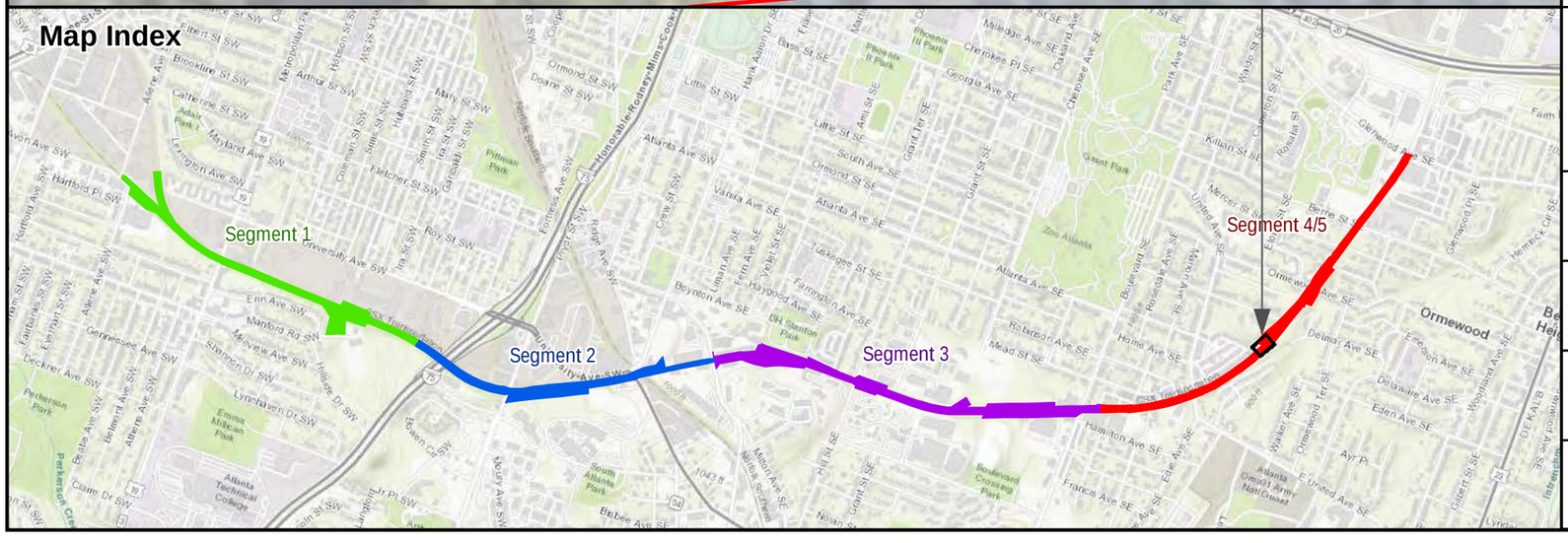
Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary



REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

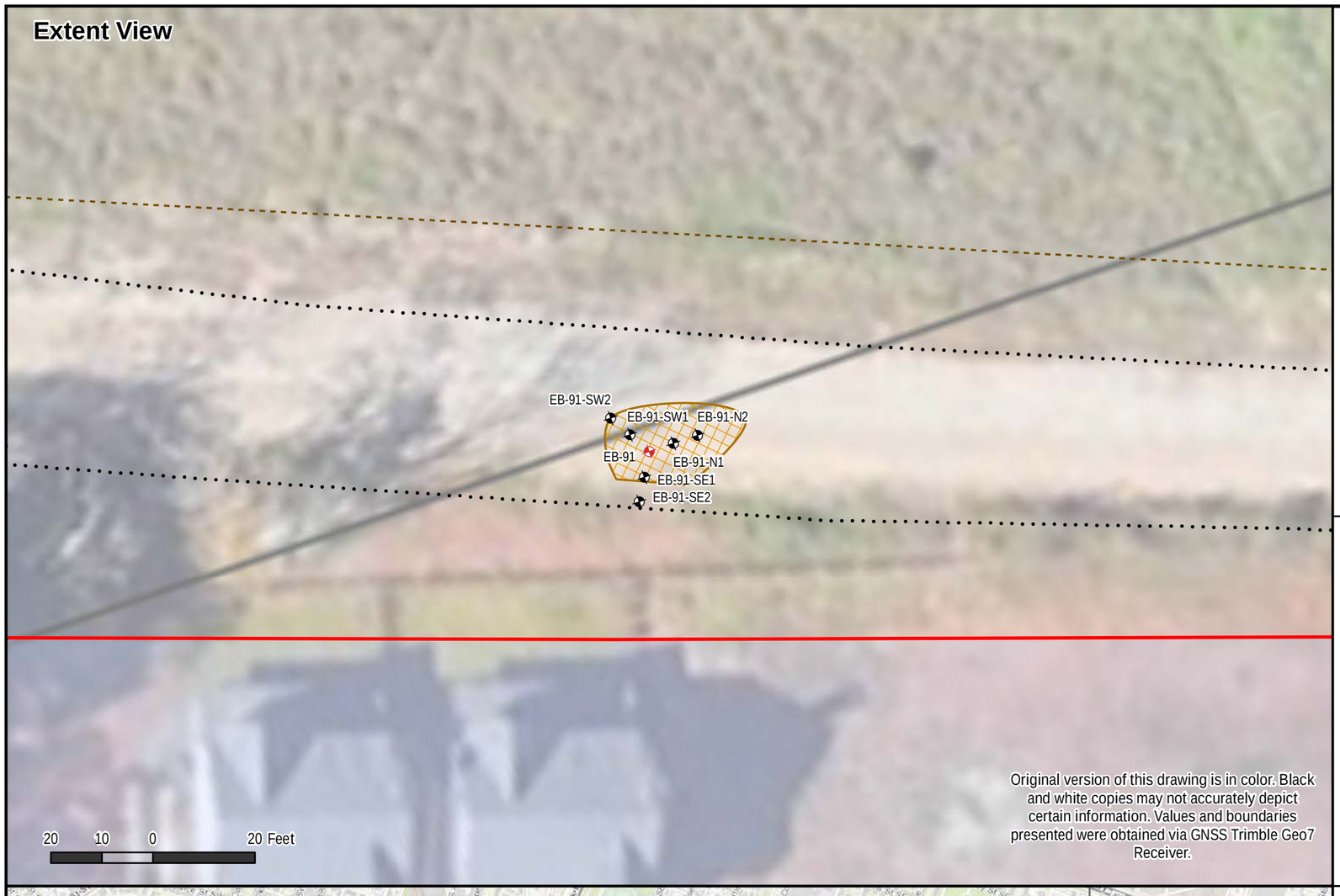
Remediation Area 54

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 13, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 31

Extent View



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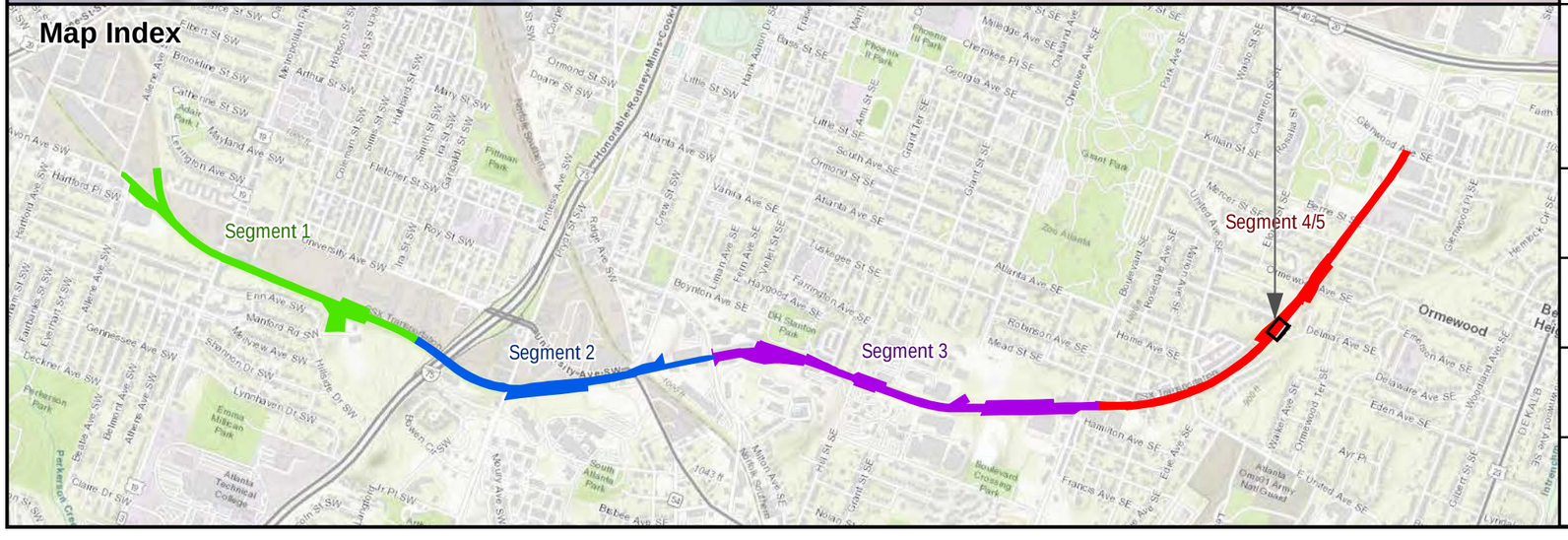
Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 12.8 yd³

Approx. Station Number: 272+95

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

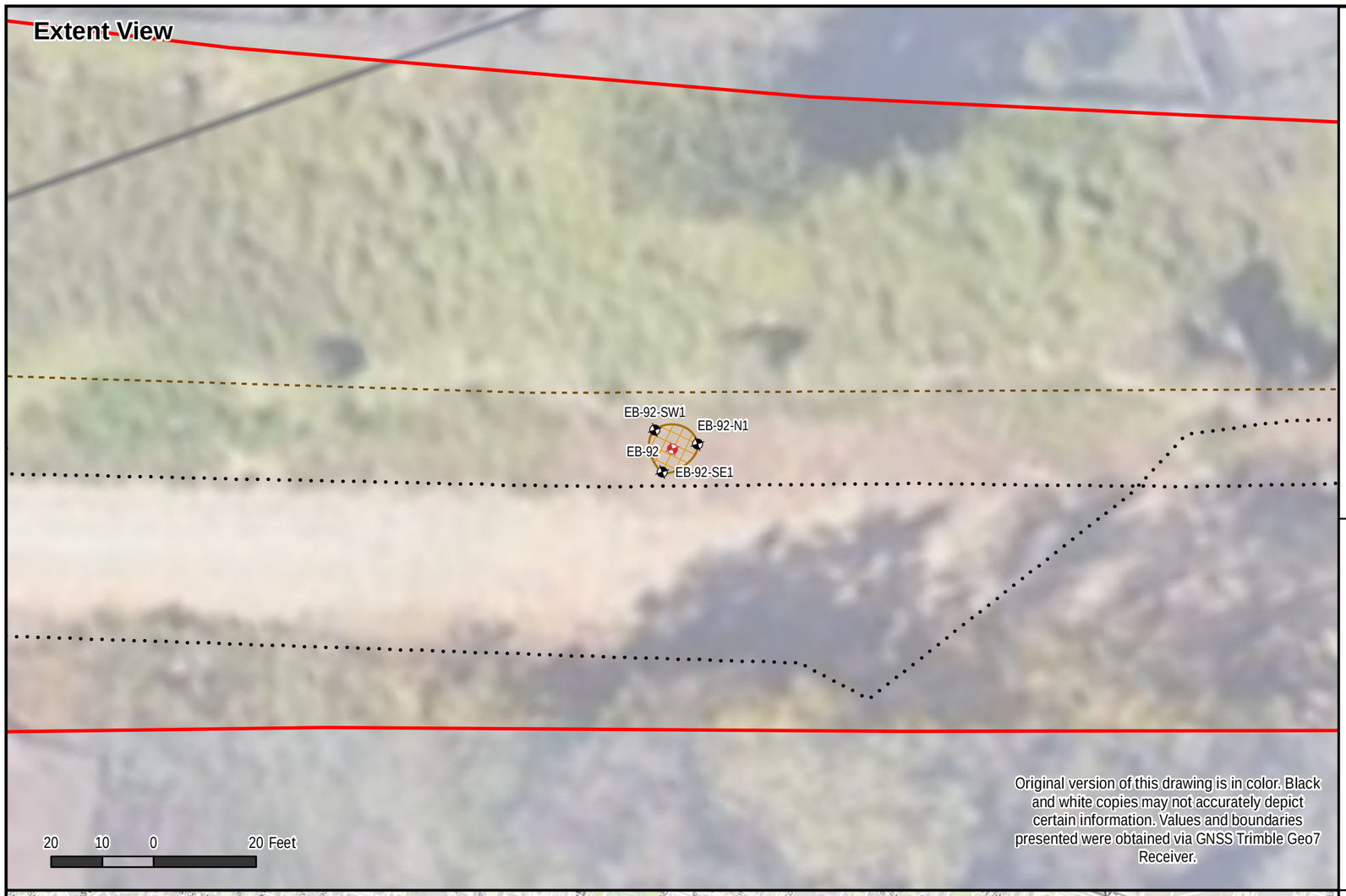
SHEET TITLE

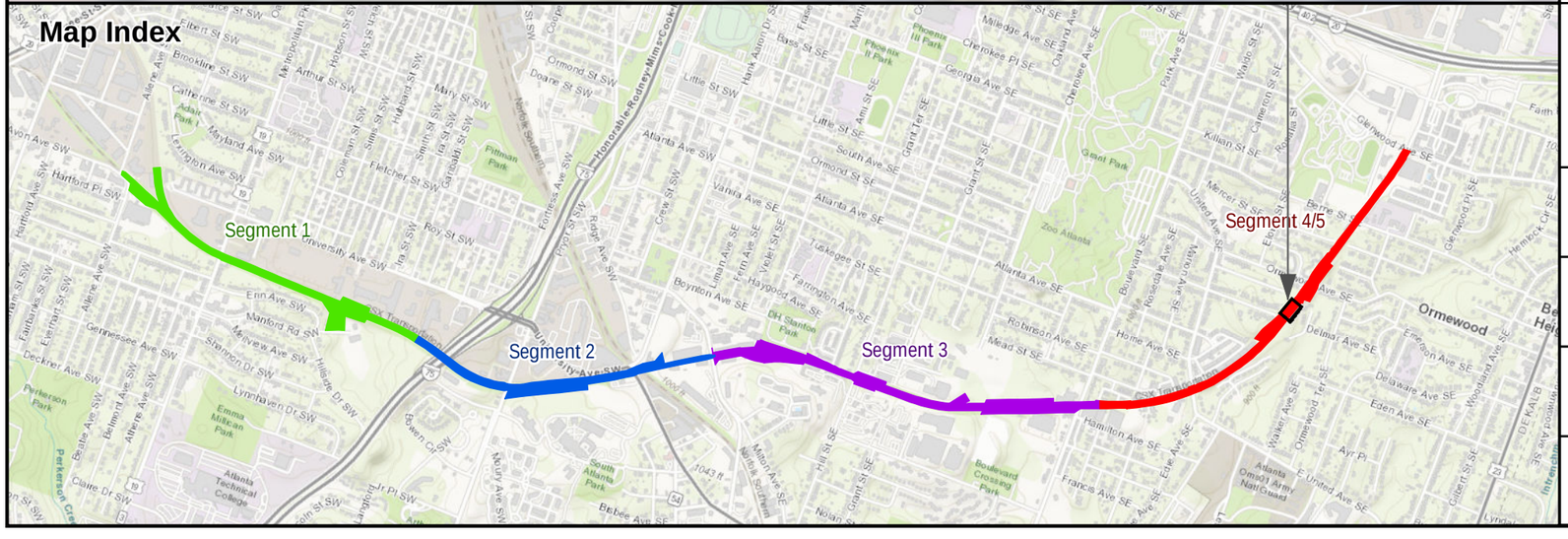
Remediation Area 55

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 12, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 32





Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 2.5 yd³

Approx. Station Number: 276+00

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

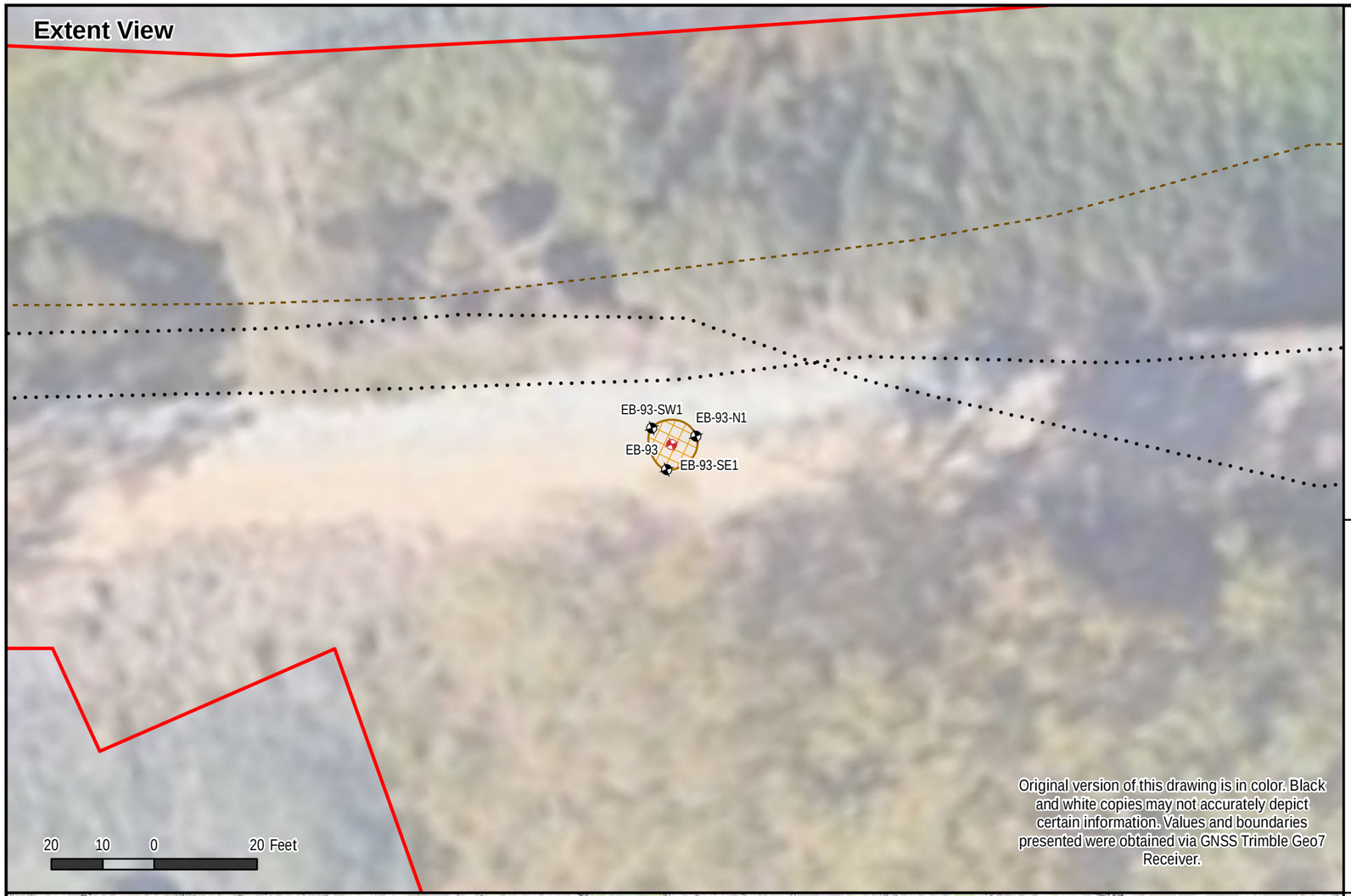
SHEET TITLE

Remediation Area 56

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 33



Remedial Photograph

Fill Placement Required
No Planned Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): No Applicable

Approx. Station Number: 278+90

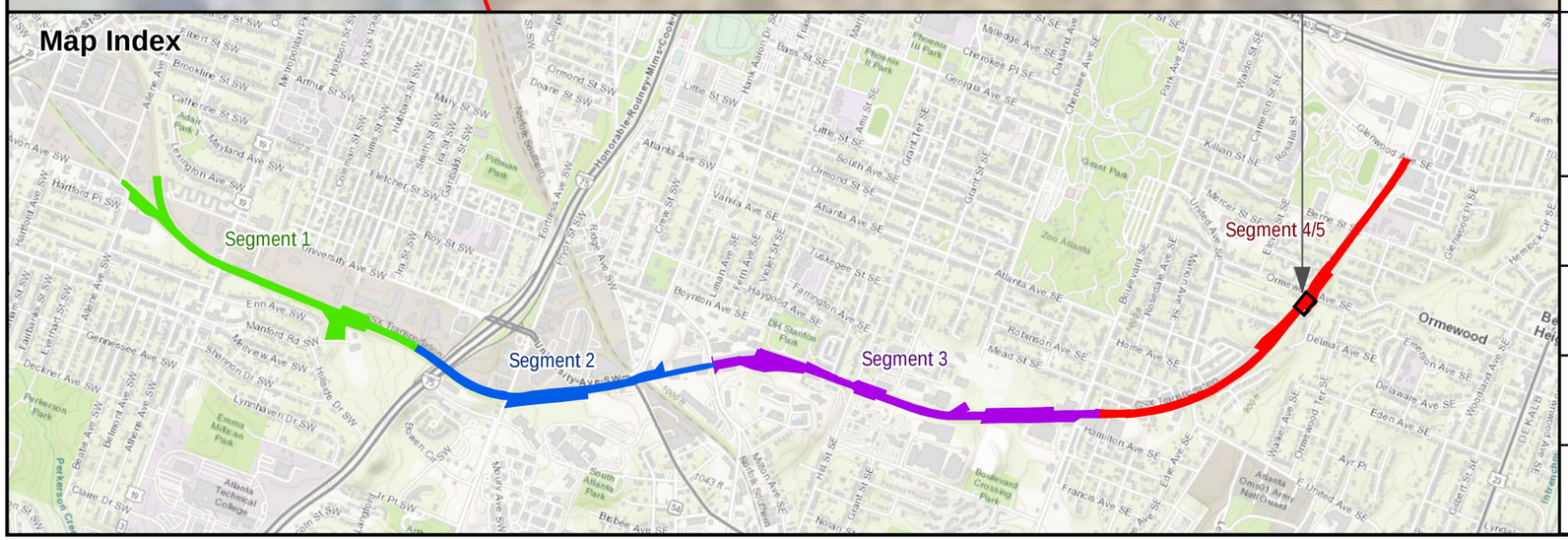
Constituents of Concern: Arsenic

Proposed Depth of Excavation: 0.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary



REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

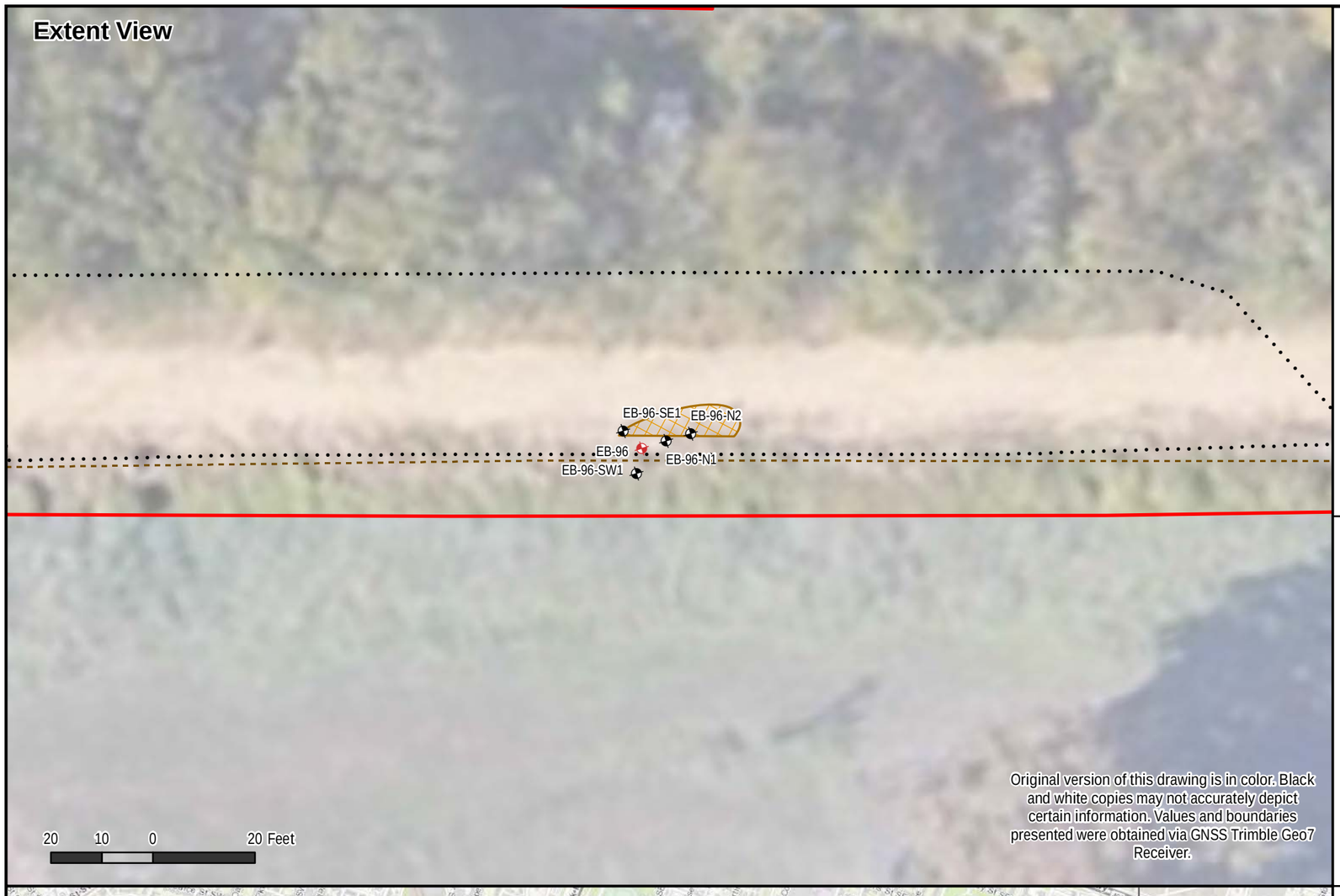
Remediation Area 57

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

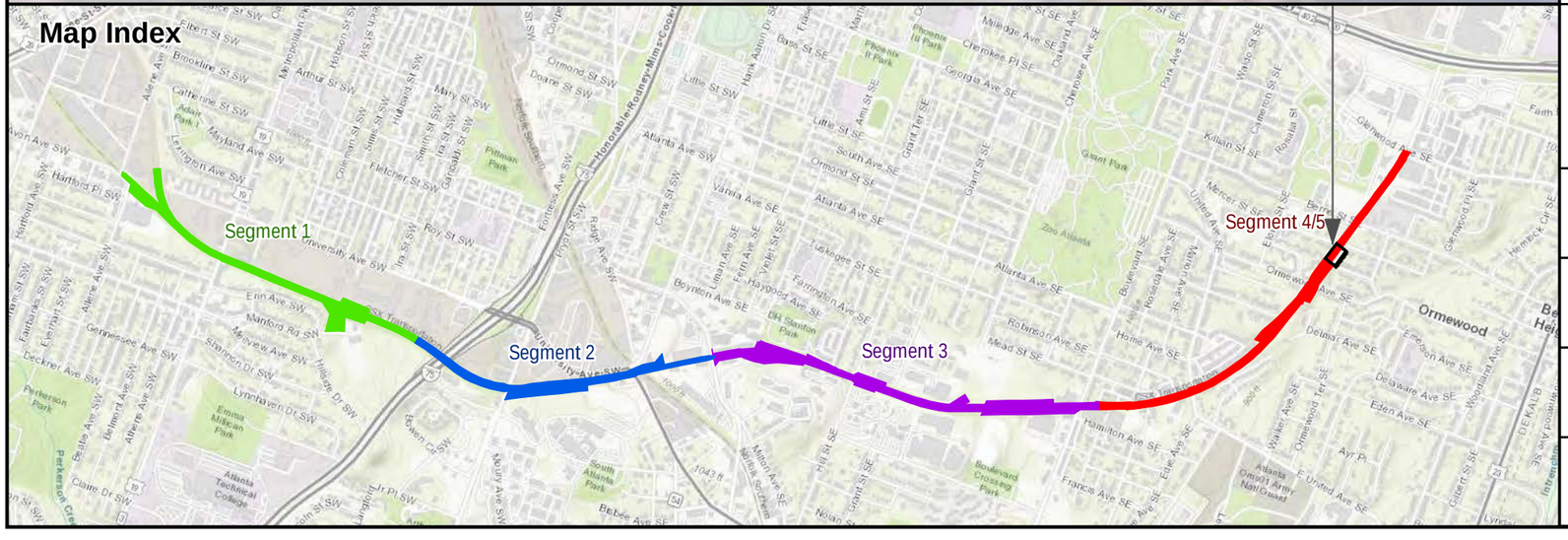
Exhibit 34

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 7.9 yd^3

Approx. Station Number: 285+95

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: Conflict not removed

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

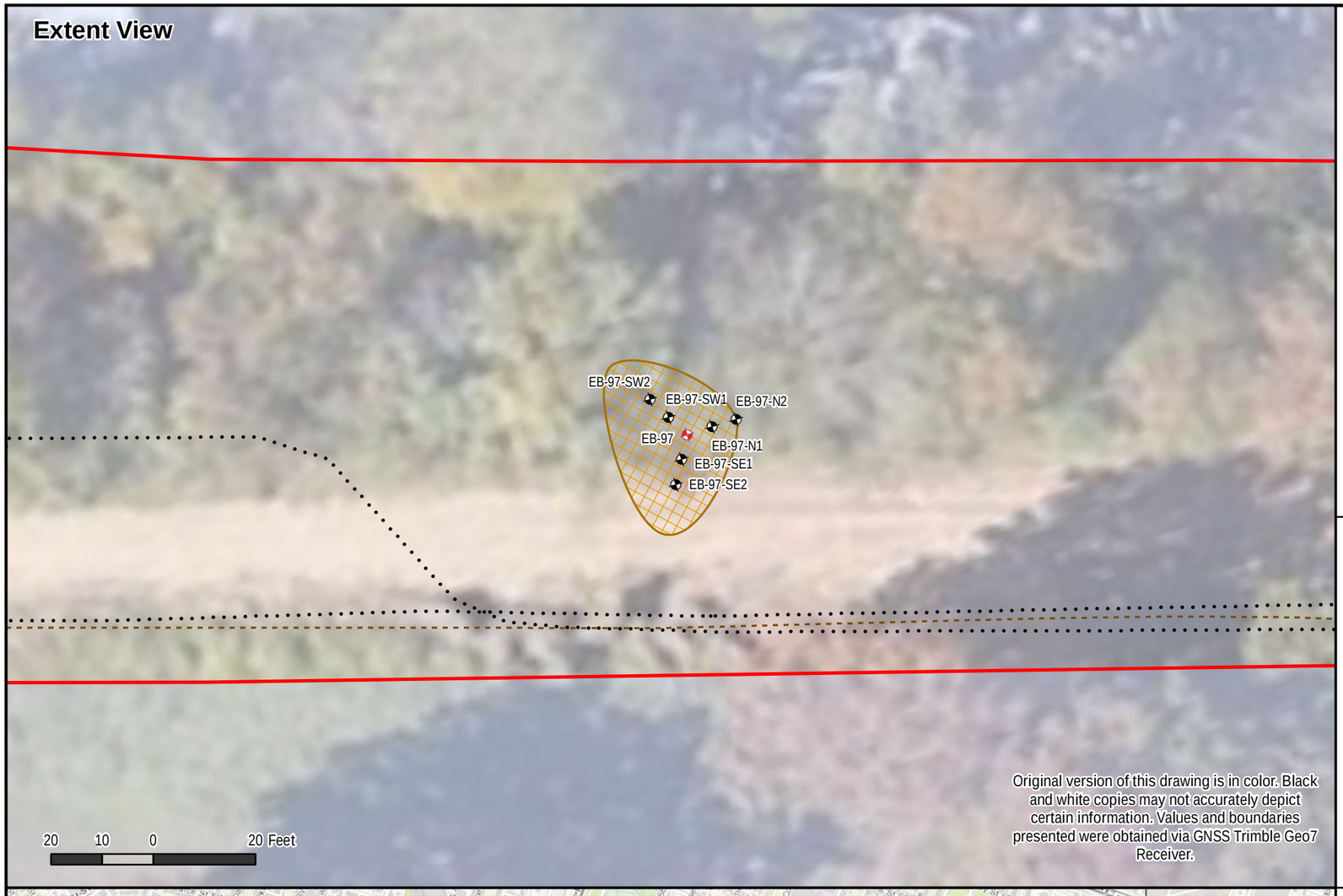
Remediation Area 58

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 12, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

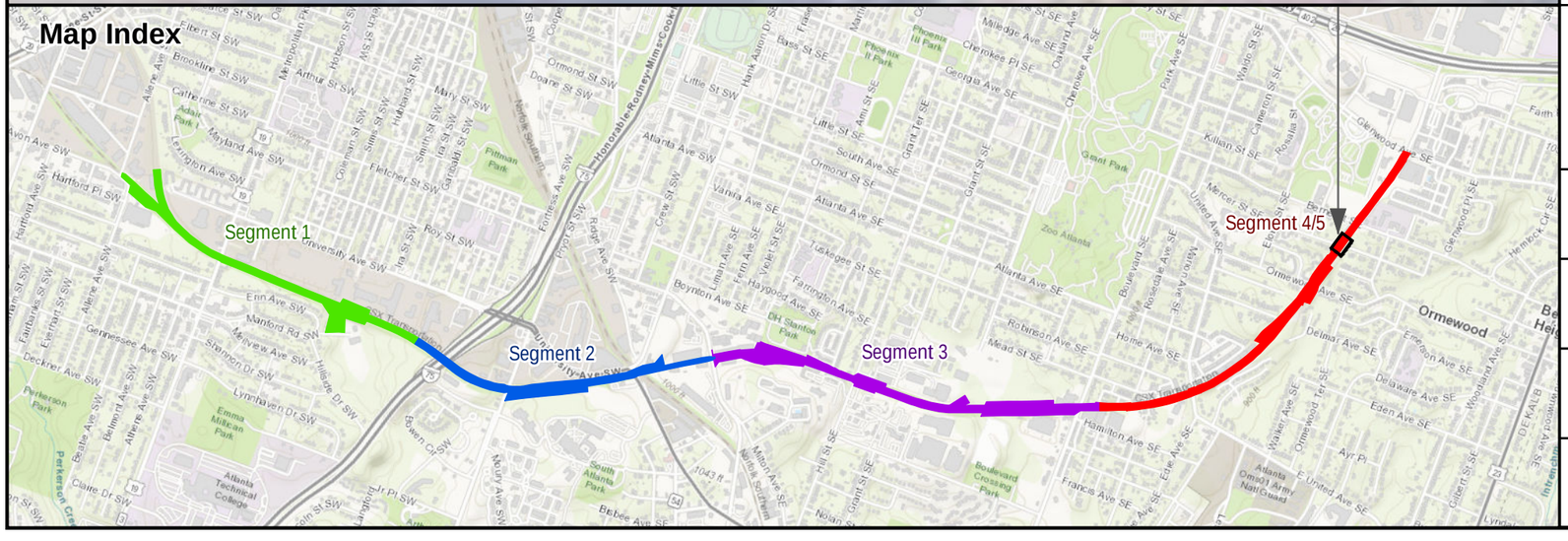
Exhibit 35

Extent View



Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 59.1 yd³

Approx. Station Number: 287+90

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.50 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING

625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 59

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

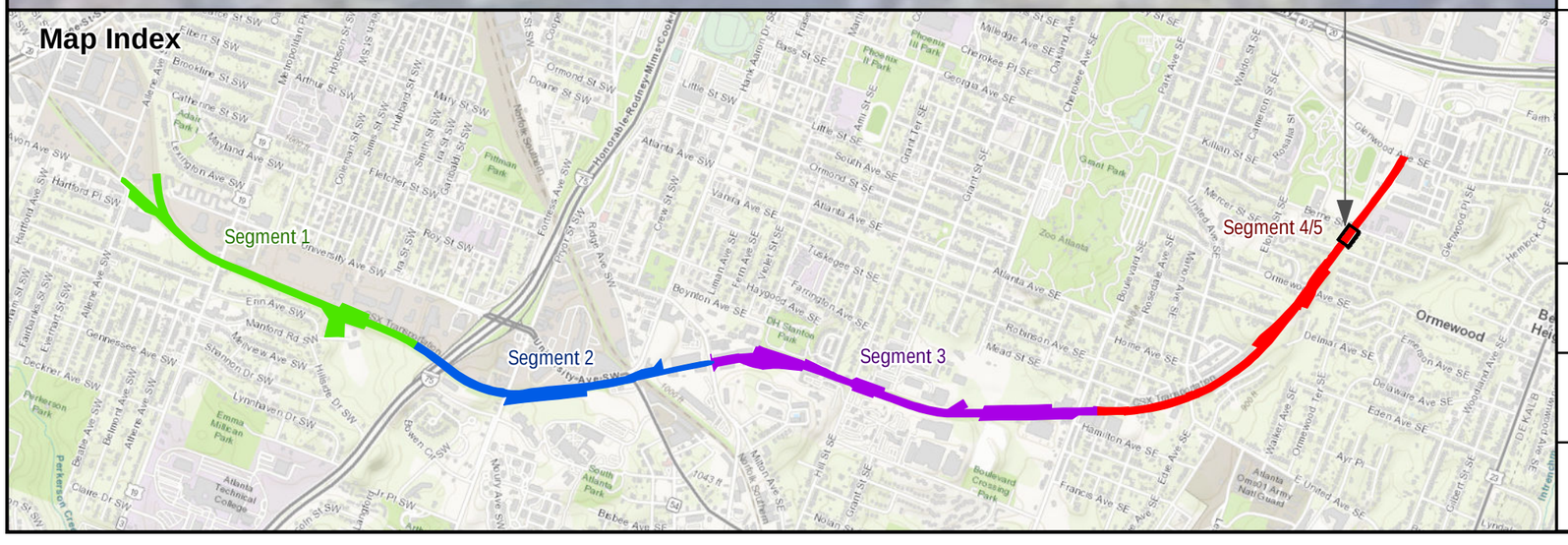
DRAWING NUMBER

Exhibit 36

Extent View

Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 6.2 yd³

Approx. Station Number: 290+15

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 1.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 60

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

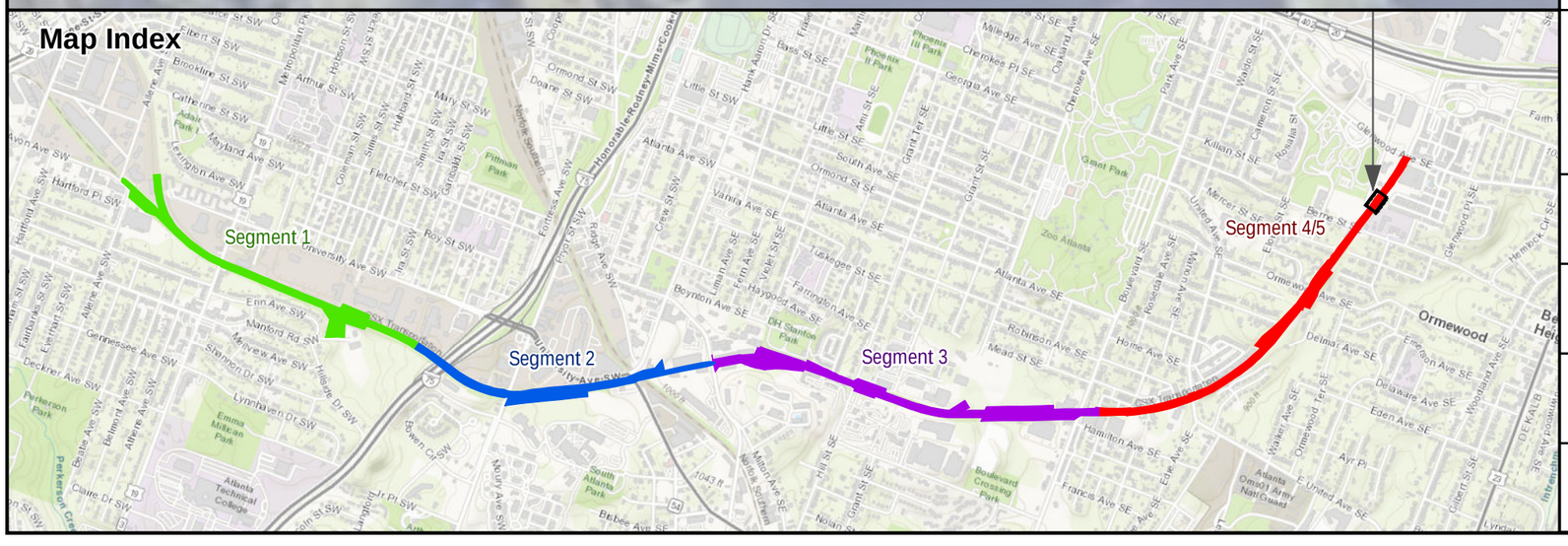
DRAWING NUMBER

Exhibit 37

Extent View

Original version of this drawing is in color. Black and white copies may not accurately depict certain information. Values and boundaries presented were obtained via GNSS Trimble Geo7 Receiver.

Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 24.3 yd³

Approx. Station Number: 296+10

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

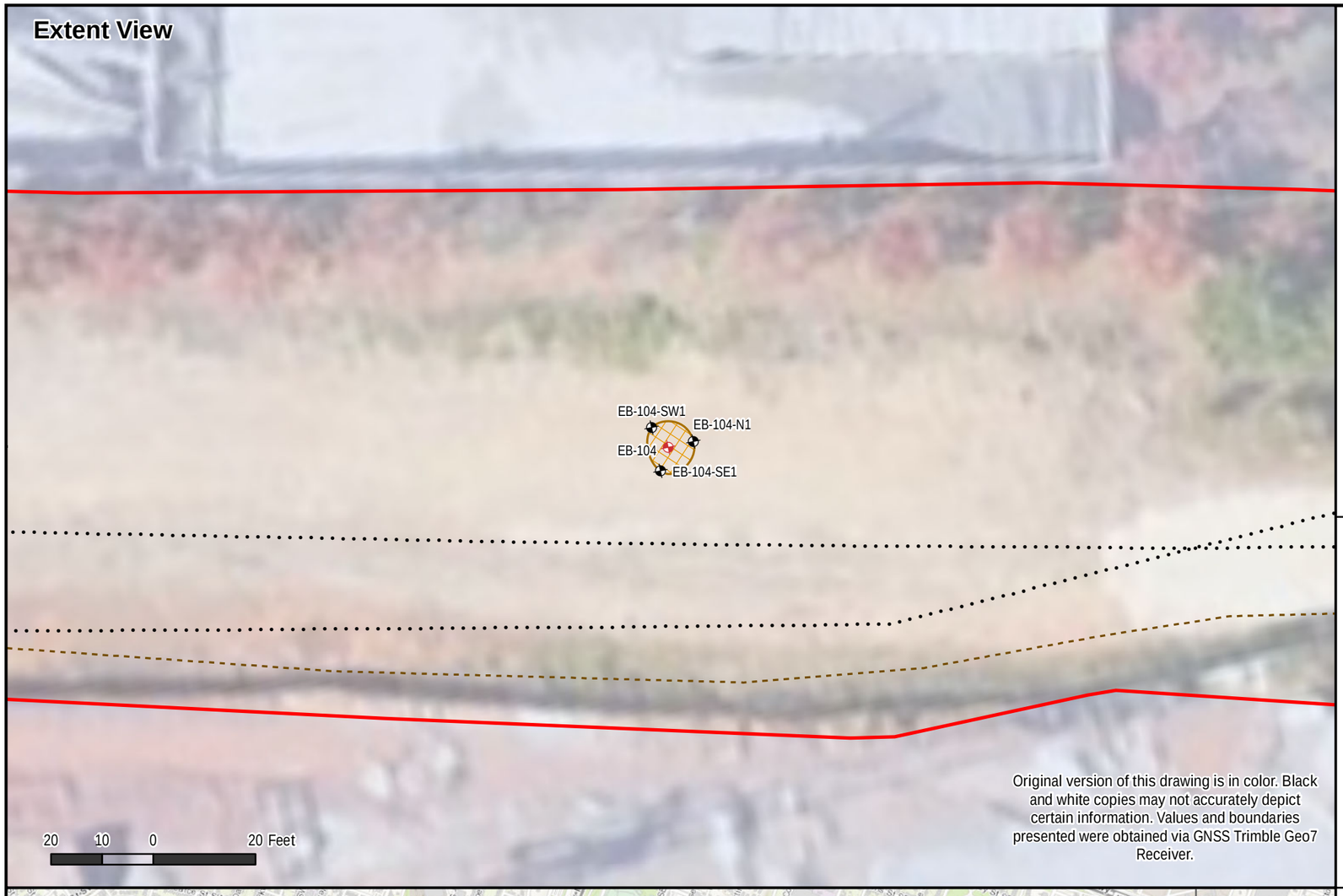
Remediation Area 61

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

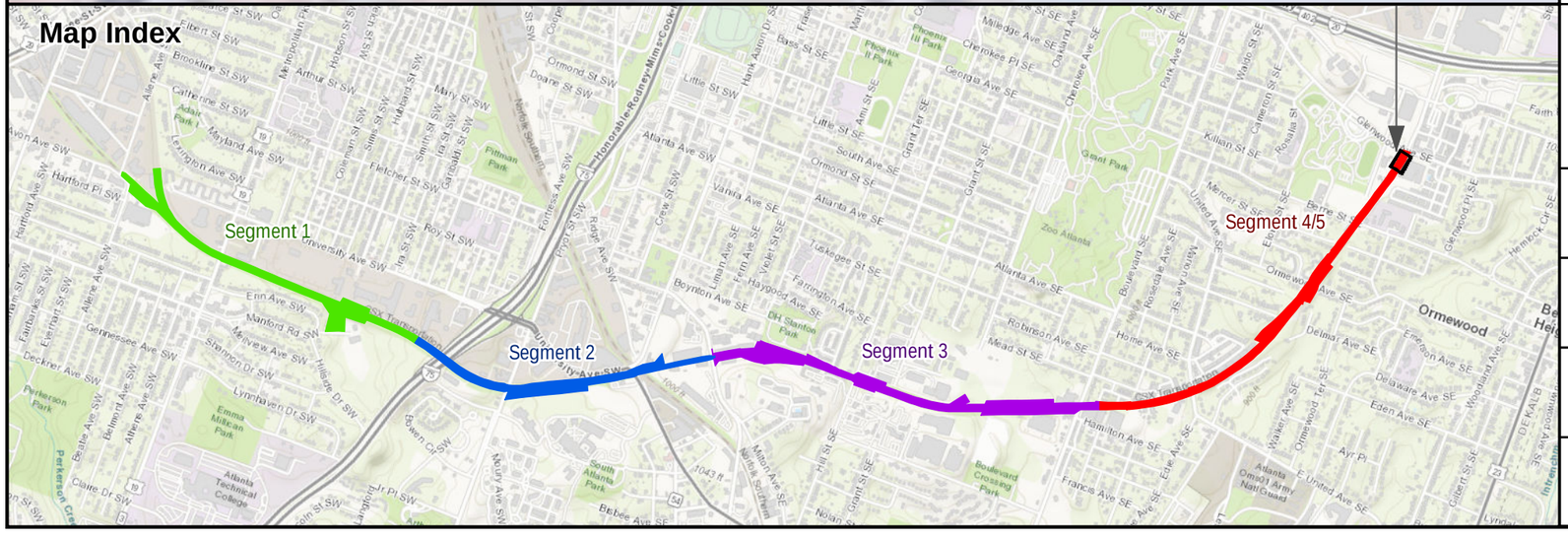
DRAWING NUMBER

Exhibit 38

Extent View



Map Index



Remedial Photograph

Pending Remediation

Summary Notes & Legend

Estimated Cubic Yards (Proposed): 5.5 yd³

Approx. Station Number: 301+90

Constituents of Concern: Arsenic

Proposed Depth of Excavation: 2.00 ft bgs

Measured Depth of Excavation (Center): 0.00 ft bgs

Utility Status: No Conflict

- Initial Soil Boring
- Delineation Boring
- Proposed Remedial
- Approx. GDOT Fiber
- MCI/Verizon Utility
- Segment 4-5 Boundary

REFERENCES

ESRI ArcMap 2020, Google Earth Imagery dated March 2019, USGS, and referenced preliminary boundaries for BeltLine Segments 2-4/5 provided by Kimley-Horn dated April 30, 2020.

UNITED CONSULTING
625 Holcomb Bridge Road, Norcross, Georgia 30071
770-209-0029 Fax 582-2900 www.unitedconsulting.com

MAIN EXTENT SCALE AND DIRECTION

1 inch = 25 feet

PROJECT

Atlanta BeltLine Southside Trail - Segment 4

CLIENT

Kimley-Horn / BeltLine

SHEET TITLE

Remediation Area 62

REVISION:	NA
PREPARED:	SCC
CHECKED:	BWS / RCG
DATE:	Oct 01, 2020
PROJECT NO.:	18-GA-01192-11/13

DRAWING NUMBER

Exhibit 39

APPENDIX D

Appendix F to PPCAP Amendment #2

Note:
Excluded and included as Appendix A to the Soil Management Plan

APPENDIX E

AES Laboratory Quality Assurance Manual

Standard Operating Procedure for the

Quality Assurance Manual

Analytical Environmental Services, Inc.
3080 Presidential Drive
Atlanta, Georgia 30340-0370
(770) 457-8177
FAX (770) 457-8188

Effective Date of Revision 25: February 3, 2020
Portal Server Location:
http:// Home/Documents/Quality Assurance/QA Manual/
AES_2020_QA_Manual_Rev_25

Andria Yildirim, President — Date 1/20/2020
808 Barn Owl Road
Marietta, Georgia 30068-2478
(770) 913-9431 phone

Mehmet Yildirim, VP of Operations — Date 1/20/2020

Dana Till, Technical Director — Date 1/20/2020

Ryan Sullivan, Laboratory Manager — Date 1/20/2020

Douglas Mendrala, Quality Assurance Manager — Date 1/20/2020

INTRODUCTION: Analytical Environmental Services, Inc. (AES) was established in 1992 in Atlanta, Georgia, and is an independent, woman-owned environmental testing laboratory dedicated to providing superior quality analytical data. The laboratory is one of the largest independent environmental laboratories in the Southeast comprised of highly skilled scientists and experts in the field of environmental testing who are dedicated to providing superior quality analytical data.

STANDARD OPERATING PROCEDURES FOR THE
QUALITY ASSURANCE PROGRAM

2.0 TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

3.0 STATEMENT OF POLICY

3.1 Quality Policy: The objective of Analytical Environmental Services, Inc is to generate high quality data in a cost effective manner, which is accurate, impartial, reliable, and adequate for its intended use. Management of AES is committed to following accepted laboratory practices to achieve high quality of testing services, and strives to ensure both the analytical validity and legal defensibility of all reported data managed so to safeguard impartiality.

AES management is committed to compliance with The NELAC Institute (TNI) Standards, AIHA-LAP, LLC International Standard, Georgia EPD as well as North Carolina and South Carolina rules to establish, implement, and maintain a quality system appropriate to the scope of all laboratory activities, including the type, range, and volume of testing. ISO/IEC 17025:2017 is the basis of laboratory accreditations. Management is committed to the accepted professional laboratory practices and shall document the policies, systems, programs, procedures, and instructions to the extent necessary to enable AES to assure the quality of the test results generated. Management is committed to good professional laboratory practice to meet customer requirements with quality service.

Laboratory management has established, documented, and maintained policies for the fulfilment of the purposes of this document and shall ensure that the policies and objectives are acknowledged and implemented at all levels of the laboratory organization. These policies address the competence, impartiality, and consistency of the laboratory operations. All documentation, processes, systems, records, related to the fulfilment of the requirements of this document shall be included in, referenced from, or linked to the management system.

Quality system documentation is communicated to, understood by, and made available to personnel through AES management by means of training and educational instruction. All laboratory staff concerned with analytical testing activities must familiarize themselves with the quality documentation and implement the policies and principles in their work. Management communicates to personnel their duties, responsibilities, and authorities. It is the policy of AES to continually improve quality systems and provide support to improvement efforts.

3.2 Purpose: The Quality Assurance Program (QAP) sets forth the management policy, organizational structure, and procedures for chemical analyses performed by AES. Management encourages the development and use of the best testing practices as dictated by each measurement situation. However, the procedures set forth herein must be followed to the greatest extent possible. All deviations must be documented in each individual case and maintained with the sample data. The QA Manual (QAM) and all Standard Operating Procedures will be reviewed no less than annually.

Appropriate use of data generated under the varying conditions encountered in environmental analyses requires reliance on the quality control practices incorporated into the procedures. Although the EPA, state environmental protection departments, The NELAC Institute (TNI), AIHA-LAP, LLC, other regulatory agencies, and clients require the use of approved methods for sampling and analysis, the mere approval of these procedures does not guarantee adequate results. Inaccuracies can result from many causes, including matrix effect, equipment malfunction, and operator error. Therefore, the quality control component of each method is indispensable and cannot be compromised.

This manual delineates the elements of the QA Program that must be implemented by all analytical sections of the laboratory. The requirements outlined in this procedure are the minimum requirements. Method-specific procedures and project-specific Quality Assurance Project Plans (QAPP) may require more stringent QA requirements.

3.3 Definitions

3.3.1 Quality Assurance (QA) is the total program for assuring reliability of the monitoring and measurement of data. It comprises all those planned and systematic actions necessary to provide adequate confidence that all aspects of laboratory service programs are performed in a manner satisfactory to AES management and to the needs of its customers.

3.3.2 Quality Control (QC) is the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process. It covers the operational procedures, techniques, and activities that provide the means to measure, evaluate and document the quality of data obtained in the laboratory. The QC Program specifies the minimum practices, which shall be used to assure that data is produced of a known and defensible quality and within acceptable limits.

3.4 Fields of Testing

This manual covers methods for the analysis of aqueous, solid, waste, and air matrices currently on AES scopes of accredited testing for AIHA-LAP, LLC, Florida DOH, The NELAC Institute (TNI), North Carolina DENR and South Carolina DHEC. A detailed list of test methods and analytes may be found in Section 5.0, which defines the minimum level of quality assurance/quality control needed to meet required specifications. All methods carried out by AES shall meet these stipulations as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs), or local regulations may require criteria other than those stated. In these cases, the laboratory will abide by the more stringent criteria, following a review and acceptance of the requirements by the Laboratory Manager and the Quality Assurance Manager.

3.5 Management of the Quality Assurance Manual

This manual was prepared in accordance with the current The NELAC Institute (TNI) standards and AIHA-LAP, LLC requirements. It also follows guidelines set by the U.S. Environmental Protection Agency, Florida DOH and ISO/IEC 17025. Tests are always carried out in accordance with stated methods and customers' requirements.

3.5.1 The QA manual is reviewed annually by the Quality Assurance Manager and laboratory personnel to confirm that it reflects current in-house practices and meets all the requirements of both AES' clients and accrediting agencies. Modifications may be made in order to correct inconsistencies, implement improvements, encompass new concepts or procedures, adapt to new regulations, or update any changes in state or national policies or standards. The Quality Assurance Manager, Laboratory Manager, Technical Director, and relevant operational staff review the changes before they are integrated into the QA manual.

3.5.2 Policies or procedures in the manual which demand immediate attention are addressed through the use of temporary and permanent Interim Change Notices as described in Section 8.

3.6 Control of the Quality Assurance Manual

The Quality Assurance Manual is considered confidential within Analytical Environmental Services, Inc. It may not be altered in any manner by anyone other than the Quality Assurance Manager, the Laboratory Manager, or an employee duly appointed by either of the aforementioned. The manual shall be marked as an "Uncontrolled Copy" if provided to external users or regulators. It is intended for the exclusive purpose of the review of AES' quality systems and shall not be used in any other way without written permission of the President, Laboratory Manager, or Quality Assurance Manager.

3.7 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence shall be as follows:

1. Analytical Environmental Services, Inc., Interim Change Notice
2. Quality Assurance Manual
3. Standard Operating Procedures
4. Other (memos, charts, published methods, etc.)

4.0 ORGANIZATION AND RESPONSIBILITY

4.1 Organization

Analytical Environmental Services, Inc. (AES) was established in 1992 in Atlanta, Georgia, and is an independent, woman-owned environmental testing laboratory dedicated to providing superior quality analytical data. The laboratory is one of the largest independent environmental laboratories in the Southeast comprised of highly skilled scientists and experts in the field of environmental testing who are dedicated to providing superior quality analytical data.

The professionals at the laboratory perform chemical and biological testing on a variety of environmental samples. These include solid waste matrices, soils, sediments, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, air sampling media, ground, surface and waste waters, aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, and tars.

4.2 Organizational Structure

The relationship between management, technical operations, support services and quality system is as follows: Laboratory Operations, Quality Assurance Department, Technical Director, and Customer Service Department report to the Vice President of Operations, who in turn reports to the company President. The Vice President of Technical Operations (Support Services) also reports directly to the President. The organizational structure of AES provides for an independent Quality Assurance Department with the overall responsibility of developing and auditing for compliance to a comprehensive Quality Assurance Program. The QA Department has the authority and organizational freedom to ensure that QA activities are implemented and accomplished. The Quality Assurance Manager reports directly to the Vice-President of Operations of AES.

4.2.1 Because of the breadth of knowledge required to produce quality data, the cooperation of numerous individuals is required. All assigned personnel shall remain diligent to identify, report, and promptly rectify issues or events affecting data quality as they occur. To encourage the identification of these situations, management at all levels shall promote continuous quality improvement throughout the entire company. These events and their resolutions must be verified and substantiated as required by this document and any other applicable QA guidelines.

Laboratory personnel have the authority and resources to carry out their duties, which include

- implementation, maintenance and improvement of the management system
- identification of deviations from the management system or from laboratory procedures
- initiation of actions to prevent or minimize such deviations
- reporting the effectiveness of the management system and laboratory activities
- Identifying needs for improvement

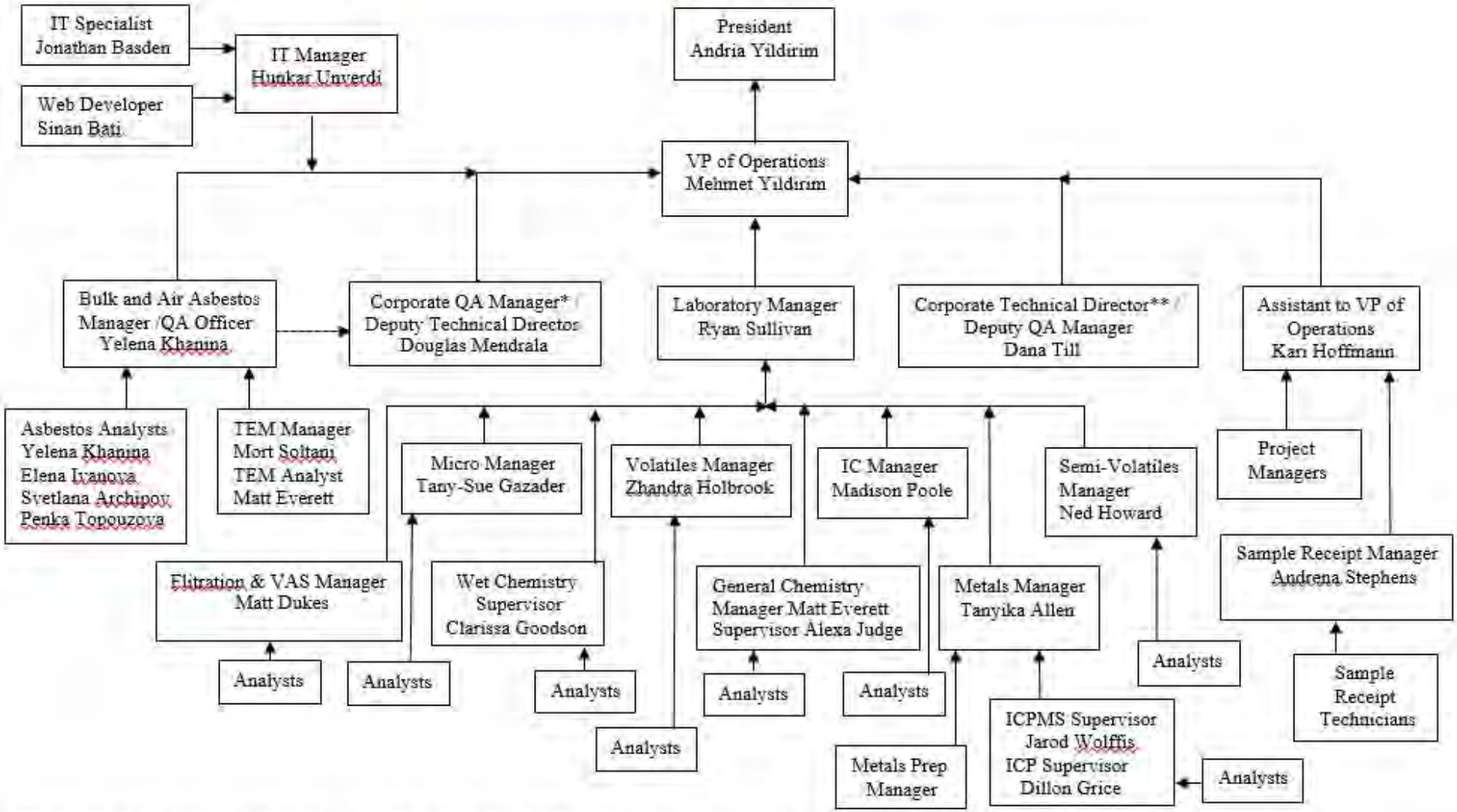
4.2.2 The establishment of a Quality Assurance Program requires the services of all the employees of AES in order to carry out the monitoring, record keeping, statistical techniques, and other functions required by the system. This total commitment of all personnel to the production and reporting of reliable data is dependent upon the conscientious effort of everyone involved. It is important, therefore, that each member of the organization have a clear understanding of his duties, responsibilities, and relationship to the total effort.

4.3 Organizational Chart

The organizational structure at AES is documented in the form of an organizational chart, Figure 4-1, which identifies the personnel involved in the production of quality data and depicts the lines of communication and responsibility throughout the entire organization.

Employees are provided routine communications in the form of training, lectures, meetings, and emails to focus on customer needs, regulatory requirements and to maintain an effective management system. This communication and internal monitoring allows for the integrity of the management system to be maintained when changes are implemented.

Figure 4-1. ORGANIZATIONAL CHART - Analytical Environmental Services, Inc



*TNI: The QA Manager will serve as deputy in the event of the Technical Director's absence.
**TNI: The Technical Director will serve as deputy in the event of the QA Manager's absence.

For AIHA-LAP LLC accreditation: The Laboratory Technical Director will serve as deputy for the IHLAP and ELLAP Technical Manager. The Laboratory Technical Director will also serve as deputy for the IHLAP and ELLAP Quality Assurance Manager. The Laboratory Quality Assurance Manager will serve as deputy for the EMLAP Microbiology Technical Manager and the Microbiology Quality Assurance Coordinator.

4.4 Responsibilities and Position Requirements

It is the responsibility of all AES employees to implement the Quality Assurance Program effectively. The roles and responsibilities of the technical management and the Quality Assurance Manager to ensure compliance with the regulatory standards (including AIHA-LAP, LLC and NELAC) are outlined in the position descriptions below. All chemists and technicians are responsible for understanding and following the measures of the QA program, and for reporting any quality failures to a Manager or Supervisor in a timely manner. Supervisors and Managers are responsible for ensuring that all laboratory personnel are familiar with the requirements of the Quality Assurance Program and that these requirements are implemented and maintained. It is the responsibility of the Supervisor to ensure that all laboratory personnel are trained to perform their assigned tasks. It is the responsibility of each Supervisor to ensure that any quality failures are reported to the Quality Assurance Department immediately.

The essential personnel involved in the implementation of and/or monitoring of the Quality Assurance Program are identified in the following sections.

4.4.1 President

The President is ultimately responsible for the quality of services provided by AES. The President is also responsible to establish and implement the procedures, policies, and findings of the QA program. The President is responsible for the commitment of delivering the appropriate tools and resources to the senior level staff and laboratory management to ensure that the overall QA program and clients needs can be met. The President authorizes the Quality Assurance Manager to perform internal audits on behalf of the company.

4.4.2 Vice-President of Operations

The Vice-President of Operations is responsible for the overall operation of the laboratory and reports directly to the President. The Vice-President of Operations ensures that all of the resources are available to implement and follow the procedures and policies as written in the AES QA Manual as well as management's commitment to compliance with The NELAC Institute (TNI) Standards. The Vice-President of Operations reviews and approves the Corporate Quality Assurance Manual. The Vice-President of Operations also authorizes the Quality Assurance Manager to perform internal audits on behalf of the company.

Either the President or Vice-President of Operations will conduct the annual management review of laboratory operations to assess the effectiveness of policies and procedures in order to implement changes where deemed necessary. The agenda of the annual meeting will include reports from all department supervisors and cover such topics as quality assurance, accreditations, documentation, changes in the laboratory, equipment and maintenance needs, results of audits etc. The topics to be discussed will be determined by the President or Vice-President of Operations. A current list of topics is presented in Attachment 6.

4.4.3 Vice-President of Technical Services

The Vice-President of Technical Services reports directly to the President and is responsible for the selection and trouble-shooting of all equipment and instrumentation. The Vice-President of Technical Services is also responsible for the installation, maintenance, and data management associated with all computers, automated equipment, network systems, software, and Internet services, as well as the Laboratory Information Management System (LIMS). The Vice-President of Technical Services ensures that all computers and automated equipment used for acquiring, processing, manipulating, recording, reporting, retrieving, or storing test data meet all of AES' Quality Assurance objectives, and that all computer software is documented and adequate for use.

This position provides for the protection of the integrity of all electronic data. All computers and automated equipment must be maintained to ensure proper functioning, which includes providing environmental and operating conditions necessary to maintain the integrity of the test data. The Vice-President of Technical Services establishes and implements appropriate procedures for ensuring electronic data security.

4.4.4 Laboratory Manager

The Laboratory Manager is responsible for the daily operations within the analytical sections of the laboratory. If the Laboratory Manager is absent for a period of time exceeding 15 consecutive calendar days, the Vice-President of Operations must designate another full-time staff member meeting the qualifications of the Laboratory Manager to temporarily perform this function. In case of a change of Laboratory Manager, all necessary, accrediting authorities must be notified in writing within thirty days. The following is the position description for Laboratory Manager:

Position Description and Requirements

Position Title: Laboratory Manager

Position Description: This position is responsible for the following:

- Oversees the daily operations of the laboratory.
- Ensures that client specific reporting & quality control requirements are met.
- Works with the Project Managers and Department Managers to ensure project objectives are met in a timely manner.
- Sets goals and objectives for both the business and the laboratory employees.
- Provides direction to departmental managers to steer all departmental efforts toward the overall corporate production goals.
- Discusses and resolves disagreements, as necessary, with laboratory personnel.
- Coordinates any unresolved concerns between the project managers and the departmental supervisors.
- Ensures that all analysts and supervisors have the appropriate education & training to properly carry out the duties assigned to them, and ensures that this training has been documented.
- Ensures that a sufficient number of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that HR policies are adhered to and maintained.
- Ensures management's commitment to compliance with The NELAC Institute (TNI) Standards
- Ensures compliance with International Standard ISO/IEC 17025
- Hires key personnel and recruits professional talent.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Schedules analytical operations.
- Supervises the maintenance of instruments and the scheduling of repairs.
- Ensures that appropriate corrective actions are taken to address analyses as requiring such actions by internal & external performance or procedural audits.
- Ensures that personnel are free from any commercial, financial or other undue pressures that which adversely affect the quality of their work.
- Supervises the preparation & maintenance of laboratory records.
- Responsible for holding documented meetings as needed with the departmental supervisors.

Position Requirements: BA or BS in Chemistry, Microbiology, Biology, Environmental Science or any other related degree. Must have 2-5 years of experience carrying out the duties described above.

4.4.5 Quality Assurance Manager

The QA Manager is responsible for establishing a Quality Assurance Program that meets the quality assurance objectives of the company, and its clients. If the QA Manager is absent for a period of time exceeding 15 consecutive calendar days, the Vice-President of Operations must designate another full-time staff member meeting the qualifications of the QA Manager to temporarily perform this function. In case of a change of QA Manager, all necessary accrediting authorities must be notified in writing within thirty days. The following is the position description for Quality Assurance Manager:

Position Description and Requirements

Position Title: Quality Assurance Manager

Position Description: This position is responsible for the following:

- Directs all corporate quality assurance (QA).
- Responsible for developing and maintaining all QA systems and documentation.
- Responsible for all aspects of the State and Federal Certification processes.
- Maintains records of acceptable performance of MDLs.
- Directs management to compliance to the AIHA-LAP, LLC Accreditation Policies
- Directs management to compliance with The NELAC Institute (TNI) Standards
- Ensures compliance with International Standard ISO/IEC 17025
- Has authorization from company President and VP of Operations to conduct internal audits
- Maintains all quality control charts.
- Has direct access to the Technical Director and to the highest level of management where decisions are made on laboratory policy and resources.
- Serves as focal point for QA/QC; has responsibility for the oversight and review of quality control data.
- Functions independently from laboratory operations for which QA oversight is held.
- Evaluates data objectively and performs assessments without outside influence.
- Performs periodic reviews of test reports under AIHA-LAP, LLC according to the LQSR.
- Conducts internal audits on the entire laboratory technical operation annually.
- Notifies laboratory management of deficiencies in the quality system and monitors corrective action.
- Maintains currency of the QA manual.
- Responsible for preparing/submitting a quarterly report to the President and Vice-President of Operations.
- Serves as deputy in the event of the Technical Director's absence.

Position Requirements: Must have a BA or BS in Chemistry, Microbiology, Biology, Environmental Science or any other related degree. Must have 2-5 years of experience carrying out the duties described above.

4.4.6 Department Director (If Applicable)

The Department Director reports to the Vice President of Operations / Laboratory Manager and is responsible for the administrative functions within the assigned department(s). This includes but is not limited to non-production activities such as monitoring Demonstrations of Capabilities, oversight of Standard Operating Procedure updates, Method Detection Limits Studies, as well as departmental instrument maintenance and quality assurance assignments. In addition, the Department Director is responsible for assuring adequate staffing and training. The following is the position description for Department Director:

Position Description and Requirements

Position Title: Department Director (If Applicable)

Position Description: This position is responsible for the following:

- Oversees the daily operations of the laboratory.
- Ensures that client specific reporting & quality control requirements are met.
- Works with the Project Managers and Group Team Leaders to ensure that project objectives are met in a timely manner.
- Sets goals and objectives for both the business and the laboratory employees.
- Provides direction to departmental managers to steer all departmental efforts toward the overall corporate production goals.
- Discusses and resolves disagreements, as necessary, with laboratory personnel.
- Coordinates any unresolved concerns between the project managers and the departmental supervisors.
- Ensures that all analysts and supervisors have the appropriate education & training to properly carry out the duties assigned to them, and ensures that this training has been documented.
- Ensures that a sufficient number of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that HR policies are adhered to and maintained.
- Ensures management's commitment to compliance with The NELAC Institute (TNI) Standards
- Hires key personnel and recruits professional talent.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Schedules analytical operations.
- Supervises the maintenance of instruments and the scheduling of repairs.
- Ensures that appropriate corrective actions are taken to address analyses as requiring such actions by internal & external performance or procedural audits.
- Ensures that personnel are free from any commercial, financial or other undue pressures that which adversely affect the quality of their work.
- Supervises the preparation & maintenance of laboratory records.
- Responsible for holding documented meetings as needed with the departmental supervisors.

Position Requirements: A Degree or the necessary experience to achieve the requirements outlined in the position description. Must have 2-5 years of experience carrying out the duties described above.

4.4.7 Technical Director

The Technical Director exercises daily supervision of laboratory procedures and the reporting of results. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Vice-President of Operations must designate another full-time staff member meeting the qualifications of the Technical Director to temporarily perform this function. In case of a change of Technical Director, all necessary accrediting authorities must be notified in writing within thirty days. The following is the position description for Technical Director:

Position Description and Requirements

Position Title: Technical Director

Position Description: This position is responsible for the following:

- Updates SOPs as required.
- Maintains Test Codes
- Ensures that all employees are properly trained
- Reviews and approves revisions to the Quality Assurance Manual.
- Maintains records of employee training including acceptable performance of IDOCs.
- Provides technical assistance in the development of new methods.
- Responsible for following direction given by the Vice-President of Operations.
- Ensures management's commitment to compliance with The NELAC Institute (TNI) Standards
- Ensures compliance with International Standard ISO/IEC 17025
- Provides technical guidance to analytical staff.
- Assists with internal and external audits.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits.
- Oversees equipment maintenance and repair.
- Assists the Laboratory Manager in the investigation of new technologies and proposed equipment acquisitions by the laboratory.
- Serves as deputy in the Quality Manager's absence.

Position Requirements: A Bachelor's Degree in chemical, environmental, biological, or physical sciences or engineering, with at least 24 college semester credit hours in chemistry and at least two years of experience in the environmental analysis of representative inorganic and organic analytes for which the laboratory seeks or maintains accreditation. A Masters or Doctoral Degree may be substituted for one year of experience.

4.4.8 Microbiology Lab Supervisor

Microbiology Lab Supervisor reports to the Lab Manager on all aspects of sample processing. The Microbiology Lab Supervisor is responsible for managing Microbiology Analysts.

Position Description and Requirements

Position Title: Microbiology Lab Supervisor

Position Description: This position is responsible for the following:

- Training and qualification of personnel (under their supervision) on procedures.
- Monitors necessary protocols and standard operating procedures, including control charts.
- Maintains QC within their area of responsibility.
- Ensures that personnel (under their supervision) use approved procedures, and maintain all QC.
- Recommends and implements new or revised QC policies as approved by the QA Manager.
- Assists Technical Director in reviewing preventative maintenance as detailed in the QA manual or SOPs.
- Reviews data and QC results, and reports non-conformances to the appropriate QA Manager, Technical Manager, and/or Vice-President of Operations.
- Provides guidance to analysts in resolving problems encountered daily during sample preparation and analysis, in conjunction with the Technical Director or Quality Assurance Manager.
- Ensures all logbooks are maintained and current.
- Maintains adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Assists Technical Director with Demonstrations of Capability.

Position Requirements: A Degree (typically Microbiology, Biology or equivalent) or the necessary experience to achieve the requirements outlined in the position description.

4.4.9 Microbiology Analyst

The Microbiology Analyst training required is described in detail in the Employee Training Files maintained by the Technical Director.

Position Description and Requirements

Position Title: Microbiology Analyst

Position Description: This position is responsible for the following:

- Performs analyses by adhering to analytical and quality control protocols prescribed by SOPs, the QA manual, and project specific requirements (e.g. data packages).
- Documents standard and sample preparation, instrument maintenance, calculations, and any observed non-conformances on work lists, bench sheets, or laboratory logbooks.
- Reports all out-of-control situations, instrument problems, matrix problems, and QC failures, which might affect the reliability of the data, to their respective supervisors or the QA Manager.
- Reviews data generated and submits it to the departmental supervisor prior to entering and submitting the data to the next level of review.

Position Requirements: At a minimum, analysts must possess a high school diploma or equivalent or the necessary experience to achieve the requirements outlined in the position description.

4.4.10 Technical Assistant

The Technical Assistant reports directly to the Technical Director and assists with the implementation and maintenance of all programs assigned to the Technical Director.

Position Description and Requirements

Position Title: Technical Assistant

Position Description: This position is responsible for the following:

- Schedules, tracks and provides preliminary document review for DOC studies.
- Performs SOP updates as instructed from Tech. Director.
- Maintains SOP document control system.
- Scans and publishes completed documents to Portal Server for archiving.
- Schedules and documents training sessions and staff meetings held by Tech. Director.
- Assists Tech. Director with development of training program content and media.
- Assists Tech. Director with day-to-day functions of the Tech. Direction Dept. as needed.

Position Requirements: A Bachelors Degree in a science or engineering based major.

4.4.11 Director of Project Management

The Director of Project Management serves as a liaison between the laboratory and its clients ensuring the delivery of reports and data packages. The following is the position description for the

Position Description and Requirements

Position Title: Director of Project Management

Position Description: The Director of Project Management serves as a liaison between the laboratory and its clients, and ensures delivery of data packages. Responsibilities include:

- Meets client specifications by communicating project and QA requirements to the laboratory.
- Assigns project managers.
- Notifies laboratory personnel of incoming projects and sample delivery schedules and requirements.
- Monitors the status of data package projects in-house to ensure timely and accurate delivery of reports.
- Informs clients of data package related problems and resolves service issues.
- Coordinates requests for sample containers and other services such as data packages.
- Reviews and approves, with input from the Vice-President of Operations, proposals for marketing.
- Reviews laboratory data reports and quotes.

Position Requirements: A Degree or the necessary experience, 2 years management or supervisory experience, strong computer and personnel skills, knowledge of the environmental and chemical sciences, and previous project management experience.

4.4.12 Project Manager

The Project Manager is responsible for directly ensuring that the individual client's needs are met on a project-by-project basis with respect to the laboratory's QA program and any project-specific QA programs. The Project Manager is responsible for disseminating any project-specific information to the Laboratory Manager and/or Laboratory Director. Non-routine QA requirements must be approved by the Laboratory Director and Laboratory Manager. The following is the position description for Project Manager:

Position Description and Requirements

Position Title: Project Manager

Position Description: This position is responsible for the following:

- Ensures effective and accurate communication between the client and the laboratory.
- Handles all client requests and needs.
- Utilizes any corporate documents to consult with clients about client questions or concerns.
- Responsible for notifying the Director of Project Management of any client activities that entail services that are not currently performed by AES.
- Assesses client requests with consultation with the Director of Project Management.
- Develops and maintains client records and requirements.
- Ensures that the laboratory is aware of, and completes, all client requests and requirements.
- Responsible for meeting with the Marketing Manager, Director of Project Management, and President on a periodic basis for marketing purposes.
- Communicates proper sampling, shipping, and receiving procedures to clients.
- Documents all client interaction and maintains all client information in the Project Management System.
- Reviews and approves data reports prior to their release to the clients.
- Ensures client specific reporting and quality control requirements are met.

Position Requirements: A Degree or the necessary experience to achieve the position requirements outlined in the Position Description.

4.4.13 Department Manager

Oversees daily operation of department(s), supervises all employees, and handles all issues in the department(s).

Position Description and Requirements

Position Title: Department Manager

Position Description: This position is responsible for the following:

- Supervise all employees to ensure they are working to full potential and being productive at all times.
- Handle all personnel issues, i.e. conflict between workers, inappropriate behavior, schedule changes, time-off requests, etc…
- Write warnings if needed.
- Ensure employee's time sheets reflect actual work schedule.
- Make sure clock in-out times are accurate.
- Make sure employees are coming to work at the designated time.
- Monitor employee breaks.
- Assign tasks to personnel using the Task Management software.
- Grade task upon completion, this is to be included in the employee's Performance Evaluation.
- The use of this software will also be used in performing supervisor's Performance Evaluation.
- Perform Employee Performance Evaluations on all employees in department.

Production responsibilities:

- Maintain backlog to ensure all samples are completed within holding time, due date, and that all special requirements are met.
- Keep track of inventory and order supplies as needed.
- Sufficient amounts of reagents, solvents, standards, etc… must be kept at all times so production is not affected because of a shortage of supplies.
- Identify and solve problems within the department including, but not limited to equipment, tests performed, and any other issues resulting from the preparation/analysis of samples.
- A supervisor is required to stay until problems are solved or rush work is completed to within a reasonable amount of time or hour (this includes staying late and working weekends.)
- Delegate work to employees.
- Assign batches and/or tests.
- Assign new tests to employees so workload can be spread evenly among staff.
- Assign duties to employees, i.e. ordering of supplies, logging in new supplies, etc…

QA Responsibilities:

- Ensure all employees are properly trained and DOC's performed.
- Ensure all CDOC's are performed on a yearly basis for all employees and for all tests.
- Ensure MDL's are completed/prepped yearly, more often where applicable, or as needed due to instrument changes/maintenance.
- Complete PT samples in a timely manner and identify any issues with test as soon as possible.
- If necessary, coordinate preparing/running of Proficiency samples with associated departments to ensure their timely completion and enough samples remain for all tests.
- QA review any data generated within department.
- Review and revise SOP's when necessary.
- Ensure all batches, logbook pages, raw data, & paperwork are scanned & posted onto the Portal Server.

Position Requirements: A Bachelors Degree preferably in chemical, environmental, biological, physical sciences, engineering, or other scientific discipline and at least two years of experience in the environmental analysis similar to that which will be overseen.

4.4.14 Supervisors

Supervisors are responsible for the operation of their respective section of the laboratory, and report to the managers.

Position Description and Requirements

Position Title: Supervisors

Position Description: Supervisors report to their respective Manager on all aspects of sample processing. If a section does not have a supervisor, the Manager of that section functions as the supervisor. The Supervisor's responsibilities include, when applicable:

- Training and qualification of personnel (under their supervision) on procedures.
- Monitors necessary protocols and standard operating procedures, including control charts.
- Maintains QC within their area of responsibility.
- Ensures that personnel (under their supervision) use approved procedures, maintain all instrumental QC.
- Recommends and implements new or revised QC policies as approved by the QA Manager.
- Assists Technical Director in reviewing preventative maintenance as detailed in the QA manual or SOPs.
- Reviews all data and QC results, and reports non-conformances to the appropriate QA Manager,
- Technical Manager, and/or Vice-President of Operations.
- Provides guidance to analysts in resolving problems encountered daily during sample preparation and analysis, in conjunction with the Technical Director or Quality Assurance Manager.
- Ensures all logbooks are maintained and current.
- Maintains adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Assists Technical Director with MDLs and IDOCs.

Position Requirements: Degree or the necessary experience to achieve the requirements outlined in the position description. Two plus years of experience will be considered in lieu of a degree.

4.4.15 Analysts

Analysts are responsible for performing the various testing, digestive, and extractive procedures required in the laboratory.

Position Description and Requirements

Position Title: Analysts

Position Description: Each type of analyst position and the specific training required is described in detail in the Employee Training Files maintained by the Technical Director. In general, analysts are responsible for the following duties:

- Performs analyses by adhering to analytical and quality control protocols prescribed by SOPs, the QA manual, turnaround times, rush analyses and short hold analyses, and project specific requirements (e.g. data packages).
- Documents standard and sample preparation, instrument calibration and maintenance, data calculations,

and any observed non-conformances on work lists, bench sheets, or laboratory notebooks.

- Reports all out-of-control situations, instrument problems, matrix problems, and QC failures, which might affect the reliability of the data, to their respective supervisors or the QA Manager.
- Reviews all data generated prior to entering and submitting the data to the next level of review.
- Suggests method improvements to their supervisor, Technical Director, or the QA Manager for potential incorporation into SOPs.

Position Requirements: At a minimum, analysts must possess a high school diploma or equivalent. If the analyst operates equipment, the analyst must satisfactorily complete a short course offered by an equipment manufacturer, professional organization, university, or other qualified training facility (in-house training is acceptable).

4.4.16 Project Manager Assistant

Project Manager Assistants are responsible for providing assistance to project managers with the production and completion of data packages.

Position Description and Requirements

Position Title: Project Manager Assistant

Position Description: Project manager assistants report to the project managers. This position is primarily responsible for assisting project managers with on time completion of all data packages and to ensure effective and accurate communication between lab and project managers with respect to data package status. In general project manager assistants are responsible for the following duties:

- Assigns data packages and completion dead lines to appropriate lab departments.
- Responsible for initial data package review after data package was completed by lab departments
- Responsible of notifying project managers or Director of Project Management of any internal problems or discrepancies that may affect data package on time completion.
- Responsible for formatting data package (inserting dividers, making table of contents, copying reports, COC and checklist, putting all data in appropriate order, etc);
- Responsible for setting bookmarks and creating CD ROM's, completing and updating data package status document (located on the AES Server) on the daily basis, and ensures that data package was scanned or copied after approved by the project manager

Position Requirements: A Degree or the necessary experience to achieve the requirements outlined in the position description.

4.5 Improper, Unethical, or Illegal Actions; Data Integrity System; and Confidentiality of Client Information and Proprietary Rights

4.5.1 It is recognized that the quality assurance program is an inherent function involving all of the organizational components and personnel. The achievement of quality objectives is attained by each individual performing assigned work in strict compliance with approved and applicable requirements and procedures.

4.5.2 For a quality assurance program to succeed, it is imperative that all employees adhere to procedures which detect and prevent improper, unethical, or illegal actions which could in any way compromise the reliability and data integrity. Training in legal, ethical, data integrity, and confidentiality of client information and proprietary rights responsibilities is mandatory. Records are maintained that document,

through individual signatures, that every employee understands the consequences of improper, unethical, or illegal actions related to data integrity. Potential instances of improper, unethical, illegal actions or Data Integrity issues will be discussed and addressed in senior management meetings.

The laboratory will inform the clients, of the information it intends to place in the public domain. Except for information that the customer makes publicly available, or when agreed between the laboratory and the customer (e.g. for the purpose of responding to complaints), all other information is considered proprietary information and shall be regarded as confidential. Personnel acting on the laboratory's behalf, shall also keep confidential all information obtained or created during the performance of laboratory activities, except as require by law. The laboratory is responsible for management of all information obtained or created during the performance of laboratory activities.

Information about the customer obtained from sources other than the customer (e.g. complainant, regulators) shall be confidential between the customer and the laboratory. The provider (source) of this information shall be confidential to the laboratory and shall not be shared with the customer, unless agreed by the source.

4.5.3 Improper actions are defined as deviations from method-specified or client-specified analytical or quality assurance practices. These events may be intentional or unintentional. Disciplinary measures may include verbal warnings, written warnings, and/or dismissal.

4.5.4 Unethical or illegal actions are defined as the deliberate falsification or alteration of analytical or quality assurance results where failed method, quality control, or client specifications are made to appear acceptable. These actions affect the integrity of the data. Also included as unethical or illegal actions is the falsification and reporting of data where analyses were never performed. Disciplinary measures may include verbal warnings, written warnings, and/or dismissal. Findings of fraud may be prosecuted to the fullest extent of the law.

4.5.5 Employee training of legal, ethical, and data integrity responsibilities establishes the program and procedures that prevent and detect improper, unethical, or illegal actions by employees. Deterrence begins with a position of zero tolerance established by management. Employee training supports and sustains the policy.

4.5.5.1 Training of laboratory employees with respect to their legal and ethical responsibilities is comprised of three basic components:

4.5.5.1.1 The definition of improper, unethical, or illegal actions.

4.5.5.1.2 The elements of the laboratory's prevention and detection program.

4.5.5.1.3 Some examples of inappropriate laboratory practices that affect data integrity.

4.5.5.2 Training courses in legal and ethical responsibilities also include the potential punishments and penalties for fraudulent conduct.

4.5.6 Laboratory management implements a variety of proactive measures to promote the prevention and detection of improper, unethical, or illegal activities. Minimum requirements are included in the quality program by means of the following:

4.5.6.1 An ethics and data integrity policy that is read and signed by all personnel.
4.5.6.2 Initial and annual ethics and data integrity training.
4.5.6.3 Internal audits.
4.5.6.4 Anti-fraud language in client contracts and project agreements, where applicable.
4.5.6.5 Analyst notation and signature on manual integration changes to data and/or calculations.
4.5.6.6 Mandatory use of electronic and computer software audit functions wherever possible.
4.5.6.7 A no-fault policy that encourages employees to come forward and report fraudulent activities.

4.5.7 Employees are provided routine communications in the form of training, lectures, and updates in policy that are intended to reduce illicit behavior.

4.5.8 Any of the following means may be used to monitor the quality and validity of test results:

4.5.8.1 Internal quality control samples.

4.5.8.2 Interlaboratory comparisons or proficiency test studies.

4.5.8.3 Certified reference materials or internal quality control using secondary reference materials.

4.5.8.4 Replicate tests using the same or different methods.

4.5.8.5 Re-testing of retained samples.

4.5.8.6 Correlation of results for different characteristics of a sample.

4.5.9 Examples of inappropriate practices include the following:

4.5.9.1 Failure to properly record and preserve data: Analysts must be able to clearly demonstrate how analytical values were obtained from the associated raw data. Such documentation shall be maintained by the laboratory and be available to data users or auditors at any time. This includes failure to document data in the original logbook or on the original company form. Transferring data from a scratch paper or note paper to the logbook or company form is never allowed. The data must be recorded in the appropriate document at the time the test or preparation is being performed by the person performing the test. Failure to comply with this will result in disciplinary measures up to and including dismissal.

4.5.9.2 Failure to properly document errors: All errors, mistakes, and justifications for manual integrations must be fully explained within the case narrative of the final report.

4.5.9.3 Failure to initiate corrective actions: Analysts having knowledge of any part of an analysis or procedure that requires corrective action must immediately notify management.

4.5.9.4 Failure to report a missed holding time: Samples analyzed outside of allowed holding times must not be reported without qualifying the data, and some results may be unusable due to lack of validity. Backdating an analysis to save a missed hold time is forbidden.

4.5.9.5 Failure to follow methods or SOPs as written: Methods and standard operating procedures must be followed without deviation. Analysts must immediately submit any changes to the Technical Director for revisions.

4.5.9.6 Signing another person's signature to documentation.

4.5.10 Improper, unethical, and illegal actions are considered fraudulent because they affect the integrity of the data. Gross deviations from specified procedures will be investigated for potential improper, unethical, illegal actions and data integrity issues. Findings of fraud may be prosecuted to the fullest extent of the law. The following are examples of improper, unethical, and illegal conduct that affect data integrity:

4.5.10.1 Improper use of manual integrations to meet calibration or method Quality Control criteria, such as peak shaving or peak enhancement, if performed solely to meet QC requirements.

4.5.10.2 Falsification of results to meet method requirements.

4.5.10.3 Reporting of results without analyses to support the data or reporting results from the analysis of one sample for those of another.

4.5.10.4 Selective exclusion of data to meet QC criteria, such as dropping calibration points without technical or statistical justification.

4.5.10.5 Misrepresentation of laboratory performance by falsifying calibration data or QC.

4.5.10.6 Reporting QC limits in data reports that are not part of the data set reported or to historical data.

4.5.10.7 Citing matrix interference as a basis for exceeding acceptance limits, especially without initiating corrective actions, in interference-free matrices.

4.5.10.8 Unwarranted manipulation of computer software such as subtracting or not subtracting a blank or background, altering chromatographic baselines, or improper background subtraction (GC/MS) to comply with ion abundance criteria in to meet QC requirements.

4.5.10.9 Improper alteration of analytical conditions, such as modifying an EM voltage or changing a GC temperature program to induce a shorter analytical run time, which makes the standard analysis different from the sample analysis.

4.5.10.10 Misrepresentation of QC samples, such as adding surrogates after sample extraction, omitting sample preparation steps for QC samples, over-spiking, or under-spiking.

4.5.11 The Data Integrity System (a.k.a. Legal & Ethical Training SOP) is reviewed annually as part of the annual management review.

4.5.12 To ensure confidentiality of data integrity issues, a chain of command policy has been adopted. Employees are encouraged to bring data integrity issues to their immediate supervisor. If the supervisor is a part of the data integrity issue, then the employee brings the issue to the Laboratory Manager, who is part of upper management. In the absence of the Laboratory Manager, the issue is brought to either the Quality Assurance Manager or the Technical Director. Confidential consultation with the Human Resources Manager may take place to resolve the issue. Discussions will take place outside the laboratory and in upper management's office(s) to again help ensure confidentiality.

4.5.13 Employees are also trained the importance of Confidentiality of Client Information and Proprietary Rights. Employees are taught as part of their Legal & Ethical Training that they should not discuss client information, events, knowledge of investigations, information about the client obtained from sources other than the client or results outside the work place. This information is considered confidential. Further, they are informed that failure to comply is a violation of their Data Integrity training and is considered grounds for termination of employment.

4.6 Undue Internal and External Pressures and Impartiality

4.6.1 AES, Inc. strives for the highest caliber of laboratory performance in conjunction with accomplishing quality objectives. One component of realizing this goal is to protect laboratory personnel from undue internal and external pressures.

4.6.2 The laboratory shall be responsible for the impartiality of its laboratory activities and shall not allow commercial, financial or other pressures to compromise impartiality. If a risk to impartiality is identified, the laboratory shall be able to demonstrate how it eliminates or minimizes such a risk.

4.6.3 At AES, Inc. analysts and technicians are insulated from work-related undue pressures that would compromise the quality of their work. Management is aware and considerate of these internal pressures such as management burdens and project deadlines, and of external stresses such as customer complaints and priority requests for analysis.

4.6.3 Management policy is to remain supportive of laboratory personnel and aware of their workloads and the demands placed upon them. Precautions are taken to ensure that there are no conflicts of interest between staff and clients. For example, priority requests, complaints, or status of work inquiries are directed through supervisors, managers, or administrative personnel.

4.6.4 Internal complaints and concerns expressed by employees are handled by AES' policy of encouraging free communication with all levels of management. An "open door" approach promotes avenues of communication that could prevent improper conduct or data integrity issues resulting from undue external and internal pressures. Reducing workload for individual employees may include assigning additional personnel to assist in heavily backlogged areas, providing additional support, supplies, or equipment, or affording technical assistance and resources.

4.7 Responsibility for QA Program Adherence

4.7.1 It is the responsibility of all AES employees to implement the Quality Assurance Program effectively. All chemists and technicians are responsible for understanding and following the measures of the QA program, and for reporting any quality failures to a Manager or Supervisor in a timely manner.

4.7.2 Supervisors and Managers are responsible for ensuring that all laboratory personnel are familiar with the requirements of the Quality Assurance Program and that these requirements are implemented and maintained. It is the responsibility of each Supervisor to ensure that any quality failures are reported to the Project Manager and the Quality Assurance Department immediately.

4.7.3 It is the responsibility of the Technical Director to ensure that all laboratory personnel are trained to perform their assigned analyses.

4.7.4 The laboratory's approved signatories (designees of the Technical Manager) are identified as follows:

Laboratory Manager
Director of Project Management
Project Managers

Individuals are authorized as project manager report signatories based on meeting the qualifications of project manager job description in the QA Manual as well as completion of the following training:

Quality Assurance Manual
Data Intergirty Training
PCM Asbestos Reports Training

Individuals are authorized to act as project manager report signatories when these documents have been completed and signed by the individual(s) and referenced managers.

5.0 QUALITY ASSURANCE PROGRAM

5.1 The Quality Assurance Program (QAP) has been developed to provide a high-quality document that complies with the intent of testing regulations, standards, and established guidelines. The QAP takes into account requirements for special controls, processes, test equipment and skills to attain the required quality and the need for verification of quality by inspection and test. It also provides for the training of personnel to attain required proficiency levels and for regular assessments of the QAP to assure the adequacy of resources and the effectiveness of management controls established to achieve quality. The Quality Manual is maintained in a current condition.

5.2 Revisions to this QAP are made and controlled by the QA Manager, Technical Director, and Vice-President of Operations in accordance with AES' quality assurance practices. Such revisions and updates shall be performed as needed to improve the effectiveness of this program. Control of this QA manual is accomplished following the requirements of Section 8.2, "Document Control".

5.3 Definitions (Not Alphabetical)

5.3.1 Batch - A group of samples and QC samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents.

5.3.1.1 Preparation Batch - is composed of between 1 and 20 samples of the same matrix and meets the criteria for a batch as described in Section 5.3.1. Preparation batches consist of extractions, digestions, or concentrations. The maximum time between the start of processing of the first and last sample in a preparation batch is 24 hours. A preparation batch must have a spiked sample and a duplicate sample (or matrix spike duplicate).

5.3.1.2 Analytical Batch - is composed of prepared environmental samples (extracts, digestates, or concentrates) or non-prepared environmental samples which are analyzed together as a group. When the batch contains non-prepared samples as a group, the rules for preparation batches must be followed.

5.3.1.2.1 Test categories where samples do not have to be prepared prior to analysis include GRO, VOC, Ion Chromatography, direct injection SVOC, orthophosphorus, turbidity, pH, and Conductivity.

5.3.1.2.2 When soil VOC or GRO samples arrive in ENCORES or in jars, they considered prepared when placed into water or methanol. Rules for preparation batches apply.

5.3.1.2.3 The maximum length of time that an analytical batch can be left open is 24 hours. An analytical batch may have no more than 20 samples of similar matrix.

5.3.1.2.4 Test procedures take precedence over analytical batch considerations. For example, if the test procedure identifies a batch as occurring over a 12 or 24 hour period, then batches may not be left open for the time period stated in Section 5.3.1.2.1.

5.3.1.2.5 Methanol or water VOC or GRO samples prepared in the laboratory from ENCORES or jars cannot be combined into a sequence with samples that have not been prepared by the laboratory so as to create a batch that contains more than 20 samples or runs for longer than 24-hours.

5.3.1.2.6 An analytical batch must include the analysis of a spiked sample and a duplicate sample (or matrix spiked duplicate) every 20 samples in the batch. In addition, internal quality control dictates that a LCS sample is also included in the batch.

5.3.1.2.7 Always analyze the quality control samples at the beginning of the analytical batch. Quality control samples include the MS, MSD, LCS, LCSD, MB, CCB, and CCV.

5.3.1.2.8 Always verify batch completion date in LIMS.

5.3.2 Accuracy - The nearness of a result or the mean (average) of a set of results as compared to the true value. Accuracy is assessed by means of reference samples, laboratory control sample (spikes), matrix spikes, etc, and is measured in percent recovery.

5.3.3 Blank - There are several types of blanks. The various types are defined below.

5.3.3.1 Calibration Blank - specified in some analytical procedures, is an aliquot of analyte-free matrix used to establish a zero-concentration instrument response value.

5.3.3.2 Reagent Blank (as defined under AIHA-LAP, LLC Accreditation) - includes all the reagents using the same procedure as is used for samples.

5.3.3.3 Method Blank, often referred to as a media blank (as defined under AIHA-LAP, LLC

Accreditation) - Blank sampling media and analytical reagents analyzed, when applicable, with each batch of samples, using the same procedure that is used for samples. Typical media includes wipes, filters, and air cartridges. Clients should supply specimens of blank sampling media from the same source lot as was used for collecting the field samples.

5.3.3.4 Method Blank (as defined for environmental samples under NELAC or other state accreditations) - an aliquot of analyte-free matrix, usually reagent water or clean sand, to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document the absence of contamination resulting from the analytical process.

5.3.3.4.1 Except for certain conditions listed below, all analytes associated with the blank must have concentrations less than the reporting limit.

5.3.3.4.1.1 The reporting limit may be raised above the level of contamination in the method blank and associated samples with documentation of client approval. (Note: This is not acceptable under <u>any</u> AIHA-LAP, LLC Accreditation Programs.)

5.3.3.4.1.2 Sample results are 10 times the concentration of the method blank. The data may be reported with a flag indicating that low level contamination was detected in the method blank. Report data with a "B" qualifier.

5.3.3.4.2 Field Blank (Usually associated with environmental samples under NELAC or other state accreditations) - also called an equipment blank. A field blank is an aliquot of analyte–free water brought to the field in sealed containers, transferred to a sample container, and transported back to the laboratory with the samples to be analyzed. The field blank is used to evaluate any possible contamination introduced to the samples during the field collection process.

5.3.3.4.3 Trip Blank - an aliquot of analyte-free water which accompanies the empty containers to the field and the collected samples back to the laboratory. The trip blank is an indicator of possible sample contamination originating from site conditions and sample transportation.

5.3.4 Initial Calibration Verification (ICV) Standard - An ICV is a standard that has been prepared from a source that is not the same as the source used for the preparation of the calibration curve. A second source represents either, a different lot number of standard purchased from the same vendor, or the same standard purchased from a second vendor. ICV standards are not prepared using the same procedures as samples (e.g., digestions or extractions). The individual test methods describe the preparative procedures and suppliers for these standards. ICV standards are analyzed immediately after a successful calibration curve has been developed. Typically, the ICV standards are prepared so that their concentrations represent a midpoint of the calibration curve.

5.3.5 Continuing Calibration Verification (CCV) Standard - A CCV is a standard that has been prepared from the same source as the calibration standards. CCV standards are not prepared using the same procedures as samples are prepared (e.g. digestions/extractions). Individual test methods describe the preparative procedures and suppliers for these standards. CCV standards must be analyzed every 10 samples throughout the analytical batch, and at the beginning and end of the analytical batch.

5.3.6 Laboratory Control Sample (LCS) - Typically prepared by spiking an analyte free matrix such as

an aliquot of reagent water or analyte–free soil (Work done under AIHA-LAP, LLC IHLAP accreditation, the LCS/LCSD is prepared by spiking the same media used for sampling. For AIHA-LAP, LLC ELLAP accreditation, the appropriate blank matrix/media is spiked.) with the analyte(s) of interest. The LCS is prepared and analyzed employing the same methodology as the associated samples. The LCS is used to monitor, assess, and control the laboratory's performance of the methods employed for sample preparation and analysis. The LCS must be performed once per analytical batch, extraction batch, or digestion batch. An extraction or digestion batch is defined as twenty or fewer samples of similar matrix analyzed in a 24-hour period using similar preparative and/or extraction techniques. In many cases, a duplicate LCS sample (LCSD) will be analyzed along with the LCS.

5.3.7 Deionized Water (DI Water, DIW) - Reagent free water that is prepared by passage through various filters and membranes.

5.3.8 Environmental Sample - An environmental sample or field sample is a representative portion of any matrix (aqueous, non-aqueous, mixed waste, etc.) collected from any source for which the determination of the composition of the contamination is requested or required. For the purpose of this procedure, environmental samples are classified as follows:

5.3.8.1 Aqueous - Aqueous samples include surface water, ground water, drinking water, or wastewater. Wastewater consists of municipal and industrial influents and effluents.

5.3.8.2 Soils - Soil samples consist of sediments, soils, and sludges.

5.3.8.3 Non-Aqueous Liquids - Non-aqueous liquids consist of solvents, oils, and fuels. These sample types are not miscible with aqueous samples.

5.3.8.4 Non-Soil Solids - Non-soil solids consist of solid waste, precipitate waste, industrial sludges, concrete, wood, paint chips, ash, and wipes.

5.3.8.5 Bioassay - Bioassay samples consist of bio-solids and municipal waste treatment sludges.

5.3.8.6 Air - Air samples consist of filters, absorbent traps, activated carbon, and passive monitors used in the collection of air samples. Additionally, air samples can be collected in SUMMA canisters or Tedlar bags. In these two cases, the sample is the air itself.

5.3.9 External Quality Control - Those practices that monitor the quality of data from sources outside the control of the laboratory (e.g. multi-laboratory performance evaluation samples and external audits).

5.3.10 Instrument Detection Limits (IDL) - The minimum concentration limits of an analyte above the instrument noise level that can be detected and quantified with a high degree of confidence (>95%).

5.3.11 Internal Quality Control - Those practices implemented internally to monitor the quality of data and which are under the control of the laboratory (i.e. intra-laboratory performance samples, internal audits, single blind samples, etc.)

5.3.12 Matrix Spike / Matrix Spike Duplicate (MS/MSD) - An environmental sample to which predetermined quantities of specific analytes are added prior to sample preparation and analysis. Percent recoveries are calculated for each of the spiked analytes to assess the effect of the matrix on analyte recovery. In addition, a calculation of precision is made between the results of the MS/MSD to determine reproducibility of results in a specific matrix. This is measured by either the Relative Percent Difference (RPD) or Percent Relative Standard Deviation (%RSD). MS and MSD samples are analyzed with each analytical, extraction, or digestion batch of up to 20 samples. MS and MSD precision and accuracy limits are developed from quality control data.

5.3.13 Method Detection Limits (MDL) - The term MDL is defined by the EPA as the minimum concentration of a substance that can be measured and reported, in a specific matrix, with 99% confidence that the measured concentration is distinguishable from method blank results (Note: previous definition was that the measured concentration was greater than zero). Initial MDLs are calculated two ways. First, they are calculated any analyte presence in method blanks as MDL_b (Blank MDL). If some but not all of the method blanks for an individual analyte give numerical results, the Blank MDL is set equal to the highest result. Second, the MDL is calculated from spiked samples, giving the MDL_S (Spike MDL). The MDL used will be the higher MDL between the Blank MDL and the Spiked MDL. MDLs are verified quarterly by analyzing two spiked samples. Annual reverification using data from the four quarterly MDL verifications or from using the last 50 or six months' worth of blanks, whichever is greater. The annual reverification is performed within 13 months of the initial MDL. The calculated MDL using the quarterly checks must be within a factor of 0.5 to 2.0 of the initial MDL. If it is, the reverification is complete and the MDL value remains the same until the next reverification. If the calculated MDL is not within a factor of 0.5 to 2.0 of the (initial) MDL study, the initial study must be repeated.

5.3.14 Precision - The agreement of a set of replicate results. Typically, the laboratory analyzes LCS and LCSD or MS and MSD samples and reports the results as RPD or %RSD.

5.3.15 Practical Quantitation Limit (PQL) - The lowest analyte concentration that can be reliably achieved, within specified limits of precision & accuracy, during routine operating conditions. Practical Quantitation Limit is used synonymously with 'Reporting Limit', "Lower Limit of Quantitation" (LLOQ), and "Minimum Level". The quantitation limits are tied to the detection limits in that the PQLs are never less that MDLs. A low level standard is analyzed at the PQL where applicable.

5.3.16 Qualifiers - A phrase or word group that limits or modifies the meaning. (See section 12.5.4)

5.3.17 RCRA - Resource Conservation Recovery Act

5.3.18 Relative Percent Difference (RPD) - A measure of agreement between two replicate results, expressed as follows:

$$RPD = 100 * \frac{X_1 - X_2}{\overline{X}}$$

where: X_1 and X_2 = the two results

$\overline{X}$ = mean value of the results

5.3.19 Relative Standard Deviation (RSD) – The variance from the mean or true value divided by the mean or true value, expressed as a percentage.

$$\% RSD = 100 * S/\overline{X}$$

where:

$\overline{X}$ = arithmetic mean of the measurements

S = variance

5.3.20 Representativeness - The degree to which data represent a characteristic of a population or set of samples. It is a measurement of both analytical and field sampling precision.

5.3.21 Standard Curve - A curve, which plots known standard concentrations or amounts of an analyte versus the instrument response for the analyte. This curve is used to determine the concentration of the analyte in the unknown samples.

5.3.22 Surrogate - Organic compound(s) which is/are similar to analytes of interest in chemical composition, extraction efficiency, and chromatographic retention, but are not normally found in environmental samples. These compounds are spiked into all blanks, standards, samples, and spiked samples prior to analysis. Percent recoveries are calculated for each surrogate to assess the effectiveness of the sample preparation and analysis and any potential matrix effects.

5.3.23 TNI - The NELAC Institute

5.3.24 AIHA-LAP, LLC - American Industrial Hygiene Association, Laboratory Accreditation Program, LLC

5.3.25 Method of Standard Additions - The standard addition technique involves adding known amounts of standard to one or more aliquots of the processed sample solution. This technique compensates for a sample constituent that enhances or depresses the analyte signal, thus producing a different slope from that of the calibration standards. It will not correct for additive interferences that cause a baseline shift.

5.3.26 Estimation of Uncertainty - is the parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurement. (See section 12.1 for more information.)

5.3.27 Measurand Quantity intended to be measured or analyte concentration. The measurands for methods under AIHA-LAP, LLC accreditation are available in the SOPs. (See section 12.1 for more information.)

5.3.28 Interim Limits - are used to establish the level of uncertainty when limits are not available until enough laboratory data has been compiled to establish historical limits. Interim limits may be derived from published methods, those limits within similar analysis, LCS recovery ranges, or based on reasonable expectations from laboratory experience.

5.3.29 Lower Limit Of Quantitation (LLOQ) - As defined in EPA's SW-846 Compendium, it is the lowest point of quantitation, or in most cases, the lowest point in the calibration curve, which is ideally less than or equal to the desired regulatory action levels based on the stated project requirements. (Synonymous with PQL, Reporting Limit, and Minimum Level.)

5.3.30 Minimum Level - is a term from 40CFR136 that refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the MDL, whichever is higher. Minimum Levels may be obtained in several ways: they may be published in a method; they may be based on the lowest acceptable calibration point used; or they may be calculated by multiplying the MDL (from the method or as determined by the laboratory) by a factor of 3.

5.3.31 BRL (Below Reporting Limit) - The acronym BRL is used to report the PQL in an easy to understand manner. On AES analytical reports, BRL is next to the Reporting Limit. Together, BRL and the Reporting Limit mean that if the analyte were present in the sample, it would be below the reporting limit. It would be below the range of specified limits of precision and accuracy. EPA considers the terms Reporting Limit, Practical Quantitation Limit, Lower Limit of Quantitation (LLOQ), and Minimum Level to be synonymous. In most cases, this corresponds to the lowest point on the calibration curve.
The relationship between the MDL and the PQL (Reporting Limit) is that the MDL is the point at which the analyte is detected but the PQL is the point at which the quantitation is considered to be of known precision and accuracy. Concentrations between the MDL and PQL are estimated values.

5.3.32 Risk - That which makes achieving an objective uncertain (or the effect of uncertainty in objectives)

5.3.33 Risk Assessment - Comparison of the risk likelihood and impact to the severity of the risk's impact.

5.3.34 Risk Management - is the identification, assessment and prioritization of risks followed by coordination to minimize, monitor, and control the impact to maximize the realization of opportunities.

5.3.35 Opportunities - Events with potential positive outcomes for the organization or company.

5.4 Data Quality Objectives for Environmental Testing

5.4.1 Precision. The laboratory objective for precision is to meet the performance criteria demonstrated for all analytical methods as published by the USEPA under SW-846 and 40 CFR Part 136. These criteria are met on similar samples and similar sample matrices. Precision is documented based on replicate analysis, usually duplicate or matrix spike duplicate samples.

5.4.2 Accuracy. The laboratory objective for accuracy is to meet the performance criteria demonstrated for these analytical methods as published by the USEPA under SW-846 and 40 CFR Part 136. These criteria are met on similar samples and similar sample matrices. Accuracy is documented based on recovery data; usually matrix spike samples.

5.4.3 Representativeness. The laboratory objective for representativeness is to provide data which is representative of the sampled medium. The representativeness of the analytical data is a function of the procedures used in processing the samples.

5.4.4 Comparability. The comparability objective is to provide analytical data for which the accuracy, precision, representativeness, and reporting limit statistics are similar in quality to data generated by other laboratories for similar samples and to data compiled by AES over time. The comparability objective may be documented by any of the following:

5.4.4.1 Inter-laboratory studies carried out by regulatory agencies.

5.4.4.2 Inter-laboratory studies initiated for specific projects or contracts.

5.4.4.3 Comparison of periodically generated statements of accuracy, precision, and reporting limits to those of other laboratories.

5.4.4.4 Through approval from the US EPA or other regulatory agencies for any procedure to which significant modifications have been made.

5.4.5 Completeness. The completeness objective for data can be set for a particular project and is expressed as the ratio of the valid data to the total data over the course of the project. The comparison between the amount of valid, or usable, data you originally planned to collect, versus how much you collected.[Appendix XII Footnote 37] (from EPA, it is usually described as a measure of the amount of available data from a statistical system compared to the amount that was expected to be obtained.)

5.5 Criteria for Quality Indicators

5.5.1 The precision and accuracy acceptability limits for analyses performed at Analytical Environmental Services, Inc are located in the LIMS and posted on the portal server. The limits in the tables are either laboratory-generated or derived from USEPA methods.

5.5.2 Table 5-3 defines the criteria for data acceptability. Data may be accepted when QC falls outside these limits if probable cause can be attributed to the matrix, and laboratory control samples (LCS) show that the method is in control. Deviations are documented in the final report to the client. In instances where an LCS limit is not available, a limit of 30-130% recovery may be used until in-house limits are available. (Note: Sometimes an alternative default limit may be found in a published method and substituted.) In some cases, lower default limits may be set with approval from the Quality

Assurance Manager and Technical Director. The acceptable range of some compounds may be broader, based on prior knowledge of the analyte (e.g., phenols in EPA Method 8270C).

5.5.3 Statistically Derived Limits

5.5.3.1 Selected methods and programs require statistically derived accuracy and precision limits. Analytical Environmental Services, Inc. routinely uses statistically derived limits to evaluate method performance and to determine when corrective action is appropriate.

5.5.3.2 The laboratory periodically updates the limits as stated, but no less than annually. Analysts must use the current limits as found in LIMS.

5.5.3.3 The QA Manager maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used. If a method requires the generation of historical limits, they can be derived from data in the LIMS database or by viewing archives.

5.5.4 Development of new QC limits.

5.5.4.1 The QA Manager determines limits using the in-house LIMS system. This is accomplished by the statistical analysis of data for each test method where the method specifies that internal limits are developed.

5.5.4.2 Reviewed data types within the methods include LCS, LCSD, MS, MSD, and surrogates in samples, control samples, and spikes. It is recommended that surrogates are evaluated on a separate basis for samples, LCS, and MS since recovery limits will be wider for client samples than for laboratory control samples.

5.5.4.3 QC limits are updated in LIMS through the Quality Control Section. To change limits, activate the tab called “control charting”. Enter the desired test code, analyte, and sample type. Enter the number of desired data points, and then “get data”.

5.5.4.4 The minimum number of data points chosen should be 20. For tests which data is generated more frequently, e.g. volatile surrogate recoveries in samples, a minimum of 40 data points should be chosen.

5.5.4.4.1 For tests in which there are less than 20 data points, use the interim limits specified by the method. If interim limits are not specified by the method, the QA Manager and Technical Director must choose interim limits that represent an estimation of the current laboratory performance. The data in the tables should be footnoted accordingly.

5.5.4.4.2 For tests in which data is generated more frequently, e.g. volatile surrogate recoveries in samples, a minimum of 40 data points is chosen. The LIMS will pick data points in historical order beginning with the date the action is being performed. The LIMS will compile as many data points are available if the requested number exceeds the number of points in LIMS The LIMS will pick data points in historical order beginning with the date the action is being performed. If the requested number exceeds the number of points in LIMS, then LIMS will compile as many data points as are available.

5.5.4.5 Data should be observed for outliers, and these samples de-selected using the “radio buttons”. Once the data is reviewed, limits can be recalculated by choosing the “Re Calc Stats” tab. Outlying data points are determined by the following two methods:

5.5.4.5.1 Grubbs Test - is a statistical test used to detect outliers in a univariate data set assumed to come from a normally distributed population.

5.5.4.5.2 Manual observation of data set to verify that the data points selected are within the

calculated control limits. If they are not, then the data points must be "de-selected" and the limits recalculated until the data is within the calculated limits.

5.5.4.6 The lower limit determined from historical data shall not be set to a value less than 10. That is, if the calculated lower limit is < 10, a default value of 10 will be used for the lower limit unless specified by the published method.

5.5.4.7 When the data set is acceptable, choose the "Preview" tab to view data in a page format. Through the "Windows" application, print the data in "Adobe" format by selection of the proper network printer. The file should be saved in one of the following folders depending on which QC type:

TestMethod_Matrix_LCS_LCSD_REC
TestMethod_Matrix_LCS_LCSD_RPD
TestMethod_Matrix _MSD_REC
TestMethod_Matrix _MSD_RPD
TestMethod_Matrix_SURR_REC

5.5.5 Review of revised QC limits

5.5.5.1 After data has been revised for each test method and matrix, a copy of the QC Tables and charts is presented to the department managers, Technical Director, and Vice President of Operations for review. After a week comment period, the updated limits are entered into the laboratory LIMS system.

5.6 External Quality Assurance Objectives

5.6.1 External Quality Control is the process of employing outside sources to monitor the quality of the data produced by the laboratory. Included in the external quality control program are the analysis of performance evaluation samples and participation in performance evaluation audits.

5.6.1.1 AES, Inc. analyzes Proficiency Test (PT) samples for each PT field of testing as defined in The NELAC Institute (TNI) and AIHA-LAP, LLC Fields of Test tables according to matrix type, analyte, and regulatory or environmental program. Samples are obtained from NELAP-designated PTOB / PTPA-approved PT providers (such as Environmental Resource Associates) for NELAP compliance or directly from AIHA-LAP, LLC to meet their program requirements. The results of the analyses are submitted to the PT Provider for scoring. Study reports are maintained for a minimum of five years on the portal server. The analyses of PT studies are conducted in accordance with all TNI or AIHA-LAP, LLC. Where required (as with gravimetric analyses for AIHA-LAP, LLC), an internal PT will be used.

5.6.1.1.1 AES participates in a minimum of two single-blind, single-concentration PT studies per year for each PT field of testing for which it is accredited. Studies are performed at least 15 calendar days apart. Successful completion of two of the last three proficiency rounds for a given PT field of testing must occur in order to maintain accreditation.

5.6.1.1.2 Blind water or soil PT samples contain amounts of specific constituents that are unknown to laboratory personnel. Upon arrival, PT samples are logged into the Laboratory Information Management System (LIMS) and tracked as routine environmental samples. PT samples provided by the vendor may be 'whole' samples or may have been provided in a concentrated form. PT vendor instructions are followed and dilutions performed on the concentrated vials to make them the 'whole' sample to be tested. Routine procedures for dilutions and analysis are followed per method specific SOPs. The laboratory results must be completed and reported within the required turnaround time.

5.6.1.1.3 AES, Inc. maintains copies of all written, printed, and electronic records, including, but not limited to bench sheets, instrument chromatograms or printouts, data calculations, and data reports resulting from the analysis of any PT sample. These records are maintained for five years or for as long as required by the applicable regulatory program, whichever is greater. These records include a copy of the PT study report forms used to report PT results. All laboratory records are available to assessors of the Primary Accrediting Authority during on-site audits.

5.6.1.1.4 Whenever a study is failed, AES determines the cause for the failure and takes the necessary corrective actions. The investigation and action taken are documented into QA records and provided, if required, to the Primary Accrediting Authority.

5.6.1.2 Performance evaluation samples are also obtained from the following list of suppliers.

5.6.1.2.1 ELPAT. This proficiency testing program is administered by the American Industrial Hygiene Association-Laboratory Accreditation Program (AIHA-LAP, LLC). Once a quarter, the laboratory receives a set of proficiency samples from Research Triangle Institute for the analysis of lead content. The matrices are soils, wipes, and/or paint chips.

5.6.1.2.2 PAT. This proficiency testing program is administered by the American Industrial Hygiene Association-Laboratory Accreditation Program (AIHA-LAP, LLC). Once a quarter, the laboratory receives a set of proficiency samples to be analyzed for metals, asbestos fibers, This program is required as part of the laboratory's certification to perform analyses on samples that measure indoor air quality.

5.6.1.2.3 EMPAT. This proficiency testing program is administered by the American Industrial Hygiene Association-Laboratory Accreditation Program (AIHA-LAP, LLC). EMPAT fungal proficiency samples are available for both the 'Direct Examination'. Once a quarter, the laboratory receives notification that the Fungal Direct Examination Proficiency Testing Program has opened on the AIHA-LAP, LLC website. The lab has access to the portal for 24 hours a day for 7 days at which time the study closes. This program requires the identification of selected slides within a set amount of time.

5.6.1.2.4 North Carolina Department of Environmental, Health and Natural Resources. Once a year the laboratory receives performance samples for certification by North Carolina for all analyses not already submitted under other programs. These samples are critical for the continuation of certification by the state of North Carolina. To renew certification each year, the lab must submit acceptable PT sample results to the NC WW/GW LC Program for each parameter, analyte, technology and matrix (where a method is matrix-specific) by October 31.
A laboratory that fails a PT sample for a parameter method technology must take steps to identify the root cause of the failure, take corrective action, report the corrective action taken to NCDENR, and participate in a second PT study meeting the criteria listed previously in this policy. The corrective action response must include the laboratory's root cause analysis and a copy of any objective evidence (e.g., calibration curves, revised procedures, records, training records, standard operating procedures, etc.) to indicate that the corrective actions have been implemented/completed. The results of the remedial PT must be received in this office within 60 days from the date the failed results are issued by the accredited proficiency testing provider. A laboratory failing the second (or remedial) PT study may be decertified for that parameter method technology (not necessarily for all technologies for that parameter).

For multi-analyte parameters (e.g., organic analyses), when greater than 80% of analytes are acceptable, but one or more individual analytes are graded unacceptable, acceptable performance has been demonstrated for the parameter method technology. The laboratory must, however, analyze a remedial PT for the individual analytes that were graded unacceptable. When a remedial PT is graded unacceptable for an individual analyte (constituting a second unacceptable result), the laboratory must qualify data for those individual analytes as "estimated" (whether detected or not) until acceptable results are obtained on two consecutive remedial PTs for the analyte in question.

5.6.1.3 Performance Audits

5.6.1.3.1 In order to maintain certification in many states, to comply with commercial contracts, and to satisfy many agency requirements, AES, Inc. must undergo initial and ongoing audits performed by external auditors. These audits may take the form of technical and/or evidentiary audits. Every section of the laboratory, both analytical and clerical, should be ready at all times to participate in these audits.

5.6.1.3.2 In the event that adverse findings or deficiencies are discovered, or observations and/or recommendations are made during an audit, QA and laboratory management shall review the comments and submit a response, including corrective actions, to the audit report.

5.6.1.4 State Audits

5.6.1.4.1 State Audits are performed in accordance with each individual state's certification program. These audits are generally performed to determine the laboratory's suitability to perform environmental analyses according to the parameters dictated by that state.

5.6.1.5 Commercial Audits

5.6.1.5.1 Audits performed by commercial clients may be scheduled on a pre-award basis for a contract. Once the contract is awarded, audits may be scheduled at the request of the client or at a pre-determined frequency. The client, as well as professional audit teams, may perform audits required by commercial clients.

5.7 Internal Quality Control

5.7.1 The internal quality control program serves two primary functions. One function is to monitor the reliability of the data (e.g., accuracy and precision). The other function is to control and maintain the quality of the data (e.g., the use of ACS grade reagents, traceable standards, etc.).

5.7.2 The following sections outline the specific actions and procedures employed to monitor the process for producing and reporting quality data that is consistent with the Quality Control Program. Processes such as, but not limited to, validity of results, verification of operator competence, recovery of known spikes, analysis of reagent blanks, calibration with traceable standards, analysis of duplicates, and maintenance of quality control charts must be employed and continually monitored. The laboratory may also adopt additional quality assurance procedures; however, the minimum requirements are discussed below. The QA Manager and Technical Director, under restrictions by the methodology and in conjunction with the appropriate laboratory management staff, shall determine which requirements shall be implemented for each section.

5.7.3 Training & Certification of Operator Competence. Quality Control begins with the establishment of basic laboratory techniques and skills. It is imperative that analysts receive proper training before performing independent laboratory analyses. Each analyst must demonstrate proficiency of laboratory techniques and skills. Records to that effect are kept in the employee's personal training files.

5.7.4 Documentation. Regardless of which analytical procedures are used in the laboratory, the methodologies employed shall be carefully documented.

5.7.4.1 Standard Operating Procedures (SOPs) and approved methods may be periodically modified, updated, or replaced in their entirety due to advances in technology, regulatory protocols, or at the discretion of laboratory management. All proposed changes, however, are reviewed by the Technical Director to ensure compliance with all regulatory protocols.

5.7.4.2 If a client requests a change of procedure, the change must be pre-approved by the laboratory prior to use. The change must be documented in writing and kept on file as part of the laboratory project records.

5.7.4.3 If a method is modified such that it no longer complies with the provisions set forth by the accrediting agencies, the client will be informed.

5.7.4.4 Documentation of analytical procedures for generating laboratory data shall be clear, concise, adequately referenced, and reflect the actual steps employed by the analyst.

5.7.5 Standard Operating Procedures (SOP). Methodologies employed in the laboratory are documented in SOPs. (Table 5-3 shows a Summary of Calibration and QC Procedures for Various Tests.) See Chapter 8 gives detailed information on SOPs.

5.7.6 Initial Calibration Verification (ICV) Standard. Individual component recovery of the ICV standard is calculated using the following equation:

$$\text{ICV Standard Percent Recovery} = \frac{A}{T} x100$$

where:
A = concentration measured
T = true value of the spiking concentration

5.7.6.1 The ICV must be made from a different source than the calibration curve standards.

5.7.6.2 The acceptable recovery limits for the ICV standards vary based on the individual procedure and are specified in Table 5-3.

5.7.6.3 If the recoveries of any of the ICV standards are not within the limits specified in Table 5-3, the test method may not be performed. The analyst must follow the out-of-control procedures discussed in Section 5.8 before initiating any analyses.

5.7.7 Continuing Calibration Verification (CCV) Standard. Individual component recovery of the CCV standard is calculated using the following equation:

$$\text{CCV Standard Percent Recovery} = \frac{A}{T} x100$$

where:
A = concentration measured
T = true value of the spiking concentration

5.7.7.1 The acceptable recovery limits for the CCV standards are procedure dependent and are specified in Table 5-3.

5.7.7.2 If the recoveries of any of the CCV standards are not within the limits specified in Table 5-3, the testing must be discontinued. The analyst must follow the out-of-control procedures discussed in Section 5.8 before continuing any analyses.

5.7.8 The Laboratory Control Sample (LCS)

5.7.8.1 The individual test methods describe the preparative procedures and suppliers for the LCS & LCSD standards. The LCS & LCSD samples are prepared in either reagent grade water or sand in accordance with the procedural steps followed for the preparation of a matrix spike sample.

5.7.8.2 Individual component recovery of the LCS(D) is calculated using the following equation:

$$\text{LCS (LCSD) Spike Percent Recovery} = \frac{A}{T} x100$$

where:

A = concentration measured
T = true value of the spiking concentration

5.7.8.3 Precision between the LCS and LCSD recoveries is calculated using the following equation:

$$\% \text{ RPD} = \frac{\text{Difference between LCS and LCSD recoveries}}{\text{Average of LCS and LCSD recoveries}} \times 100$$

5.7.8.4 The acceptable recovery limits for the LCS standards vary based upon the individual procedure and are specified in LIMS test codes.

5.7.8.5 If recoveries of any of the LCS standards are not within the limits specified in the table, the testing must be stopped. If the precision between the two recoveries is not within the limits specified in the table, the testing must be stopped. The analyst must follow the out-of-control procedures discussed in Section 5.8 prior to continuing any analyses.

5.7.9 Matrix spike (MS) and matrix spike duplicate (MSD). Individual component recovery of the matrix spike is calculated using the following equation:

$$\text{Matrix Spike Percent Recovery} = \frac{(A-B)}{T} \text{x}100$$

where:

A = concentration measured after spiking
B = background concentration
T = true value of the spiking concentration

5.7.9.1 MS and MSD sample recovery limits are used to determine matrix affects on the recovery target analytes. The acceptable recovery limits for the MS and MSD standards are indicated in LIMS test codes.

5.7.9.2 It is the discretion of the department manager to have a batch re-processed or re-analyzed after assessment of the matrix spike recovery values and other batch QC data. The analyst must follow the out-of-control procedures discussed in Section 5.8 prior to continuing any analyses.

5.7.9.3 In the event that insufficient sample is provided for MS/ MSD analysis, the narrative of the final report must be amended to indicate lack of sample for analysis of MS and / or MSD.

5.7.10 An Initial Demonstration of Capability (IDOC) study is performed to establish the ability of an analyst and/or analytical system to generate acceptable precision and accuracy data. An IDOC study is performed on each certified method and matrix analyzed in the laboratory where applicable. Samples prepared for the IDOC studies are made from a second source independent of the standard

source used for the calibration determination. A second source standard may be a standard purchased from the same manufacturer but a different lot or batch. Four LCS's are prepared and analyzed. To establish the ability to generate acceptable accuracy and precision, the analyst must perform the following operations:

5.7.10.1 Because of the nature of several test methods, IDOCs cannot be performed. These tests represent methods where samples of known concentrations cannot be prepared in the laboratory. Specific requirements for these test methods are described in Table 5-1***.

5.7.10.2 Calculate the average recovery (x) in µg/L, and the standard deviation of the recovery(s) in µg/L, for each analyte using the four results. Demonstration of Capability must be updated and documented annually or more frequently if required by method with a Continuing Demonstration of Capability (CDOC). Other options for CDOC include the use of successfully passed third party Proficiency Test (PT) studies and Method Detection Limit studies that meet recovery and reporting limit criteria. (See Table 5-1)

5.7.10.3 The Method Performance Section of the individual SOP provides laboratory recovery and precision data for the method. Similar results from spiked water should be expected. Results are considered comparable if the calculated standard deviation of the recovery does not exceed the single laboratory RSD or 10% (20% for some organic analytes), whichever is greater and the mean recovery lies within the interval indicated by the test method, or X ± 15%, whichever is greater. Specific requirements for each NELAP certified test method as well as those required by AIHA-LAP, LLC are described in Table 5-1***.

Table 5-1 Demonstration of Capability Acceptance Criteria

Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
SM2120B Color	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2120E Color ADMI	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E100.2	Prep, LCS or PT	Meet Grid QC, Calib of TEM, EDXA, Camera
E120.1 Conductivity	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM4500H+B pH	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2540C TDS	4 LCS or PT	PT acceptance Criteria
SM2540D TSS	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2540B TS	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
E160.4 VS	PT	PT acceptance Criteria
SM2540F Settleable Solids	PT	PT acceptance Criteria
E1664B Oil and Grease_TPH	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E180.1 Turbidity	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E200.7 ICP AES Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E200.8 ICP MS Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E245.1 Mercury	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E300 Anions by IC	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
SM2310B Acidity	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM2320B Alkalinity	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500Cl G Residual Chlorine	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500CN G Amenable Cyanide	4 LCS	LCS Control Limits
SM4500CN E Total Cyanide	4 LCS or PT	LCS Control Limits or PT acceptance Criteria

Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
E350.1 Ammonia (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E351.2 TKN	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E353.2 Nitrate (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E353.2 Nitrate_Nitrite (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
NECi N07-0003 Nitrate-Nitrite (DA)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E353.2 Nitrite (as N)	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500NO2 B Nitrite (as N)	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500O G Dissolved Oxygen	4 LCS	LCS Control Limits
E365.1 Ortho Phosphorus	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E365.1 Total Phosphorus	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E365.3 Ortho Phosphorus	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500S2 F Sulfide	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM4500SO3 B Sulfite	4 LCS or PT	RSD Limit ≤ RPD Limits
SM5210B BOD	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
E410.4 COD	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM5310B TOC	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
E420.1 Total Phenolics	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E420.4 Total Phenolics	4 LCS or PT; LCR / MDL	LCS Control Limits, MDLs or PT acceptance Criteria
SM5540C MBAS Surfactants	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E610 PAHs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E615 Herbicides	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E624.1 VOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
E625.1 SVOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
FL-PRO	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
PMOIST	4 LCS or PT	Demonstration using Real World Samples
RSK-175 Dissolved Methane, Ethane, Ethene	4 LCS	MDLs or LCS Control Limits
SM10200H Chlorophyll	4 LCS	LCS Control Limits
SM2340B Hardness	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM3500Cr B Hexavalent Chromium	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM3500Fe B Ferrous Iron	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SM5210B CBOD	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SM9222B Total Coliforms	PT	PT acceptance Criteria
SM9222D Fecal Coliforms	PT	PT acceptance Criteria
SM9223B E.Coli / Total Coliforms	PT	PT acceptance Criteria
SW1010 Flash Point	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW1030	DUP	Demonstration using Real World Samples
SW1311 TCLP & 1312 SPLP	SOP Signoff/AES Training	N/A
SW6010 ICP AES Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW6020 ICP MS Metals	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW7196 Hexavalent Chromium	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW7470 Mercury in Water	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria

Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
SW7471 Mercury in Soils	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW7473 Mercury in Soils	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8011 EDB DBCP	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8015 DAI	4 LCS	LCS Control Limits
SW8015 DRO or GRO	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8081 Pesticides	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8082 PCBs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8151 Herbicides	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8260 Oxygenates	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8260 VOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8270 SVOCs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8310 PAHs	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW8315 Formaldehyde and Acetaldehyde	4 LCS	MDLs or LCS Control Limits
SW9010_9014 Cyanide	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9030_9034 Sulfide	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9040 pH in Water	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW9045 pH in Soil	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW9050 Conductivity	4 LCS or PT	LCS Control Limits or PT acceptance Criteria
SW9056 Anions by IC	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9060 TOC	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9065 Total Phenolics	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9070 Oil and Grease_TPH in Water	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9071 Oil and Grease_TPH in Soils	4 LCS or PT	LCS Control Limits, MDLs or PT acceptance Criteria
SW9081 Cation Exchange Capacity	SOP Sign-Off Only	Demonstration using Real World Samples
SW9095 Free Liquids by Paint Filter	SOP Sign-Off Only	Demonstration using Real World Samples
TO-14A, TO-15		MDL or LCS Control Limits

*LCS Control Limits and RPD Limits as per LIMS Test Code Limits

Table 5.1 (Cont.) - Demonstration of Capability Acceptance Criteria

AIHA-LAP, LLC METHODS		
Certified Method	DOC Requirement	Control Limits/ Acceptance Criteria*
SW3050B / N7082 (Lead Paint)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
SW3050B / 7420 (Lead in Soil)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
SW3050B / 7000B (Lead in Soil)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
N7082 (Lead in Dust Wipe)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
N7303 (Lead in Air)	IDOC: 4 sets of 5 Ref CDOC: Batch QC or PT	75% within 80-120%Rec LCS Control Limits, MDLs or PT Acceptance Criteria
N7400 (Asbestos PCM)	PT Samples	PT Acceptance Criteria
Fungal Air Direct Exam (Micro)	PT Samples	PT Acceptance Criteria

Fungal Bulk Direct Exam (Micro)	PT Samples	PT Acceptance Criteria
Fungal Surface Direct Exam (Micro)	PT Samples	PT Acceptance Criteria

5.7.10.4 The large number of analytes in multi-element analyses presents a substantial probability that one or more will fail at least one of the acceptance criteria when all analytes of a given method are determined. Should this occur, re-analyze only the failed analytes, following the procedures discussed in this section.

5.7.10.5 When one or more of the analytes tested fails at least one of the acceptance criteria, the analyst must proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.10.6 Due to the nature of several test methods, IDOCs cannot be performed. These tests represent methods where samples of known concentrations cannot be prepared in the laboratory. Tests that are included in this category are EPA 110.2, 160.3, 160.4, 160.5, 150.1, 9040, 9045, 1010, SM 2340B, SM2340G, SM9223, and SM9222. To complete IDOCs for these tests, the analyst(s) must satisfactorily pass available PE samples for all appropriate matrices.

5.7.10.7 Analyst Demonstration of Capability and training includes the following:

Quality Assurance Manual Training (annually)
Data Integrity (Legal & Ethical) Training (annually)
SOP Training (initially and as updated)
ICNs associated with the SOPs (initially and as updated)
Demonstration of Capability (program specific)
Procedure and Checklist Training (initially and as updated)

Individuals are authorized to perform analysis when these documents have been completed and signed by the individual(s) and referenced managers.

5.7.10.8 AIHA-LAP, LLC Training Requirements

AIHA-LAP, LLC Technician/Analyst Training Requirements. All technicians and analysts must complete training and demonstrate proficiency prior to analysis of any ELLAP or IHLAP program samples. The laboratory documents the competence requirements for each function influencing laboratory activities, including requirements for education, qualification, training, technical knowledge, skills and experience using the following:

- Resumes for the determination of education and previous experience
- Standard Operating Procedures (SOPs) and other training verified with sign-offs (QA Manual, Data Integrity, Health & Safety, general procedure training, etc.)
- Proficiency Testing results
- Routine Quality Control performance
- Frequency of Corrective Action Reports pertaining to analyst
- Observations from management
- Internal audit assessments

The training and proficiency demonstrations must meet the requirements specified in the AIHA-LAP, LLC LQAP Policy Document, Modules 2A, 2B and 2C and are described in Section 1.2 and 1.3 below.

5.7.10.8.1 ELLAP Specific Technician/Analyst Training Requirements:

5.7.10.8.1.1 Initial demonstration of capability.

Each technician/analyst must complete at least 20 days work/training in the prep and / or metals analysis lab using technologies/instrumentation similar to that to be used for ELLAP samples under the direct supervision of an ELLAP trained technician / analyst prior to unsupervised prep / analysis of ELLAP regulated client samples.

Each analyst/technician must read, understand & agree to follow the laboratory SOP and document using the SOP Acknowledgement sign-off form. Each technician /

analyst must prep and/or analyze as appropriate at least 2 blind reference material test samples. These samples may be AIHA-LAP, LLC provided PT samples or laboratory prepared Certified Reference Material of the appropriate matrix, i.e. soil, paint, wipe (spiked with baghouse dust) or air filter. Results must fall within the PT acceptance range or laboratory LCS range as appropriate.

Each technician/analyst must complete a minimum of 4 independent test runs of sample preparation/analysis prior to prepping/analyzing actual samples. This test is performed through the digestion/analysis of four separate groups of 5 replicate, matrix specific Certified Reference Material samples, with each group separated by at least one day. To be deemed acceptable per ELLAP requirements, 75% of the replicates in each group must recover within 90-110% of the true value. Any individual group that fails to meet the ELLAP criteria must be repeated in its entirety (all 5 replicates repeated).

Once all requirements in 5.7.10.8.1.1 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples. Documentation of approval to begin work is defined as the date signed by the Technical Director (or designee) on the Demonstration of Capability Certification form.

5.7.10.8.1.2 Continuing Demonstration of Capability (CDOC). Each technician/analyst must demonstrate continued capability at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or in house laboratory QC samples, i.e. LCS samples. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or Policy Module 2C, Table 2C-1 LCS control limits per samples used.

5.7.10.8.1.3 All IDOC and CDOC documentation for ELLAP related procedures is maintained and available for review for at least 5 years.

5.7.10.8.2 IHLAP Chemistry Specific Technician/Analyst Training Requirements:

5.7.10.8.2.1 Initial demonstration of capability.
Each technician/analyst must complete at least 20 days of work/training in the prep and/or metals analysis lab using technologies/instrumentation similar to that used for IH samples under the direct supervision of an IH trained technician/analyst prior to unsupervised prep and/or analysis of IH regulated client samples. Each analyst /technician must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form. Each technician / analyst must prep and/or analyze as appropriate at least 2 blind reference material samples (concentration unknown to the technician/analyst). These samples may be AIHA-LAP, LLC provided PT samples or laboratory prepared Certified Reference Material added to the method specific media used for client samples. Results must fall within the PT acceptance range or laboratory LCS range as appropriate.
Once all requirements in 5.7.10.8.2.1 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples.
Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.2.2 Continuing Demonstration of Capability (CDOC). Each technician/analyst must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or in house laboratory QC samples, i.e.

LCS samples. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory established LCS control limits as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or LIMS LCS data as appropriate.

5.7.10.8.2.3 All IDOC and CDOC documentation for IHLAP related procedures is maintained and available for review for at least five (5) years.

5.7.10.8.3 IHLAP Asbestos by PCM Specific Technician/Analyst Training Requirements:

5.7.10.8.3.1 All PCM technicians/analysts must complete a NIOSH 582 equivalent training course and successfully pass the course examination during their training period and prior to beginning unsupervised work on client samples.

5.7.10.8.3.2 Initial demonstration of capability.
Each technician/analyst must complete at least 20 days of work/training in the PCM analysis lab using technologies/instrumentation similar to that to be used for IH/PCM samples under the direct supervision of an IH/PCM trained technician / analyst prior to unsupervised prep and/or analysis of IH/PCM regulated client samples.
Each analyst/technician must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form.

Each technician/analyst must prep and/or analyze as appropriate at least 2 blind reference material test samples (concentration unknown to the technician/analyst). These samples may be an AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the PT acceptance range or laboratory reference slide counting acceptance ranges as appropriate.

Once all requirements in 5.7.10.8.3.2 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples. Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.3.3 Continuing Demonstration of Capability (CDOC).
Each technician/analyst must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory reference slide counting acceptance ranges as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or in the QC data log books maintained in the PCM laboratory as appropriate.

5.7.10.8.3.4 All IDOC and CDOC documentation for IHLAP related procedures is maintained and available for review for at least 5 years.

5.7.10.8.4 EMLAP Specific Technician Training Requirements:

5.7.10.8.4.1 EMLAP laboratory technicians must meet minimum educational requirements of a high school diploma or GED.

5.7.10.8.4.2 Initial demonstration of capability.
Each technician must complete at least 6 months documented training for Air Direct Exam (spore trap) and work/training in the EMLAP microbiology laboratory under

the direct supervision of an EMLAP trained technician/analyst prior to performing unsupervised technician level work on EMLAP regulated client samples.

Each technician must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form.
Technician level personnel are limited to preparatory operations and assistance in all steps leading to the identification of microorganisms and may not perform analyses or be responsible for the final decisions related to the identity of microorganisms, except as described below:
"Technicians may function as analysts for Air-Direct Examination (spore traps) analysis after completion of 12 months documented on the job training and demonstrated proficiency. During the 12 month analyst training period, the trainee may perform work under the direct supervision of another qualified analyst. All work must be reviewed by another qualified analyst prior to release of data."

Technicians functioning as analysts shall demonstrate proficiency by successful analysis of EMLAP PT samples or laboratory reference slides to document their ability to identify genus/groups of fungi reported. The technician must also complete and pass the laboratory Fungal Identification Examination/Quiz as administered by the Micro Dept. Manager. Once all requirements in 5.7.10.8.5.2 have been met, the technician will be approved to begin unsupervised prep/analysis of client samples. Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.4.3 Continuing Demonstration of Capability (CDOC).
Each technician must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory reference slide counting acceptance ranges as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or in the QC data log books maintained in the microbiology laboratory as appropriate.

5.7.10.8.4.4 All IDOC and CDOC documentation for EMLAP related procedures is maintained and available for review for at least 5 years

5.7.10.8.5 EMLAP Specific Analyst Training Requirements:

5.7.10.8.5.1 EMLAP laboratory analysts must meet minimum educational requirements of a baccalaureate degree in microbiology, biology or related life science.

5.7.10.8.5.2 Initial demonstration of capability.
Each analyst must complete at least 3 months of documented training fro Air Direct Exam (spore trap) and at least 6 months of work/training in the EMLAP microbiology laboratory prior to performing unsupervised work on EMLAP regulated client samples. Each analyst must read, understand and agree to follow the laboratory SOP as documented using the SOP Acknowledgement sign-off form. Each analyst must prep and/or analyze as appropriate at least 2 blind reference material test samples. These samples may be an AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the PT acceptance range or laboratory reference slide counting acceptance ranges as appropriate and

document proper identification of genus/species and genus/groups of fungi reported.

Once all requirements in 5.7.10.8.5.2 have been met, the technician/analyst will be approved to begin unsupervised prep/analysis of client samples. Documentation of formal approval to begin work is defined as the date signed by the Technical Director on the Demonstration of Capability Certification form.

5.7.10.8.5.3 Continuing Demonstration of Capability (CDOC). Each technician/analyst must demonstrate continued proficiency at least every 6 months through the analysis of AIHA-LAP, LLC provided PT samples or laboratory prepared Reference Slides. Results must fall within the AIHA-LAP, LLC PT acceptance criteria or laboratory reference slide counting acceptance ranges as appropriate. CDOCs are documented via AIHA-LAP, LLC PT reports or in the QC data log books maintained in the microbiology laboratory as appropriate.

5.7.10.8.5.4 All IDOC and CDOC documentation for EMLAP related procedures is maintained and available for review for at least 5 years.

5.7.11 The Method Detection Limit (MDL). MDL studies are performed initially for a test and verified quarterly. Reverification occurs annually within 13 months of the initial MDL study. The MDL Procedure is as follows:

5.7.11.1 Estimate the MDL

5.7.11.1.1 Use the previous MDL study.

5.7.11.1.2 Use 3 times the standard deviation of (low level ideally) spikes.

5.7.11.1.3 Determine the concentration or region of your calibration curve where there is a significant change in sensitivity and use that concentration. (This could also be at your instrument's limitation to detect.)

5.7.11.2 Determine the Initial MDL

5.7.11.2.1 Determination of the Blank MDL (MDL_b) using method blank values for certain analytes is the first step to determining an MDL. For those analytes that show identified concentrations in Method Blanks, enter the values into the MDL spreadsheet (that is posted with the MDL procedure) and determine the MDL. If some but not all of the method blanks for individual analytes give numerical results, set the MDL equal to the highest result.

5.7.11.2.2 Determination of the Spiked MDL (MDL_S) - Next perform the Spiked MDL (MDL_S) study in one of the following ways

5.7.11.2.2.1 <u>Single Instrument Spiked MDL</u>

5.7.11.2.2.1.1 Prepare and analyze at least seven replicates at a concentration determined by the estimated MDL procedure. These seven replicates must be prepared in at least three separate batches and analyzed (run) on three different days. (Run each of the 3 batches on different days.) Enter the values obtained into the MDL spreadsheet (that is posted with the MDL procedure).

5.7.11.2.2.1.2 Use 2 or 3 study replicate values (for a total of 5) from the previous two MDL studies performed within the last 24 months assuming the spike concentration used for those studies is the same concentration to be used for the initial MDL determination. In addition, prepare and analyze at least two

more replicates at the same concentration. Populate the MDL spreadsheet with those values.

5.7.11.2.2.1.3 Submit both spreadsheets to the Department Manager or the QA Manager for review and approval.

5.7.11.2.2.2 Multiple Instrument Spiked MDL

5.7.11.2.2.2.1 Prepare and analyze at least two replicates per instrument (minimum seven total replicates) at a concentration determined by the estimated MDL procedure. Replicates must be prepared in at least three separate batches and analyzed (run) on three different days. Enter the values obtained into the MDL spreadsheet (that is posted with the MDL procedure).

5.7.11.2.2.2.2 Use 2 or more study replicate values per instrument from the previous two instruments' MDL studies performed within the last 24 months assuming the spike concentration used for those studies is the same concentration to be used for the initial MDL determination. Enter these values into the MDL spreadsheet.

5.7.11.2.2.2.3 Submit both spreadsheets to the Department Manager or the QA Manager for review and approval.

5.7.14.1 Method Blank (MB). For each method, the analyst must analyze reagent water blank daily to demonstrate that interferences from the analytical system is under control. The method blank is treated in the same manner as any sample, including any sample preparations such as digestions and extractions.

5.7.12.1 In the method blank, the concentration of any analyte of interest should not exceed the laboratory established practical quantitation limit (PQL). If contamination is detected in the blank, one of the following conditions must be met, or re-analysis of all associated samples is required (Section 5.8, Out of Control Procedures).

5.7.12.1.1 With documentation of client approval, the PQL may be increased above the level of contamination in the method blank & associated samples. Report data with a "B" qualifier.

5.7.12.1.2 For sample results greater than or equal to 10 times the concentration of the method blank, the data may be reported with a flag indicating that low level contamination was detected in the method blank. Report data with a "B" qualifier.

5.7.13 Surrogates and Surrogate Recovery measured during the analysis of organic compounds. In order to monitor sample extraction efficiency, all client samples, blanks, and QC samples are fortified with surrogate spiking compounds before extraction and injection into the instrument.

5.7.13.1 Acceptance Criteria: Acceptable surrogate recoveries are contained in LIMS.

5.7.13.2 At a minimum, the laboratory annually updates surrogate recovery limits on a matrix-by-matrix basis for each test method.

5.7.13.3 If the surrogate recovery fails the above stated acceptance criteria, the analyst must proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.13.4 Calibration curves. At a minimum, a 5 point calibration curve must be developed for each surrogate that is used in a particular test method.

5.7.14.2 Internal standard retention time - The retention times of the internal standards in the calibration verification standard must be evaluated immediately after or during GC or GC/MS acquisition.

5.7.14.2.1 If the retention time for any internal standard changes by more than 30 seconds from the retention time of the mid-point standard in the most recent initial calibration sequence, then the chromatographic system must be inspected for malfunctions and corrections must be made. Proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.14.2.2 Internal standard response – If the area for any of the internal standards in the ICV or CCV changes by more than a factor of two (-50% to +100%) from that of the mid-point standard level in the most recent initial calibration sequence, the mass spectrometer or GC system must be inspected for malfunctions and corrections must be made unless the exceedance is caused by matrix interference. Proceed according to the out-of-control procedures discussed in Section 5.8.

5.7.14.3 Determination of Retention Time Window. Before establishing windows, be certain that the GC, GC/MS, or HPLC system is within optimum operating conditions. To determine the retention time window, make three injections of the sought for standard(s) or analyte(s) throughout the course of a 72 hour period. Serial injections over less than a 72-hour period result in retention time windows that are too tight.

5.7.14.3.1 Calculate the standard deviation of 3 absolute retention times for standard(s) in question.

5.7.14.3.2 The retention time window for individual peaks is defined as plus-or-minus (+/-) three (3) times the standard deviation of the absolute retention time.

5.7.14.3.3 In those cases where the standard deviation for a particular analyte is zero, the laboratory should use +/- 0.05 minutes as a retention time window.

5.7.14.3.4 The laboratory must calculate retention time windows for each standard on every existing GC column and on each new GC column when it is installed. The data is be retained by the laboratory for a period of 5 years.

5.7.14.4 For TCLP analysis, a matrix spike should be prepared and analyzed for each waste type (e.g., oil, solid) associated with a batch of 20 or fewer samples of similar matrix.

5.7.15 Additional Quality Control Parameters Required for Metals Analysis by 7000 Series Methods.

5.7.15.1 Dilution test. For each analytical batch, select one typical sample for serial dilution to determine whether interferences are present. The concentration of the analyte should be at least 25 times the estimated detection limit.

5.7.15.1.1 Determine the apparent concentration in the undiluted sample. Dilute the sample by a minimum of five fold (1 + 4) and reanalyze.

5.7.15.1.2 If all of the samples in the batch are below 10 times the detection limit(s), perform the spike recovery analysis.

5.7.15.1.3 Agreement within 10% between the concentration of the undiluted sample and five times the concentration of the diluted sample indicates the absence of interferences, and such samples may be analyzed without using the method of standard additions.

5.7.15.2 Spike Recovery Test. If results from the dilution test do not agree (or if none of the samples in the batch are at a concentration level that is 10 times the MDL) the spike recovery test must be performed.

5.7.15.2.1 Withdraw another aliquot of the test sample and add a known amount of analyte to bring

the concentration of the analyte to 2 to 5 times the original concentration.

5.7.15.2.2 If all of the samples in the batch have analyte concentrations below the detection limit, spike the selected sample at 20 times the detection limit.

5.7.15.2.3 Analyze the spiked sample and calculate the spike recovery. If the recovery is less than 85% or greater than 115%, the method of standard additions shall be used for all samples in the batch or data qualified and narrated with client report.

5.7.16 Additional Quality Control Parameters Required for Metals Analysis by ICP Methods.

5.7.16.1 The upper limit of the linear dynamic range must be established for each wavelength utilized. This is accomplished by measuring the signal response of a standard that is 10% higher than the upper range of the calibration curve.

5.7.16.2 The laboratory must establish and verify every six months an inter-element spectral interference correction routine to be used during sample analysis. See the individual ICP method SOPs for instructions on performing this test.

5.7.16.3 Duplicate or matrix spike duplicate samples. For all target metals, one sample per analytical batch is digested and analyzed in duplicate or as matrix spike duplicate. The results are compared and should meet the precision control limits established.

5.7.16.4 An instrument blank should be run after any sample giving a response that exceeds the calibration range of the instrument. This is done to show that there is no carry-over to the next analysis. The instrument blank shall consist of a high purity solvent (e.g., hexane for pesticide analysis by GC/ECD, methylene chloride for semi-volatiles analysis by GC/MS).

5.7.17 Additional Quality Control Parameters Required for Microbiological Test Methods.

5.7.17.1 Laboratory water quality must be checked and documented at the frequency indicated in the following table.

Table 5-2 Laboratory Water Quality Criteria

Requirement	Criteria	Frequency
pH	5.5-7.5	Each day test is performed
Residual Chorine	<1.0 mg/L	Each day test is performed
Conductivity	<2.0 µmho/cm @25°C	Each day test is performed
Heterotrophic Plate Count	<500 colony forming units/ml	Monthly
Bacteriological Ratio	0.8-3.0	Annually
Cd, Cr, Cu, Ni, Pb, Zn	<0.05 mg/L each, total <1.0 mg/L	Annually
NH_3, Organic Nitrogen	<0.1 mg/L	Monthly
TOC	<1.0 mg/L	Monthly
Student's t value	<2.78 (Annual use test)	Annually

5.7.17.2 The laboratory maintains records of monthly checks on sterile water and membrane filters as evidence of trends in contamination levels for microbiology through Heterotrophic Plate Count measurements. If the contamination level exceeds 1000 CFU/ml, all equipment should be checked for sterility and re-sterilized as necessary. In addition, if additional testing indicates that the problem is still present, then the room used for bacteriological testing should be cleaned with a disinfectant soap and plate counts measured again. Repeat the process as necessary.

5.8 Procedures for Assessing and Treating Out-of-Control Situations.

5.8.1 Quality control analyte samples consist of the following: Method Blanks, Duplicates, Laboratory Control Sample, Laboratory Control Sample Duplicate, Matrix Spike, Matrix Spike Duplicate, Initial Calibration Verification, Continuing Calibration Verification, BFB and DFTPP tunes, internal standards, surrogates, post digestion spikes, and dilution tests.

5.8.2 If any of the quality control analyte recovery values are outside either the laboratory or method-established control limit(s), they are considered to be out-of-control.

5.8.3 The resolution of an out-of-control situation, with identification and correction of the root cause, must be documented prior to initiating subsequent analyses. Documented corrective action (which may or may not require re-analysis) must also be performed if any of the recovery values in the LCS exhibit any "out-of- control" patterns.

5.8.4 Out-of-control conditions include the following special situations:

5.8.4.1 When the acceptance criteria for the continuing calibration verification has a high bias and there are associated samples that are non-detects, then the non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be re-analyzed after the source of the problem has been corrected.

5.8.4.2 When the acceptance criteria for the continuing calibration verification have a low bias, those sample results may be reported if they exceed a maximum regulatory limit or decision level. Otherwise, the samples affected by the unacceptable verification shall be re-analyzed after the source of the problem has been corrected.

5.8.4.3 The root cause of such failures must be investigated and documented in a Non-Conformance Report (NCR). Any corrective actions identified as a result of the investigation must be implemented and documented in a Corrective Action Report (CAR) prior to reprocessing the affected sample batch.

5.8.4.4 The QC requirements for each test method are listed LIMS test codes. They are also posted as charts and tables on the portal server. Unless otherwise indicated, if tables and charts have been produced, the precision and accuracy limits were determined from laboratory data.

5.8.5 Risks and Opportunities

The laboratory has adopted a risk management approach to Risk and Opportunities defined in ISO / IEC 17025:2017 section 8.5. This requires the laboratory to determine risks and opportunities, evaluate their severity and impact, and to address these risks with actions that will ultimately improve results and prevent future negative effects.

The laboratory addresses risks and opportunities quarterly as part of the laboratory's quarterly audit by way of the Risk Assessment Table and Chart. Risks are identified via the laboratory and upper management staff by the evaluation of corrective actions, internal audits, complaints, management reviews, procedures, occurrences, meeting discussions, incidents, and personnel suggestions. Each identified risk is recorded in the Risk Assessment Table (Table 5-3) and assigned a score from 1-5 for the likeliness of occurrence. This scale from 1 to 5 gives an indication of the likelihood of the occurrence. (1=Unlikely, 2=Seldom, 3=Occasional, 4=Likely, 5=Definite). In addition, a severity of impact score is assigned from 1-5. This rates the impact of the event, if the event occurred. (1=Insignificant, 2=Marginal, 3=Moderate, 4=Critical, 5=Catastrophic).

These scores are combined. Each score combination correlates to a risk rating, which shows the necessity of action requirement. This risk ratings are Extreme, High, Medium, and Low. This risk

rating prompts an action in accordance with the rating: Extreme - Act Now, High - Further Action Necessary Soon, Medium - Further Action Optional, Low - No Further Action.

The Risk Assessment Chart (Table 5-3) assists with the visualization of the risk severity and corresponds to the Risk Assessment Table, where each risk data point will show up on this "heat map" (termed by the colors used) of Likelihood vs. Impact. The heat map is shaded from green to red, where green indicates low risk and no action is necessary, yellow indicates medium risk and action is optional, orange indicates high risk and action is necessary soon, and red indicates extreme risk and action is needed immediately. In response to these results, actions taken to mitigate the specified risks are detailed in the Risk Assessment Table to track progress.

This Risk Assessment Table and Chart is included in the Quarterly Report to Management.

Identified Risks are mitigated through:

- Training and Awareness
- Continued Audits (Internal, External, Customer, Third Party)
- Design and organization for efficiency, reliability, ease, and maintainability

After implementation of the risk action, the risks are monitored by tracking and evaluating performance, ensure "lesson learned" feedback goes into future planning and activities, and by established metrics (such as QC charting).

All of these stated components will be evaluated by upper and departmental management during the annual management review to verify the effectiveness of the risk resolution.

5.8.6 Improvement

Opportunities for improvement can be identified through risk management approach utilizing the Risk Assessment Table and Chart, or by the review of the operational procedures, the use of the policies, overall objectives, audit results, corrective actions, management review, suggestions from personnel, risk assessment, analysis of data, and proficiency testing results.

The laboratory identifies and selects opportunities for improvement and implements the necessary actions in a number of ways.

Opportunities for improvement are identified by using the following practices:

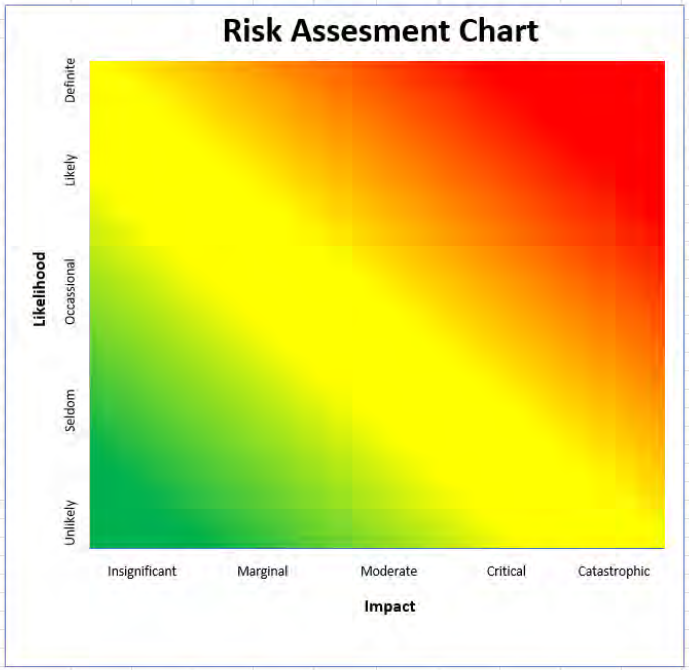
1. Corrective Actions
2. Data or QA Review
3. Internal Audits
4. Weekly management meeting discussions
5. Departmental management reviews
6. Proficiency testing results
7. Review of operational procedures
8. Feedback from personnel and clients

As with Risk and Opportunities, improvements will be evaluated by upper and departmental management during the annual management review to verify the effectiveness of the risk resolution.

Table 5-3 Risk Assessment Table and Chart

Risk Assesment Table

Description of Identified Risk	Risk	Likelihood (1-5)	Impact (1-5)	Action Requirement	Action Taken
	R1			Act Now	
	R2			Act Now	
	R3			Act Now	
	R4			Act Now	
	R5			Act Now	
	R6			Act Now	
	R7			Act Now	
	R8			Act Now	
	R9			Act Now	
	R10			Act Now	
	R11			Act Now	
	R12			Act Now	
	R13			Act Now	
	R14			Act Now	
	R15			Act Now	
	R16			Act Now	
	R17			Act Now	
	R18			Act Now	
	R19			Act Now	
	R20			Act Now	
	R21			Act Now	
	R22			Act Now	
	R23			Act Now	
	R24			Act Now	
	R25			Act Now	



Risk Rating	
Low	No Further Action
Medium	Further Action Optional
High	Further Action Necessary Soon
Extreme	Act Now

Likelihood	Impact
Unlikely (1)	Insignificant (1)
Seldom (2)	Marginal (2)
Occasional (3)	Moderate (3)
Likely (4)	Critical (4)
Definite (5)	Catastrophic (5)

5.9 Inter-laboratory QA and QC

5.9.1 Each section of the laboratory may be given blind and double blind samples to analyze for requested parameters. Blind samples may be assigned in containers to be diluted, digested, and/or extracted and analyzed by the appropriate laboratory section. Double-blind samples arrive on a pre-scheduled basis from a "client" as real samples to be analyzed by designated analytical sections for specific analytes.

5.9.2 Blind QC samples may be used as a test of proficiency for analysts needing certification and/or qualification for performing an analysis. The Section Supervisor should obtain the QC sample from, either, the Quality Assurance Department or from a source independent of the source of standards for the analysis.

5.9.3 Double blind samples represent quality control samples whose analyte concentrations are known to, either, an outside source, such as a client, or an inside source, such as the Quality Control Manager, Project Managers, or the Technical Director.

5.9.3.1 Double blind samples will arrive in the lab as real samples and their identity will not be known to anyone as quality control samples except for Quality Assurance and Department Manager.

5.9.3.2 The results of these double-blind samples will be sent to the "client" to be compared to the true value of the samples. The laboratory's performance on these samples may be compared to other laboratories in the program (if applicable). These results will be mailed to the Quality Assurance Department.

5.9.3.3 When the double blind samples are created within the laboratory, a report will be generated by the Quality Assurance Manager or the Technical Director that indicates the true value of the analyte. These values will be compared to the reported value by the laboratory. The analysis of double blind samples is used as an aid to improve quality control within the laboratory.

5.10 Sample Dilution

5.10.1 All instruments are periodically calibrated with calibration curves. The calibrations typically are developed by comparison of area or intensity against sample concentration. Per the requirements of the various accreditation agencies, the calibrations are verified initially and periodically, usually every day or every 12 hours.

5.10.2 Various test methods additionally require that the linear range of the instrument is determined on a specified frequency.

5.10.3 In the event that a measured sample concentration exceeds the concentration of the highest calibration standard or the linear range of the instrument (where determined), the sample must be diluted per the following procedure.

5.10.3.1 The analyst should attempt to dilute the sample so that the measured concentration of the diluted sample is approximately 60% that of the highest standard in the calibration curve.

5.10.3.2 The sample must be diluted with the same matrix as the undiluted sample as indicated below.

5.10.3.2.1 Aqueous samples are diluted with reagent grade distilled water.

5.10.3.2.2 Extracts in solvents are diluted with the same solvent of the same purity.

5.10.3.2.3 ICP digestates are diluted with nitric acid or hydrochloric acid-water mixtures that emulate the original matrix.

5.10.3.3 The sample dilution is reported in the LIMS and on the data sheet. The results are reported to the client and the reporting limits are automatically adjusted by the LIMS system to account for the sample dilution.

Table 5-4 Summary of Calibration and QC Procedures for Various Tests

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
SW-8081B	Five-point initial calibration	Initial calibration prior to sample	RF = 20%	Correct problem then repeat initial
Pesticides	for all analytes	analysis		calibration
SW-8082A				
PCB			Linear - least squares regression	
SW-8151A			r>0.995	
Herbicides	Second source calibration	Once per five point initial	All analytes within 15% of	Correct problem then repeat initial
SW-8015C	verification standard (ICV)	calibration - from second source.	target value	calibration
Organics			GRO/DRO = 15% PRO = 20%	
GRO	Retention time window	System set-up	3 times standard deviation for	Correct problem then re-analyze
DRO	calculated for each analyte		each analyte retention time from	all samples analyzed since
FL-PRO			72 hour study	retention time check
SW-8315A	Continuing calibration	Before sample analysis, after	All analytes within 15% of	Correct problem then repeat initial
Carbonyls	verification	every 10 samples, and at the end	target value	continuing calibration verification
		the analysis sequence with	GRO/DRO = 20% PRO = 25%	and re-analyze all samples since
		varying concentrations	8081B/8082A = 20%	last successful CCV
		GRO/DRO Every 12 hours before		
		sample analysis, after every 10		
		samples, and at the end of the		
		analytical sequence		
		GRO/DRO = RT window		
		required analyzed at same		
		frequency as CCV		
	Breakdown check (Endrin	Daily prior to analysis of samples	Degradation <15%	Inlet column maintenance; repeat
	and DDT)(1)			breakdown check. Correct problem
	Method Blank	Once per analytical batch	No analytes detected > PQL	Then re-prep and analyze the method
				and all samples processed with the
				contaminated blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				& all samples in the affected batch
	Surrogate Spike	Every sample, spiked sample,	See LIMS Test codes	Check system, re-inject, re-extract
		standard, and method blank		
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method for the		method until the IDOC passes
		first time - second source.		method criteria
	LLOQ	Initial	LCS range ±20%	
		Annually	0.5-2 times established LLOQ	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
	Second column	100% for all positive results	Same results as primary	Only report the results that match.
	confirmation (2)	(not for 8015B)	column analysis	Use the highest results
SW-8260D	Tune BFB for 8260B	Prior to initial calibration		Analyst cannot perform the test until
SW-8270E	Tune DFTPP for 8270D	Prior to initial calibration		the tune passes method criteria
	Five-point initial calibration	Initial calibration prior to sample		Correct problem then repeat initial
	for all analytes	analysis.		calibration
	Second source calibration	Once per five point initial	All analytes within 30% of	Correct problem then repeat initial
	verification standard (ICV)	calibration-second source.	target value	calibration
	Retention time window	Each Sample	Relative retention time (RRT) of	Correct problem then re-analyze
	calculated for each analyte		the analyte within 0.06 RRT units	all samples analyzed since
			of the RRT	retention time check
	Continuing calibration	Daily prior to analysis of samples		Correct problem then repeat initial
	verification	and every 12 hours of analysis		continuing calibration verification
		time.		and re-analyze all samples since
				last successful CCV. If not met the

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
SW-8260D	Internal Standards	Every sample/standard	Target compounds ≤20%	system should be evaluated, and
SW-8270E			Retention Time RT +/-30 seconds	corrective action should be taken
			from RT of the mid- point in the	before analysis. If criterion is not met
			CCV/ICAL(sample/standard)	for more than 20% of the compounds
			EICP area within -50% to +100%	Included In the initial calibration, then
			of ICAL mid-point standard	corrective action must be taken prior to
	Internal Standards	Every sample/standard	Target compounds ≤20%	analysis of samples.Inspect GC/MS for
				malfunctions; mandatory re-analysis of
				samples analyzed while system was
				malfunctioning. Correct problem then
	Method Blank	Once per analytical batch	No analytes detected > PQL	re-prep and analyze method blank and
				all samples processed with the
				Contaminated blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in the affected
				analytical batch
	Surrogate Spike	Every sample, spiked sample,	See LIMS Test codes	Check system, re-inject, re-extract
		standard, and method blank		
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	LCS range ±20%	
		Annually	0.5-2 times established LLOQ	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
SW-7000	3-point initial calibration	Daily initial calibration prior to	Correlation coefficient >0.995 for	Correct problem then repeat initial
Metals	(min. 3 stds and a blank)	sample analysis	linear regression	calibration
	Second source calibration	Once per initial daily calibration	All analytes within 10% of	Correct problem then repeat initial
	verification standard (ICV)	second source.	target value	calibration
	Continuing calibration	Before sample analysis, after	All analytes within 20% of	Correct problem then repeat initial
	verification	every 10 samples, and at the end	target value	continuing calibration verification
		the analysis sequence		and re-analyze all samples since
				last successful CCV
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
				analyze method blank and all samples
				processed with that blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in the affected batch.
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
	Dilution test: 1:4 dilution	Each preparatory batch	Five times dilution sample result	Perform post digestion spike
		Sample concentration must be	must be within 10% of the	addition
		20X MDL	undiluted sample result	
	Recovery Test	When dilution test fails or	Recovery within 15% of target	Perform method of standard
		sample concentration < 20X MDL	results	additions

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
SW-9010C	Initial calibration	Daily initial calibration prior to	Correlation coefficient >0.995 for	Correct problem then repeat initial
CN Distil	(six standards and a blank)	sample analysis	linear regression	calibration
Cyanide				
	Distilled standards (one	Once per initial daily calibration	All analytes within 10% of	Correct problem then repeat initial
	high and one low)		target value	calibration
	Second source calibration	Once per initial daily calibration	All analytes within 15% of	Correct problem then repeat initial
	verification standard (ICV)	second source.	target value	calibration
	Continuing calibration	Before sample analysis, after	All analytes within 15% of	Correct issue, repeat initial continuing
	verification	every 10 samples, and at the end	target value	calibration verification and re-analyze
		the analysis sequence - varying		all samples since last successful CCV.
		concentrations		
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
				method blank and all samples
				processed w/ contaminated blank.
	LCS/LCSD	One per prep batch	All analytes within 15% of	Re-prep, reanalyze the LCS/LCSD and
			target value	all samples in the analytical batch
	MS/MSD	One per prep batch (9010B)	All analytes within 30% of	None - Narrate the results in LIMS
		Every 10 samples (9012A)	target value	
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA-624.1	Tune BFB for 8260B	Prior to initial calibration and	See individual method for	Analyst cannot perform the test
EPA-625.1	Tune DFTPP for 8270C	continuing calibration verification	tune criteria.	method until the tune passes
		every 12 hours		method criteria
	5-point initial calibration	Initial calibration prior to sample	%RSD<35%	Correct problem then repeat initial
	for all analytes	analysis		calibration
	Second source calibration	Once per 5 point initial	All analytes within range of	Correct problem then repeat initial
	verification standard (ICV)	calibration	method criteria (SOPs/Methods)	calibration
	Continuing calibration	Daily prior to analysis of	All calibration analytes within	Correct problem then repeat initial
	verification	samples - varying concentration.	Range of method specified criteria	continuing calibration verification
			(SOPs/Methods)	and re-analyze all samples since
				last successful CCV
	Internal Standards	Every sample/standard	Retention time +/-30 seconds	Inspect GC/MS for malfunctions;
			from retention time of the mid-	mandatory re-analysis of samples
			Point in the CCV/ICAL	analyzed while system was
				malfunctioning.
	Retention time window	Each Sample	Relative retention time (RRT) of	Correct problem then re-analyze
	calculated for each analyte		the analyte within 30 seconds	all samples analyzed since
			of the RT	retention time check
			(sample/standard)	
			EICP area within -50% to +100%	
			of ICAL mid-point standard	
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
				analyze method blank and all samples
				processed with this blank.
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in the affected
				analytical batch

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
	Surrogate Spike	Every sample, spiked sample,	See LIMS Test codes	Check system, re-inject, re-extract
		standard, and method blank		
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Re-verification		
TO-14A	New Canister Check	New - pressurize with humidified	demonstrate <0.2ppb of target	Re-clean canister and retest
TO-15		UHP nitrogen; analyze after aging	analytes	
VOC		24 hours to determine cleanliness		
	Canister Leak Check	Pressurize to 30 psig and check	Pressure should not vary more	Repair canister and retest
		pressure after 24 hours	than +/- 2 psig over 24 hours	
	Canister Blank Check	Pressurize to 30 psig with	demonstrate <0.2ppbv of target	Re-clean canister and retest
		humidified UHP nitrogen	analytes; requires 24 hours of	
			aging prior to analysis	
	Sampling System	Pass humidified UHP nitrogen	demonstrate <0.2ppbv of target	Re-clean canister and retest
	Certification	through sampling system and	analytes	
	(Zero Air Certification	demonstrate <0.2ppbv of target		
	using UHP Nitrogen)	analytes		
	Dynamic Calibration	Pass humidified UHP nitrogen	demonstrate <0.2ppbv of target	Clean system and retest
	System Certification	through the dynamic calibration	analytes	
		system		
	Sampler System	Use humidified gas standards to	Recovery between 90 and 110%	Clean system and retest
	Certification	compare results from a canister		
		collected with the sampling		
		system and on-line GC-MS		
	Instrument Performance	Prior to the analysis of any	Verify the mass spectral ion	Retune or perform routine
	Check (BFB Tuning)	samples, blanks, or calibration	abundance is in accordance with	maintenance then retune
		standards, load 50 ng or less of	Table 7-1 of SOP	
		BFB every 24 hours		
	Initial Calibration (ICal)	Prior to analysis of samples and	R^2>0.995	Correct problem and recalibrate
		blanks but after the instrument		
		performance check (following any		
		corrective action):		
		Variation of Relative Response	<30% RSD for the RRF each	Correct problem and recalibrate
		Factor (RRF)	target analyte	
		Variation of Relative Retention	Each standard within 0.06 RRT	Correct problem and recalibrate
		Time (RRT)	Units of mean for each analyte	
	Internal Standard (IS)	Each IS response	Must be within 40% of the mean	Correct problem and recalibrate
	ICAL Response		response over the ICAL	
		IS ICAL Retention Time	Each IS should be within 20 s of	
			the mean retention time over the	
			ICAL	
	Daily Calibration	Prior to the analysis of samples	Must be within +/- 30% for ICAL	Reanalyze; if still fails, perform
	(Continuing Calibration	and blanks but after tuning criteria	for each target analyte	instrument maintenance and reanalyze
	Verification-CCV)	have been met, analyze mid-level		
		standard		

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
	Laboratory Method Blank	Analyze one every 24 hours;	Blank should not contain any	Reanalyze; prepare new canister and
TO-14A	(LMB)	pressurize (2 atm) clean canister	target analyte greater than PQL.	analyze
TO-15		with >20% relative humidity UHP	Each IS response in the blank	
VOC		nitrogen	must be within +/- 0.33 minutes	
			of the most recent calibration	
	Sample Technical	Analyzed on a GCMS system	Meeting the BFB Tune, ICAL, and	Reanalyze sample. Qualify / Narrate
	Acceptance Criteria		continuing calibration criteria	data appropriately
			outlined in SOP	
		Analyzed with a LMB meeting	Must meet method in SOP. All	
		criteria	target analytes within ICAL range.	
			Ea. IS RT within+/- 30% minutes	
			of the most recent calibration.	
EPA-245.1	Initial calibration (minimum	Daily initial calibration prior to	Correlation coefficient >0.995 for	Correct problem then repeat initial
Mercury	5 standards and a blank).	sample analysis.	linear regression.	calibration.
	Linear Dynamic Range	Once Annually	Analyte within 10% of target	Calibration range lowered to meet
			value (not necessary if diluting	LDR results.
			within calibration curve).	
	Second source calibration	Once per five point initial	All analytes within 5% of	Correct problem then repeat initial
	verification standard (ICV)	Calibration - second source.	target value	calibration
	Continuing calibration	Before sample analysis, after	All calibration analytes within 10%	Correct problem then repeat initial
	verification	every 10 samples, and at the end	of target value before	continuing calibration verification
		of the analysis sequence -	sample analysis	and re-analyze all samples since
				last successful CCV
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
				analyze method blank and all samples
				processed with that blank
	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
				and all samples in that batch
	MS/MSD	One per prep batch	See LIMS Test codes	None - Narrate the results in LIMS
	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
		performs the test method for the	LCS Accuracy for Limits	method until the IDOC passes
		first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA 200.7	Initial calibration (minimum	Initial calibration prior to sample	Not applicable	Correct problem then repeat initial
SW-6010D	1 standards and a blank)	analysis		calibration.
ICP Metals				
	CRI /LLICV/LLCCV	Set to PQL	Result must be greater than	Correct problem the repeat initial
			calibration blank, <PQL	calibration
			±30% for all analytes	
	Check Standard	Calibration verification	All analytes within 5% of	Correct problem, then reanalyze the
			target value	calibration standard and check std.
	Second source calibration	Once per initial calibration -	Mean value of all analytes	Fix problem, repeat initial calibration
	verification standard (ICV)	second source.	within 5% of target value for 200.7	
			within 10% for 6010D	
	ICSA	Interference analytes Ca, Fe, Mg, Al	Concentrations of analytes	Stop analysis; fix problem. Reanalyze
		Beginning, end & periodic intervals	within 20% of target value	ICS; reanalyze all affected samples.

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
	ICSAB	Interference analytes Ca, Fe, Mg, Al	Concentrations of analytes	Stop analysis; fix problem. Reanalyze
EPA 200.7		Beginning, end & periodic intervals	within 20% of target value	ICS; reanalyze all affected samples.
SW-6010D				
ICP Metals	Linear dynamic range	Every six months	All analytes within 10% of	Calibration range adjusted to meet
			target value.	calibration results.
	Calibration blank	After every calibration verification	No analytes detected within +/-	Correct problem then repeat initial
			one MDL	continuing calibration verification
				and re-analyze all samples since
				last successful calibration blank
	Continuing calibration	Before sample analysis, after	Analytes within 10% of target	Repeat calibration and re-analyze
	verification (CCV)	every 10 samples, and at the	value for method 200.7,	all samples since last successful
		end of the analysis sequence -	within 10% for method 6010D	calibration verification.
	Method Blank	Once per analytical batch	No analytes detected within +/-	Correct problem then re-prep and
			one MDL	analyze method blank and all samples
				processed with the contaminated blank
	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample.
		Sample concentration must be	%RSD must be 30% for soil	Check system, re-prep, re-analyze
		4X MDL or greater for valid results		as needed
	LCS/LCSD	One per prep batch	200.7: within 15% of target	Re-prep and analyze the LCS/LCSD
			6010D: within 20% of target	and all samples in that batch
	Dilution test: 1:4 dilution	Each preparatory batch	Five times dilution sample result	Perform post digestion spike
		Sample concentration must be	must be within 20% of the	addition
		20X MDL	undiluted sample result for	
			6010D and 10% for 200.7	
	Recovery Test	When dilution test fails or	Recovery within 25% of target	Perform method of standard
		sample concentration < 20X MDL	value	additions
	MS/MSD	One per prep batch	All analytes within 20% RPD	Check system, re-prep, re-analyze
			MS- (200.7 70-130%)	as needed
			(6010D 75-125%)	
			PDS-(200.7 85-115%)	Sample Conc. > 10X spike Conc., if
			(6010D 80-120%)	not , cannot validate MS
	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA 200.8	Initial calibration (minimum	Initial calibration prior to sample	Not applicable	Correct problem then repeat initial
SW-6020 B	1 standards and a blank)	analysis		calibration.
Metals				
	CRI /LLICV/LLCCV	Set to PQL	Result must be greater than	Correct problem the repeat initial
			calibration blank, <PQL	calibration
			±30% for all analytes	
	Check Standard	Calibration verification	All analytes within 5% of	Correct problem, then reanalyze the
			target value	calibration standard and check std.
	Second source calibration	Once per initial calibration -	Mean value of all analytes within	Correct problem then repeat initial
	verification standard (ICV)	second source.	5% of target value for 200.8	calibration
			within 10% for 6020B	
	ICSA	Interference analytes Ca, Fe, Mg, Al	Concentrations of analytes	Terminate analysis; correct problem
		Beginning, end & periodic intervals	within 20% of target value	reanalyze ICS; reanalyze all affected
		(every 12 hours)		samples.

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
	Linear dynamic range	Every six months	All analytes within 10% of	Calibration range adjusted to meet
			target value.	calibration results.
EPA 200.8	Calibration blank	After every calibration verification	No analytes detected within +/-	Correct problem then repeat initial
SW-6020 B			one MDL	continuing calibration verification
Metals				and re-analyze all samples since
				last successful calibration blank
	Continuing calibration	Before sample analysis, after	Analytes within 10% of target	Repeat calibration and re-analyze
	verification (CCV)	every 10 samples, and at the	value for method 200.8,	all samples since last successful
		end of the analysis sequence -	within 10% for method 6020B	calibration verification.
	Method Blank	Once per analytical batch	No analytes detected within +/-	Correct problem then re-prep and
			one MDL	analyze method blank and all samples
				processed with the contaminated blank
	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample.
		Sample concentration must be	%RSD must be 30% for soil	Check system, re-prep, re-analyze
		4X MDL or greater for valid		as needed
		results.		
	LCS/LCSD	One per prep batch	200.8: within 15% of target	Re-prep and analyze the LCS/LCSD
			6020B: within 20% of target	and all samples in the affected
				analytical batch
	Dilution test: 1:4 dilution	Each preparatory batch	Five times dilution sample result	Perform post digestion spike
		Sample concentration must be	must be within 10% of the	addition
		20X MDL	undiluted sample result for	
			6020 B or A and 10% for 200.8	
	Recovery Test	When dilution test fails or	Recovery within 25% of target	Perform method of standard
		sample concentration < 20X MDL	value	additions
	MS/MSD	One per prep batch	All analytes within 20% RPD	Check system, re-prep, re-analyze
			MS/MSD-200.8: 70-130%	as needed
			MS/MSD-6020B: 75-125%	
			PDS-6020B: 75-125%	Sample Conc. > 10X spike Conc., if
				Not, cannot validate MS
	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	LLOQ	Initial	Spike ±35%, RSD <20%	
		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
EPA 608.3	Minimum 3-point initial	Initial calibration prior to sample	RF = 20%; Linear - least squares	Correct problem then repeat initial
Pest/PCB	calibration for all analytes	analysis	regression r>0.995	calibration
	Second source calibration	Once per five point initial	All analytes within 20% of	Correct problem then repeat initial
	verification standard (ICV)	calibration - from second source	target value	calibration
	Retention time window	Each day test is performed.	3 times standard deviation for ea.	Fix problem then reanalyze samples
	calculated for each analyte		analyte RT from 72 hour study	analyzed since retention time check
	Continuing calibration	Before sample analysis, after every		Fix problem. Repeat initial continuing
	verification	20 injections, at the end of analysis		calibration verification; reanalyze all
		sequence - varying concentrations		samples since last successful CCV
	Breakdown check (Endrin	Daily prior to analysis of samples	Degradation <20%	Inlet column maintenance; repeat
	and DDT)(1)			breakdown check
	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
				method blank & all samples processed
				with the contaminated blank.
	LCS/LCSD	One per prep batch	All analytes within range of	Re-prep and analyze the LCS/LCSD
			method criteria (SOPs/Methods)	and all samples in the affected batch.

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
EPA 608.3	Surrogate Spike	Every sample, spiked sample,	All analytes within range of	Check system, re-inject, re-extract
Pest/PCB		standard, and method blank	method criteria (SOPs/Methods)	
	MS/MSD	Every batch	All analytes within range of	None - Narrate the results in LIMS
			method criteria (SOPs/Methods)	
	IDOC	Every time a new analyst	All analytes within range of	Analyst cannot perform the test
		performs the test method	method criteria (SOPs/Methods)	method until the IDOC passes
		for the first time - second source.		method criteria
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
		Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
	Second column	100% for all positive results	Same results as primary	Only report the results that match.
	confirmation (2)		column analysis	Use the highest results
SM2540C	Verification standard	Each batch	All analytes within 10% of	Repeat test. If results are still not
TDS	Single standard		target value	within 10%, report result and narrate
SM2540D	(if available)		Flashpoint result 77-82°F	in LIMS.
TSS				
SM2540B	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
T. Residue				method blank and samples processed
EPA-160.4				with the contaminated blank.
VS				
SM2540F	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample. If results
Sett Solids		Sample concentration must be	and 30% for soil.	not within RSD limits, report QC
SM-2540E		2X MDL or greater for valid		failure in LIMS or flag as
SW-1010A		results.		non-homogenous for soils.
Flashpoint				
SW1030	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
Ignitability		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
EPA-350.1		for the first time - second source.		method criteria
Ammonia	Five-point initial calibration	Initial calibration prior to sample	RF = 10%	Correct problem then repeat initial
EPA-351.2	for all analytes	analysis	Linear - least squares regression	calibration
TKN	(Excludes BOD, CBOD)		r>0.99; ≥0.995 for 9056A	
EPA-353.2				
NO3/NO2				
NECi-07-0003				
NO3/NO2				
EPA-365.1	Second source calibration	Once per five point initial	All analytes within 10% of	Correct problem then repeat initial
EPA-365.3	verification standard (ICV)	calibration - from second source.	target value	calibration
Phosphorus				
Sulfate				
SM4500S2F	Continuing calibration	Before sample analysis, after	All analytes within 10% of	Correct problem then repeat initial
SW-9034	verification	every 10 samples, and at the end	target value	continuing calibration verification
Sulfide		the analysis sequence - varying		and re-analyze all samples since
SM4500SO3B		concentrations		last successful CCV
Sulfite	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
EPA-410.4				analyze method blank and all samples
COD				processed with the contaminated
SM5310B				blank.
SW-9060A	LCS/LCSD	One per prep batch	See LIMS Test codes	Re-prep and analyze the LCS/LCSD
TOC				and all samples in the affected
EPA-420.1				analytical batch
EPA-420.4				
SW-9065				
Phenolics				
SM5540C				
MBAS				
EPA-300.0	MS/MSD	Every 10 samples (9038)	See LIMS Test codes	None - Narrate the results in LIMS
SW-9056A		One per prep batch (remainder)		
IC				
Oil & Grease	IDOC	Every time a new analyst	See LIMS Test codes	Analyst cannot perform the test
SW-9071B		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
SW-1664B		for the first time - second source.		method criteria
SM5210B				
BOD	LLOQ	Initial	Spike ±35%, RSD <20%	
SM5210B		Quarterly	Spike ±35%, RSD <20%	Re-evaluate, repeat study
CBOD				

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action (3,4)
	MDL	Initial Blank & Spike MDL Study	MDL < Spike Level	Reverification, repeat study
	(Excludes BOD, CBOD)	Quarterly Verification. Annual	Analyte specific per test	
		MDL Study Reverification		
SM2310B	Verification standard	Each batch	All analytes within 10% of	Repeat test. If results are still not within
Acidity	Single standard (if available)		target value	10%, report result; narrate in LIMS
SM2320B				
Alkalinity	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem, re-prep and analyze
				method blank and samples processed
				with the contaminated blank.
Wastewater				
Coliforms	Duplicate	One per batch	%RSD must be 20% for water	Reanalyze duplicate sample. If results not
SM9222D		Sample concentration must be	and 30% for soil.	within RSD limits, report QC failure in LIMS
F. Coliform		2X MDL or greater for valid results.		or flag as non-homogenous for soils
SM9222B				.
T. Coliform	IDOC	Every time a new analyst	See LIMS Test code or QC Charts	Analyst cannot perform the test
		performs the test method	LCS Accuracy for Limits	method until the IDOC passes
		for the first time - second source.		method criteria
	Method Blank	Once per analytical batch	No analytes detected > PQL	If method blank is contaminated,
Drinking Water				reanalyze duplicate sample.
Coliforms	Duplicate	If available		
F. Coliform				
SM9223				
T. Coliform	IDOC	Every time a new analyst		Analyst cannot perform the test
SM9221D		performs the test method		method until the IDOC passes
		for the first time - second source.		method criteria.
EPA-120.1	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
Conductivity				analyze method blank and all samples
Color				processed with the contaminated blank.
SM2120F				
SM2120B	Single Standard	Once per analytical batch	All analytes within 10% of	Correct problem then repeat initial
SM4500H+B			target value	calibration
pH			Conductance and color standard	
EPA-180.1			within 5% of target value.	
Turbidity				
SM4500ClG				
Residual Chlorine				
SW-9095B	Duplicate	One per batch	%RSD must be 20%	Reanalyze duplicate sample. If results
Paint Filter			pH Duplicates <0.1 pH Units	not within RSD limits, report QC
SM4500OG				failure in LIMS
DO				
SW-1311	Method Blank	Once per analytical batch	No analytes detected > PQL	Correct problem then re-prep and
TCLP				analyze method blank and all samples
SW-1312				processed with the contaminated
SPLP				blank.
	Post extraction duplicate	One per batch	%RSD must be 20%	Reanalyze duplicate sample. If results
				not within RSD limits, report QC
				failure in LIMS
	Post extraction spike	Once per analytical batch	See individual test methods.	See individual test methods.

1. Endrin/DDT breakdown check for 8081B only.
2. Excludes chlordane, toxaphene, and PCB.
3. Sample data associated with QC non-conformances resulting in high bias may be reported if all target analytes are below reporting limits.
4. In the event that reanalysis is not possible, I.e. no remaining sample, holding times expired, etc., data may be reported with non-Conformance and its potential affect on the data described in a Case Narrative.

6.0 SAMPLE BOTTLE AND PRESERVATIVE PREPARATION

6.1 Analytical Environmental Services, Inc. does not provide sampling services, therefore, has no sampling plan or procedures. If requested by the client, AES does provide appropriate pre-cleaned sample containers. The laboratory assumes responsibility for supplying the proper containers and preservatives.

6.2 Sample Container Preparation: Table 6-1 contains information for the correct containers needed for each analysis.

6.2.1 A laboratory label and proper preservative are added to the sample bottle prior to shipment or pick-

up by the client. Some clients may request several cases of bottles, preservative in separate containers, and separate labels. Should this occur, the client would be responsible for label attachment and the addition of preservatives in the field. If the client performs these duties, this is indicated on the bottle label and the chain of custody.

6.2.2 If contamination is observed in trip blanks, a representative from each "lot" of sample containers may be analyzed for the detected parameter(s) to ascertain the cause.

6.2.3 Bottle contamination checks are typically accomplished by filling the bottle with DI water and analyzing for the analytes in question. If any results are above the reporting level, contamination is present and the source must be found.

6.2.3.1 A typical method of laboratory contamination is the introduction of volatile compounds into VOC vials by the use of extraction chemicals such as methylene chloride. Another means of laboratory contamination is the cross contamination of analytes into reagent bottles through poor analytical techniques. An example would be returning aliquots of reagents to their original containers after use. In this instance, contaminants in the reagents are measured as part of the sample result when the reagent is used in the test. Finally, cross contamination can occur during analysis when glassware that is used for the test is not been properly cleaned between samples.

6.2.3.2 If the analysis indicates that the contamination source is the bottle manufacturer, the vendor or manufacturer must be informed immediately. Use of the affected bottles must stop immediately and another lot of bottles used instead.

6.2.3.3 Methods of eliminating sample contamination are discussed in the individual analyte SOPs.

6.2.3.4 Procedures for checking sample bottles for sterility and metals contamination are outlined in the Sample Receiving SOP (Sec. 3.1.2.3).

6.3 When the addition of preservatives is performed by laboratory personnel, the preservation type and amount used is marked on the label. This procedure informs the sample collection agent that the sample bottle has pre-measured preservative in it. Additionally, it provides important safety information for the sample collection agent.

6.4 Preservatives prepared by the laboratory are documented in a Preparation Standard logbook. The logbook contains the preservative preparation information including the preservative lot number and if the chemical was used "as is" from the manufacturer or if it was prepared in the lab. See Sec. 6.7.

6.5 Proper packing of bottles is essential to prevent breakage during shipping. All bottles should be wrapped in bubble wrap and the container, usually a cooler, filled with packing material.

6.6 Certain biological analyses require a sterile bottle for sampling. This includes plate counts, E-coli, and Total Coliform analyses. The laboratory purchases sterilized bottles for these analyses. Never break the seal on these bottles or open them as this can contaminate the bottles.

6.7 Preservatives and removal of interferences.

6.7.1 There are several preservatives used to increase the holding time for an analysis. In most cases, these preservatives are required by the test method, and are added to alter the sample pH or to remove possible interferences. The preservatives used at AES include the following:

6.7.1.1 HCl: 1:1 Hydrochloric Acid (2 ml per liter of sample) is added to VOC vials and other sample bottles to lower the resultant pH to ≤ 2 after the addition of sample to the bottle.

6.7.1.2 H_2SO_4: Concentrated Sulfuric Acid (2 ml per liter of sample) is added to sample bottles to lower the resultant pH to ≤ 2 after the addition of sample to the bottle.

6.7.1.3 NaOH: Solid Sodium Hydroxide pellets are added to sample bottles to raise the resultant pH to ≥ 12 after the addition of sample to the bottle.

6.7.1.4 HNO_3: Two ml per liter of sample of a 1:1 Nitric Acid (1 part concentrated Nitric Acid mixed with 1 part DI water) is added to sample bottles to lower the resultant pH to ≤ 2 after the addition of sample to the bottle.

6.7.1.5 EDTA: One ml per 100ml sample of a 2.5% EDTA solution (2.5g dissolved in 100 ml of DI water) is added to various types of sample bottles to remove any metal interferences.

6.7.2 Low results can be expected when analyzing for BOD, Volatile Organics, and Pesticides in the presence of chlorine. These samples must be tested for the presence of chlorine. This procedure is performed by placing a sample drop on a starch-potassium iodide paper strip. If the strip turns blue, chlorine is present and treatment is needed. Chlorine removal is accomplished through the addition of sodium thiosulfate (usually 2 – 4 ml of a 0.008% or a 1 N solution). Following the addition of this compound, the destruction of chlorine is verified through a subsequent chlorine check.

6.7.3 Low results can also be expected when analyzing for BOD in the presence of cyanides. Testing for the presence of cyanide is performed by placing a drop of sample on a lead acetate paper strip. If the strip turns black, cyanide is present and treatment is needed. Cyanide removal is accomplished through the addition of ascorbic acid, a few grains at a time, until the paper does not turn black. A few more grains can be added to the sample to ensure cyanide removal.

6.8 Bottle Kit Preparation

6.8.1 The number of bottles required per test, type of preservatives, and bottle type are method specific.

6.8.2 Table 6-1 indicates the preservation, holding times, and containers required for the types of tests and matrices analyzed in the laboratory.

TABLE 6-1
Preservation, Holding Time and Containers

Analysis	Matrix*	Holding Time	Container	Preservative
Acidity	Water	14 days	P, G	0 - ≤6°C[1]
Alkalinity	Water	14 days	P, G	0 - ≤6°C[1]
Bicarbonate, Alkalinity	Water	14 days	P, G	0 - ≤6°C[1]
Carbonate, Alkalinity	Water	14 days	P, G	0 - ≤6°C[1]
Ammonia	Water	28 days	P, G	1:1 H_2SO_4(pH<2), 0 - ≤6°C[1]
Ammonia	Soil	28 days	G	0 - ≤6°C[1]
Base/Neutral/Acid (BNA)	Water	7 days (Ext)	G	0 - ≤6°C[1]
Base/Neutral/Acid (BNA)	Soil	14 days (Ext)	G	0 - ≤6°C[1]
BOD	Water	48 hours	P, G	0 - ≤6°C[1], check for Cl

Analysis	Matrix*	Holding Time	Container	Preservative
Bromide	Water/Soil	28 days	P, G	0 - ≤6°C[1]
BTEX	Water	14 days	G	1:1 HCl (pH<2), 0 - ≤6°C[1] check for Cl^-
Analysis	Matrix*	Holding Time	Container	Preservative
BTEX	Soil	48 hours to preserve, 14 days	Pre-weighed vials or Encore*	Sodium Bisulfate, 0 - ≤6°C[1] or Methanol, 0 - ≤6°C[1]
Carbonate	Water	14 days	P, G	0 - ≤6°C[1]
Cation Exchange Capacity (EPA 9080 and 9081)	Soil	180 days	G	0 - ≤6°C[1]
CBOD	Water	48 hours	P, G	0 - ≤6°C[1], check for Cl
Chloride, Total	Water	28 days	P, G	0 - ≤6°C[1]
Chloride, Total	Soil	28 days	P, G	0 - ≤6°C[1]
Chlorine, Total Residual	Water	Immediately	P, G	None
Chlorophyll a	Water	Filtration: <48 hrs Analysis: 21 days	G (amber)	0 - ≤6°C[1]
COD	Water	28 days	P, G	1:1 H_2SO_4, 0 - ≤6°C[1]
E.Coli	Drinking Water	30 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C[1]
Coliform, Total	Drinking Water	30 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C[1]
Coliform, Fecal	Drinking Water	8 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C[1]
Coliform, Fecal	Non-potable Water	8 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C[1]
Coliform, Fecal	Soil / Sludge	24 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C[1]
Coliform, Total	Non-potable Water	8 hours	P, sterilized	Sodium Thiosulfate, 0 - ≤6°C[1]
Coliform, Total	Soil Sludge	24 hours	P, sterilized	0 - ≤6°C[1]
Color	Water	48 hours	P, G	0 - ≤6°C[1]
Color, ADMI	Water	48 hours	P, G	0 - ≤6°C[1]
Conductivity	Water	28 days	P, G	0 - ≤6°C[1]
Conductivity	Soil	28 days	P, G	0 - ≤6°C[1]
Corrosivity (pH)	Soil Sludge	Immediately, 15 minutes	G	0 - ≤6°C[1]
Cobalt thiocyaniate active substances (CTAS)	Water	48 hours	P, G	0 - ≤6°C[1]

Analysis	Matrix*	Holding Time	Container	Preservative
Cyanide, Amenable	Water	14 days	P, G	NaOH (pH>12), 0 - ≤6°C[1]
Cyanide, Amenable	Soil	14 days	P, G	0 - ≤6°C[1]
Cyanide, Reactive	Waste	14 days	P (opaque), G (amber)	0 - ≤6°C[1]
Cyanide, Total	Water	14 days	P, G	NaOH (pH>12), 0 - ≤6°C[1]
Cyanide, Total	Soil	14 days	P, G	0 - ≤6°C[1]
Density / Specific Gravity	Water	7 days	P, G	0 - ≤6°C[1]
Density / Specific Gravity	Soil / Sludge	6 months	P, G	0 - ≤6°C[1]
DRO	Water	7 days (ext)	G	0 - ≤6°C[1]
DRO	Soil	14 days (ext)	G	0 - ≤6°C[1]
EDB, DCBP	Water	14 days (Ext)	40 mL VOA	0 - ≤6°C[1]
Ferrous Iron	Water	24 hours	P, G	None, 0 - ≤6°C[1]
Flash Point/Ignitability	Liquid	6 months	P, G	None
Flash Point/Ignitability	Solid	6 months	P, G	None
Ignitability	Solids	6 months	P, G	None
FL-PRO	Water	7 days	G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
FL-PRO	Soil	14 days	G	0 - ≤6°C[1]
Fluoride	Water	28 days	P, G	None
FOC/FOM	Solid	28 days	G	0 - ≤6°C[1]
Formaldehyde	Water	72 hrs, to tumble, 72 hrs. to analyze	250 mL G (amber)	0 - ≤6°C[1]
Formaldehyde	Soil	From leachate 72 hours	G	0 - ≤6°C[1]
GRO	Water	14 days	40 mL VOA	1:1 HCl (pH<2), 0 - ≤6°C[1]
GRO	Soil	48 hours, 14 days after pres.	Pre-weighed vials or Encore*	Sodium Bisulfate, Methanol, 0 - ≤6°C[1]
Hardness, calculation	Water	6 months	P, G	1:1 HNO_3 (pH<2)
Herbicides	Water	7 days (Ext)	G (amber)	0 - ≤6°C[1]

Analysis	Matrix*	Holding Time	Container	Preservative
Herbicides	Soil	14 days (Ext)	G	0 - ≤6°C[1]
Hexavalent Chromium	Water	24 hours	P, G	0 - ≤6°C[1]
Hexavalent Chromium	Soil	30 days (Ext)	P, G	0 - ≤6°C[1]
Lead	Air	6 months	Cartridge**	None
Lead	Wipe	6 months	Bag***	None
Lead	Paint	6 months	Bag	None
MBAS (Surfactants)	Water	48 hours	P, G	0 - ≤6°C[1]
Mercury	Water	28 days	P, G	1:1 HNO_3 (pH<2)
Mercury, Dissolved	Water	28 days after filtration and preservation	P,G	Field filter or filter upon receipt, 1:1 HNO_3(pH<2)
Mercury	Soil	28 days	P, G	0 - ≤6°C[1]
Metals (Total), except Mercury	Water	6 months	P, G	1:1 HNO_3 (pH<2)
Metals (Dissolved), except Mercury	Water	6 months after filtration and preservation	P, G	Field filter or filter upon receipt, 1:1 HNO_3(pH<2)
Metals (Total), except Mercury	Soil	6 months	P, G	None
Nitrate	Water	48 hours	P, G	0 - ≤6°C[1]
Nitrate	Soil	48 hours	P, G	0 - ≤6°C[1]
Nitrate-Nitrite	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
Nitrate-Nitrite	Soil	28 days	P, G	0 - ≤6°C[1]
Nitrite	Water	48 hours	P, G	0 - ≤6°C[1]
Nitrite	Soil	48 hours	P, G	0 - ≤6°C[1]
Nitrogen, Organic TKN minus Ammonia	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
Nitrogen, Organic TKN minus Ammonia	Soil	28 days	P, G	0 - ≤6°C[1]
Oil and Grease (HEM)	Water	28 days	G (amber)	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
Oil and Grease (HEM)	Soil	28 days	G	0 - ≤6°C[1]
Oxygen, Dissolved (DO)	Water	Immediately, 15 minutes	P, G	None

Analysis	Matrix*	Holding Time	Container	Preservative
PAH	Water	7 days (Ext)	G (amber)	0 - ≤6°C[1]
PAH	Soil	14 days (Ext)	G	0 - ≤6°C[1]
Paint Filter Liquids Test	Waste	28 days	G	0 - ≤6°C[1]
PCB	Water	365 days	G (amber)	0 - ≤6°C[1]
PCB	Soil	365 days	G	0 - ≤6°C[1]
PCM	Air	Not Specified	Cartridge**	None
Pesticides, Chlorinated	Water	7 days (Ext)	G (amber)	0 - ≤6°C[1]
Pesticides, Chlorinated	Soil	14 days (Ext)	G	pH 5-9, 0 - ≤6°C
Pesticides, Special	Water	7 days (Ext)	G (amber)	0 - ≤6°C[1]
Pesticides, Special	Soil	14 days (Ext)	G	0 - ≤6°C[1]
pH	Soil, Water	Immediately, 15 minutes	P, G	None
Phenolics	Water	28 days	G (amber)	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
Phenolics	Soil	28 days	P, G	0 - ≤6°C[1]
Phosphorus, Ortho	Water	48 hours	P, G	0 - ≤6°C[1]
Phosphorus, Total	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
Phosphorus, Total	Soil	28 days	P, G	0 - ≤6°C[1]
Potassium Permanganate	Water	48 hours	40 mL VOA	0 - ≤6°C[1]
RSK-175: Ethane, Ethene, Methane	Water	14 days	40 mL VOA	1:1 HCl (pH<2), 0 - ≤6°C[1]
Semi-Volatiles	Water	7 days (Ext)	G (amber)	0 - ≤6°C[1]
Semi-Volatiles	Soil	14 days (Ext)	G	0 - ≤6°C[1]
Salinity	Water	28 days	P	0 - ≤6°C[1]
Silica as SiO2	Water	6 months	P	1:1 HNO_3 (pH<2), 0 -≤6°C[1]
Field to SPLP Extraction (Tumble): Semivolatiles	Liquid / Solid	14 days	G	0 - ≤6°C[1]
Field to SPLP Extraction (Tumble): Mercury	Liquid/Solid	28 days	G	0 - ≤6°C[1]
Field to SPLP Extraction (Tumble): Metals, except Hg	Liquid/Solid	180 days	G	0 - ≤6°C[1]

Analysis	Matrix*	Holding Time	Container	Preservative
FOR FLORIDA*** Field to SPLP ZHE Extraction (Tumble)	Solid	48 hours, 14 days after Freezing	25gram Encore****	0 - ≤6°C[1] freeze upon receipt
OTHER STATES Field to SPLP ZHE Extraction (Tumble)	Solid	14 Days	G	0 - ≤6°C[1]
Solids, Settleable	Water	48 hours	G	0 - ≤6°C[1]
Solids, Total	Water	7 days	P, G	0 - ≤6°C[1]
Solids, Total Dissolved	Water	7 days	P, G	0 - ≤6°C[1]
Solids, Total Suspended	Water	7 days	P, G	0 - ≤6°C[1]
Solids, Total Volatile	Water	7 days	P, G	0 - ≤6°C[1]
Sulfate	Water	28 days	P, G	0 - ≤6°C[1]
Sulfate	Soil	28 days	P, G	0 - ≤6°C[1]
Sulfide	Water	7 days	P, G	NaOH to pH>9 / Zinc Acetate, 0 - ≤6°C[1]
Sulfide	Soil	7 days	P, G	0 - ≤6°C[1]
Sulfite	Water	Immediately, 15 minutes	P, G	0 - ≤6°C[1]
Sulfide, Reactive	Waste	7 days	P (opaque), G (amber/clear)	0 - ≤6°C[1]
Field to TCLP Extraction (Tumble): Volatiles	Liquid / Solid	14 days	G	0 - ≤6°C[1]
Field to TCLP ZHE Extraction (Tumble): Semi-Volatiles	Liquid / Solid	14 days	G	0 - ≤6°C[1]
Field to TCLP Extraction (Tumble): Mercury	Liquid/Solid	28 days	G	0 - ≤6°C[1]
Field to TCLP Extraction (Tumble): Metals, except Hg	Liquid/Solid	180 days	G	0 - ≤6°C[1]
Temperature	Water	Immediately, 15 minutes	P, G	None
TKN	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
TKN	Soil	28 days	P, G	0 - ≤6°C[1]
Total Inorganic Carbon	Water	28 days	P, G	0 - ≤6°C[1]
Total Organic Carbon	Water	28 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
Total Organic Carbon	Soil	28 days	P, G	0 - ≤6°C[1]
TOX	Waste	7 days	P, G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]

Analysis	Matrix*	Holding Time	Container	Preservative
TPH (SGT-HEM)	Water	14 days	G	1:1 H_2SO_4 (pH<2), 0 - ≤6°C[1]
TPH (SGT-HEM)	Soil	28 days	G	0 - ≤6°C[1]
Turbidity	Water	48 hours	P, G	0 - ≤6°C[1]
Volatile Organics	Air	30 days	Canister	None
Volatiles by SW8260D except 2-Chloroethylvinyl ether	Water	14 days	G (40 mL VOA)	1:1 HCl (pH<2), 0 - ≤6°C[1]
Volatiles Analyte 2-Chloroethylvinyl ether by SW8260D	Water	7 Days	G (40 mL VOA)	0 - ≤6°C[1]
Volatiles Analytes Acrolein and Acrylonitrile by SW8260D	Water	7 Days	G (40 mL VOA)	1:1 HCl (pH 4-5), 0 - ≤6°C[1]
Volatiles by E624.1 including 2-Chloroethylvinyl ether but not Acrolein and Acrylonitrile	Water	14 Days	G (40 mL VOA)	0 - ≤6°C[1]
Volatiles Analyte Acrylonitrile by E624.1	Water	7 Days	G (40 mL VOA)	0 - ≤6°C[1]
Volatiles Analyte Acrolein by E624.1	Water	3 Days	G (40 mL VOA)	0 - ≤6°C[1]
Volatiles Analytes Acrolein and Acrylonitrile by E624.1	Water	14 Days	G (40 mL VOA)	1:1 HCl (pH 4-5), 0 - ≤6°C[1]
Volatile Organics by SW8260D	Soil	48 hours, 14 days after preservation	Pre-weighed vials or Encore*	Sodium Bisulfate or methanol, 0 - ≤6°C[1]

* Encore™ Samplers are approved by EPA and allow Volatile soil organics to be transported to the lab without preservative. If an Encore sampler is not used, the soil samples must be weighed in the field and preserved with sodium bisulfate or Methanol (5 ml). This will raise the detection limits considerably. See EPA SW-846 method 5035 for further information.

** Usually sampled with a cartridge device that attaches to an air pump that samples an area for a given amount of time. There are several types of cartridges approved by NIOSH, but all are self-contained and require no special treatment.

*** Lead wipe material provided to clients meets the requirements of ASTM E1792, either Ghost Wipe, Environmental Express Cat#4210, or equivalent. A specified area, usually 1 square foot, is "wiped" with this material. The wipe is placed in a non-contaminating (non-metal) container for shipment to the lab.

**** Samples for FL SPLP VOCs are collected in 25 g Encore™ Sampler. If the sample is not frozen upon receipt by the laboratory, then the sample holding time is 48 hours and the SPLP extraction must be performed within 48 hours of sample collection. Sample may be frozen by the laboratory upon arrival and maintained at a temperature of -10ºC. If the sample is frozen, the holding time is 14 days from collection and the SPLP extraction must be performed immediately once the sample is thawed to 4ºC. NOTE: Neither the samples for SPLP extraction nor the samples for total analysis may be frozen prior to delivery to the laboratory in order to meet the 48-hour holding time.

[1] 0 - ≤6°C[1] Samples delivered to the laboratory on the same day they are collected may be considered acceptable if the samples are received on ice showing that the cooling process has begun.

P Plastic container G Glass container

7.0 CUSTODY OF SAMPLES, EQUIPMENT, AND SUPPLIES

7.1 Review of New Work

7.1.1 The Laboratory Manager is primarily responsible for determining the capacity of the facility and its resources to handle new work, although other senior members of management may be called upon to provide expertise and input as needed. This determination consists of a comprehensive appraisal of

the client's projected needs. Factors assessed are the ability of the laboratory to comply with the requirements of its accreditations while maintaining the expected level of legal defensibility and analytical validity of all reported data.

7.1.2 Prior to the acceptance of any new requests, tenders, or contracts by Analytical Environmental Services, Inc., the appropriateness of facilities and resources is considered utilizing the information in the following sections. If the facility and/or resources are inadequate to perform the work, the Laboratory Manager may exercise his discretion to refuse to perform all or part of a particular project. The Client Services Manager will be informed of this decision and the Project Managers will inform the client. The laboratory affords clients cooperation to clarify requests and to monitor the laboratory's performance in relation to the work performed (while ensuring confidentiality to other clients). Differences between the request and the contract shall be resolved before laboratory activities commence.

7.1.2.1 Facilities. The facility must be suitable for the proper receipt and storage of the number and type of samples proposed to be accepted.

7.1.2.2 Resources.

7.1.2.2.1 Stipulated methods, sample preparations, final reports, data packages, and deliverables are reviewed to determine the availability of suitable instrumentation and personnel.

7.1.2.2.2 The laboratory must be capable of meeting all analytical requirements for the selected test methods. The specified requirements and methods must be adequately defined, documented, and understood.

7.1.2.2.3 The laboratory shall advise and obtain approval from the client before subcontracting work to another laboratory.

7.1.2.3 Contracts

7.1.2.3.1 The methods and procedures selected will be capable of meeting the customer's requirements.

7.1.2.3.2 The laboratory will inform the customer when the requested method is inappropriate or out of date.

7.1.2.3.3 Any differences between the request or tender and the contract shall be resolved before laboratory activities commence.

7.1.2.3.4 Each contract shall be acceptable to both the laboratory and customer.

7.1.2.3.5 Deviations requested by the customer shall not impact the integrity of the laboratory or the validity of results.

7.1.2.3.6 The customer shall be informed of any deviation from the contract.

7.1.2.3.7 If a contract is amended after work has commenced, amendments shall be communicated to all affected parties.

7.1.2.3.8 The laboratory shall cooperate with customers in clarifying requests and monitoring the laboratory's performance in relation to the work performed.

7.1.2.4 Records of Reviews

7.1.2.4.1 Records of Reviews including changes shall be retained.

7.1.2.4.2 Records shall also be retained of pertinent discussions relating to customer's requirements or laboratory activities.

7.1.3 Technical and Management Capability

7.1.3.1 The review of capability must establish that the laboratory possesses the necessary physical personnel, information, and resources to perform the tests in question. Additionally, the laboratory personnel must have the skills and expertise required for performing these tests.

7.1.3.2 The laboratory shall have adequate personnel at all times during the performance of analytical testing to ensure that clients receive data which meets the terms and conditions of the work agreement.

7.1.3.3 The review may consider the results of previous work of a similar nature or, where new testing is being implemented, the results of interlaboratory testing, trial tests, proficiency samples, MDL studies, etc.

7.1.4 Discrepancies

7.1.4.1 Any differences between the request or tender and the capability of the laboratory to fulfill the proposed work are resolved before any testing begins. (The Chain of Custody is used to verify discrepancies because it is a form of contract.)

7.1.4.2 Modifications are allowed upon consent of the client. Changes are documented in the contract prior to acceptance. Each contract shall be acceptable to both the laboratory and the client.

7.1.4.3 Problems encountered during any stage of reviewing the testing are addressed and resolved to the satisfaction of both the laboratory and the client.

7.1.5 Records

7.1.5.1 The laboratory maintains any records for the initial review of new work entering the laboratory, including any significant changes in the proposed work plan.

7.1.5.2 Communication logs (telephone calls, on-site visits, meetings, e-mails, etc.) are used to record all pertinent discussions concerning the client's requirements. Logs must include the date, time, brief details of the exchange, resolution of any complaints, and identification of the parties involved.

7.1.5.3 Subcontracted work is fully described and documented in advance of receipt of the work from the client.

7.1.6 Once work has been accepted, the Director of Project Management is responsible for setting up the client in the LIMS system, setting up an account with the client, and monitoring the project to ensure that all of the client's requirements are met.

7.2 Sample Receipt

7.2.1 The laboratory has defined protocols for receiving samples and for the "logging in" process. These protocols provide information to the analysts regarding requested analyses, holding times, types of preservation, matrices, etc.

7.2.2 Sample Acceptance Policy - The laboratory will accept or reject samples for analytical testing based on presence, absence, or resolution of the required criteria specified for labeling, preservation, documentation, identification, hold time, container type, or volume. If this information is missing or comes into question, a corrective action report will be started to address any nonconformances. Upon completion of the corrective action, it will be determined if the laboratory accepts the samples. Samples will be considered accepted upon final login review. Unaccepted samples will be noted in the project narrative if other samples received meet the requirements.

7.2.2.1 The laboratory sample acceptance policy outlines circumstances under which samples are

accepted and rejected. This policy is available to sample collection personnel and includes the following:

7.2.2.1.1 Documentation shall include sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any comments concerning the samples.

7.2.2.1.2 Client samples should be properly labeled with unique identification. Indelible ink should be used along with water resistant labels.

7.2.2.1.3 Sample containers should be suitable for the requested test and the analysis hold time must be adhered to. (See table 6-1 for Preservation, Hold Time, and Containers required.)

7.2.2.1.4 Sufficient sample volume must be available for the requested tests. If the client does not provide enough sample for all the tests, it will be noted on the sample receipt checklist. The project manager will contact the client to determine which tests the lab is to perform on the sample and whether or not the client will provide additional sample for other tests.

7.2.2.1.5 If samples show signs of damage, contamination or inadequate preservation, or any other concern, a corrective action must be initiated to determine if samples are acceptable for the requested analysis. Project managers with the assistance of the Director of Project Management, Technical Director, Quality Assurance Manager, or the Laboratory Manager address and close the corrective action by either accepting or rejecting the samples. (Corrective Actions and Nonconformances section 13.0)

7.2.3 Upon receipt, each sample is identified by a laboratory-issued project number and a unique individual sample number. Properly followed, the preceding procedures provide court defensible documentation related to sample release to the lab, proper preservation and handling, and traceability throughout the analytical and reporting process.

7.2.4 Samples usually arrive at the laboratory in one of three ways: 1) delivered by carrier (UPS, Federal Express, and Mail), 2) delivered by courier, or 3) delivered by client personnel. In all cases, a document called a "Chain of Custody" (COC) must accompany the samples. This document, supplied by the laboratory to clients, is designed to provide to the laboratory all the necessary information about the client, samples, and which analyses are required. In addition, this document provides evidentiary information indicating who had samples in their possession at any time and when possession was changed. In some instances, the client provides their own chain of custody

7.2.5 Once samples have been relinquished to the laboratory, they are checked for condition including the type(s) of preservation employed (temperature, pH, etc.), correctness of containers, and if the COC has been properly completed and signed.

7.2.5.1 Almost all soil and water matrix samples require a transport temperature of (0 - ≤6°C.) The samples should be packed in ice in a thermal container. Typically, an insulated ice cooler is used for sample transportation. The cooler should have a temperature blank included for use as a sample temperature check. The temperature blank is a plastic bottle filled with water.

7.2.5.1.1 Temperature is measured with a calibrated thermometer. The thermometer is individually identified and labeled with its calibration expiration date. The temperature of the blank must always be recorded during the login procedure. If the temperature is outside the 4 ± 2°C range, this should be annotated so that the project managers can notify the client.

7.2.5.1.2 Samples that are hand-delivered to the laboratory immediately after collection may not meet these temperature criteria. In these cases, the samples shall be considered acceptable there is evidence that the chilling process has begun (such as arrival on ice).

7.2.5.2 Before placement in the storage area, samples must be checked for integrity. If any bottles are broken or have leaked, the client must immediately be contacted. This is particularly important if there are no duplicates of the sample in order to obtain instructions from the client on how to handle the situation. It may be necessary to re-sample for the incomplete tests.

7.2.5.3 Sample labels are checked against the Chain of Custody for accuracy and discrepancies. Custody seals must be intact if used. This procedure is best accomplished by sorting samples by their location rather than by their testing requirements. For example, all samples labeled "MW-1A" are combined and may include VOCs, metals, SVOCs, etc. Make sure that all sample labels match the COC for number of analyses, sample ID, matrix, etc. If a discrepancy is found, the variance is noted on the Sample Receipt checklist and the client is contacted to clarify the problem.

7.2.5.4 Samples are checked for type and proper degree of preservation. This only applies to aqueous samples and never to volatile organic samples (VOC samples are checked after the vial has been opened and the sample analyzed). There are several types of preservation required for the different analyses. Most involve either a high or low pH.

7.2.5.4.1 To check the sample for pH, take a clean disposable Pasteur pipette and touch its tip to the top of the aqueous surface. Sample should be drawn by capillary action up the tube. Remove the pipette, recap the sample and touch the Pasteur pipette to some pH paper. Read the paper to the nearest pH unit.

7.2.5.4.2 Check the preservation chart (Section 6) to see if the pH is in the range required for the sample. If not, notify the Project Manager immediately. The Project Manager may require the addition of proper preservative to the sample. If the holding time is affected by inappropriate preservation, this should also be communicated to the client and analysts through the Project Manager.

7.2.5.5 Samples are checked for holding time. Holding times begin the moment the sample is taken, not when it is received. While most analyses have a holding time of several days, holding times vary widely from as little as 15 minutes to as long as 6 months. The time involved in shipment of a sample to the laboratory can greatly reduce the amount of time the analyst has to perform the procedure. It is therefore critical that holding times be noted accurately and the appropriate analyst or manager notified immediately if holding time is running out (less than 24 hours left).

7.2.5.6 Results of observations are noted on a "Sample Receipt Check List" at login.

7.2.5.7 If the COC matches the samples it represents, the sample custodian, through LIMS, will issue individual numbers for each sample received. These numbers are the project number followed by a single digit assigned to each bottle. This indicates that the samples are from the same site. For example, a group of samples is logged in as project "C8855". Each sample within the project is given a sequential number starting with the number "1". Thus, "C8855-1" is the first sample of this group.

7.2.5.7.1 The sample bottles are given a letter designator beginning with letter "A" that corresponds to each sample "fraction" received at the laboratory. For example, samples collected for metals and SVOC in two bottles would be designated as "A" and "B". The two sample bottles in the above example would be designated as "C8855-1A" and C8855-1B".

7.2.5.7.2 The assigned alphanumeric sample names are written on the COC, usually in the far right column, and on the sample label or top.

7.2.5.7.3 To ensure that sample identifiers remain intact, use an indelible ink pin, such as a

Sharpie™, when marking samples.

7.2.6 All samples are properly logged into the computer with all pertinent information, including any comments about improper preservation or holding times. This information is compiled into a spreadsheet called the "daily" and the information is distributed to the analysts. A folder is prepared with a cover sheet that gives the project number and lists the analyses needed. All information pertaining to the project is placed inside the folder including the COC, client contact information, and any special documentation.

7.2.7 Samples are then placed in the sample holding area, either in the appropriate cooler or on the correct shelf. If the project requires a continuous Chain of Custody, they must be logged out of the area by the analyst and logged back in when analysis is completed using the logbook provided. If the sample is completely exhausted, this must be noted in the logbook.

7.2.8 Any deviations must be brought to the attention of the client and/or the Project Manager so the client may be contacted for directions on how to proceed. For example, some samples may be unsuitable for testing if the temperature has not been maintained.

7.2.9 After all sample information is logged into the computer, a printout of the entered data is made. A second individual must verify the accuracy of the sample information entered. If the log-in, COC, and all sample information are approved, the checking individual initials the work and the project folder is given to the Project Manager.

7.2.10 Occasionally, samples require special storage times after the analyses are complete. This should be noted when these samples arrive at the laboratory to avoid them being prematurely discarded. To apprise all affected personnel, annotate this information into LIMS. These samples are to be stored in the special holding area designated by the Sample Receiving Department. A Project Manager will notify the Sample Receiving Department which samples are required to be placed in this area.

7.2.11 Sample bottles are segregated according to their required analyses. Samples analyzed for volatile organics are placed in a separate cooler/refrigerator from semi-volatile organics or inorganics because of the high probability of cross-contamination from inorganic and waste samples. Samples for metal analyses do not require cooling. These samples may be placed on the shelf at room temperature.

7.2.12 Once samples have been removed from a cooler, the cooler must be cleaned before reuse. Typically, rinsing and air drying of the cooler will be sufficient. Make sure to return clients' coolers.

7.3 Review of Sample Login

7.3.1 When samples (a project) arrive at the laboratory, a project is created in the laboratory information management system (LIMS) and reviewed by a project manager as discussed in the Section 7.3.3.

7.3.1.1 A "Review of Sample Login" report is filled out by the sample custodian and this report is turned in to the project manager. The project manager reviews the information to ensure that all analyses, sample IDs, etc. are correct.

7.3.1.2 If any problems were found, they are corrected. A copy of the problem and its resolution is transmitted to the Sample Receiving Manager.

7.3.2 Sample Receipt Checklist (SRCL)

7.3.2.1 The sample receipt checklist (Appendix VIII) is a list of all information pertaining to the arrival of a project at the laboratory. If any problems are found, such as errors on the chain-of-custody (COC), or any situation does not comply with the procedure or method, such as problems with sample preservation or holding time, the project manager is notified immediately in order to

contact the client. The following list represents the questions asked on the SRCL:

7.3.2.1.1 Was the shipping container/cooler in good condition?

7.3.2.1.2 If there were custody seals on the shipping container/cooler, were they intact?

7.3.2.1.3 If there were custody seals on the samples, were they intact?

7.3.2.1.4 Was the container/temperature blank in compliance?

7.3.2.1.5 Was the chain-of-custody present?

7.3.2.1.6 Was the chain-of-custody signed when relinquished and received?

7.3.2.1.7 Did the chain-of-custody agree with sample labels?

7.3.2.1.8 Were samples received in the appropriate containers to perform the requested analysis? If VOA vials were received, were all vials void of headspace?

7.3.2.1.9 Were all sample containers received intact?

7.3.2.1.10 Was sufficient sample volume received to perform requested analysis?

7.3.2.1.11 Were all samples received within the EPA recommended holding times and within the recommended temperature ranges?

7.3.2.1.12 Was turnaround time marked on the chain-of-custody?

7.3.2.1.13 If samples were submitted for volatiles analysis, did they have zero headspace?

7.3.2.1.14 Was the pH acceptable for water samples upon receipt?

7.3.2.1.15 Were samples in good condition?

7.3.2.1.16 Is a known blank included for diffusive samples or AIHA-LAP, LLC lead analysis?

7.3.2.2 All information at the top of the SRCL, such as client name, date/time received, and carrier name, must also be checked for accuracy. All out-of-compliance and non-conforming events are documented on the SRCL as well as in the PM non-conformance corrective action in LIMS. The client is contacted to discuss the issue or conflict. Resolution, as agreed upon by the client, is documented in the PM corrective action in LIMS and SRCL. Either the Director of Project Management or the Laboratory Manager closes out all corrective actions.

7.3.2.3 In addition, for Drinking Water samples associated with Waster Suppliers, the following Sample Information will be documented for samples where applicable and when available.

7.3.2.1.1 Name of System (PWSS identification number if available)

7.3.2.1.2 Sample Identification (if any)

7.3.2.1.3 Sample Site location

7.3.2.1.4 Sample Type (e.g. routine, repeat, raw or process)

7.3.2.1.5 Date and Time of collection

7.3.2.1.6 Analysis required

7.3.2.1.7 Disinfectant Residual (if available)

7.3.2.1.8 Name of sampler and organization (if not water system)

7.3.2.1.9 Sampler's Initials

7.3.2.1.10 Person(s) transporting sample from system to laboratory (If not sampler), if shipper used, shipping records available

7.3.2.1.11 Any remarks

7.3.3 Procedure for Creating and Reviewing Projects in LIMS

7.3.3.1 Open the project in LIMS and verify that the client name listed on the COC is the client selected in the LIMS. Check for any client related notes, such as "report samples on a dry-weight basis" or "provide final report in duplicate" in the "Client ID" field. Verify that this information has been passed on in the work order.

7.3.3.2 Check the project name and check for any project specific requirements in the project notes. Ensure that this information has been carried over into the work order.

7.3.3.3 Go to the "ReportOptions" screen and, if known, enter the state where the samples were collected. In the field "Rpt Name", select the proper reporting format. The preferred format is "AES base report". However, try to select the format that will reduce the overall size of the report, such as "base report consolidated". Unless the client has requested "J" flags, turn off the "Qualifiers" selection key.

7.3.3.4 Go to the "InvoiceInfo" screen. Enter the P.O. number if the client has provided one. If the client has pre-paid, enter this information into the "PrePaid" field and ensure that the accounting department has been informed. Enter any markups for rush fees. Enter into the "MiscCharges" field any sample media charges, courier fees, shipping charges or other expenses. Enter appropriate comments into the "MiscComments" field. The following information is entered into LIMS using the following format:

7.3.3.4.1 Rush Fees: Rush fees applied for same business day TAT.

7.3.3.4.2 Rush fees applied for next business day TAT.

7.3.3.4.3 Rush fees applied for two business day TAT.

7.3.3.4.4 Sample Media Charges: Current charges apply.

7.3.3.4.5 Shipping Fees: FED-EX shipping fees included.

7.3.3.4.6 Courier Fees: Courier fees included.

7.3.3.4.7 Sampling Fees: Sampling fees included.

7.3.3.5 Select the "LOGIN" key. Remove the COC from the folder. Systematically check each sample and fraction in the following order:

7.3.3.5.1 Verify the date and time received.

7.3.3.5.2 Verify the sample I.D. on the COC against the information that is entered into the LIMS.

7.3.3.5.3 Verify the sample description against what is entered for the tag number. If no sample description is given put "N/A" in the field.

7.3.3.5.4 Verify the date and time collected.

7.3.3.5.5 Verify the sample matrix.

7.3.3.5.6 Verify container type. Container type should match the type of container requested for the analysis. Any discrepancies should be noted on the SRCL.

7.3.3.5.7 Verify the number of containers.

7.3.3.5.8 Verify the storage area. This should be consistent with the appropriate storage location in the walk in cooler except for Volatiles/Metals/Oil & Grease and TPH samples which are stored in their corresponding laboratory.

7.3.3.5.9 Enter essential sample or analytical information into the sample comments field, such as "expect high concentrations", "perform 5x concentration", or "perform library search".

7.3.3.5.10 Verify that each sample and fraction is logged in for the requested analysis. This must be done independently of the above steps. Attempting to perform both tasks at the same time will only increase the probability of errors.

7.3.3.5.11 Expand the test field column so that the entire code for every analysis is visible.

7.3.3.5.12 Verify, one sample fraction at a time, that each of the appropriate test codes and their corresponding prep code are entered. If there is a test code that is missing a prep code, return to the project and pull the appropriate prep code. Add the prep code to the test field column. If the test code does not appear to have a prep code, inform the Director of Project Management.

7.3.3.5.13 For each test, check the selection list and ensure that the appropriate compounds have been chosen. Check every test.

7.3.3.5.14 If you are aware that a project requires specific detection limits, verify them at this time.

7.3.3.5.15 If air samples are received, click on the "Air Data" screen and verify the air volume in liters against what is listed on the COC.

7.3.3.5.15.1 If no sample volume is given, enter the sample flow rate in liters, change the units to L/min and enter the time sampled in hours and minutes. Hit the "Calc Air Unknowns" to calculate the volume.

7.3.3.5.16 Enter the media type and size. This information is found in the "tests" screen in the media field. If the media provided by the client is not the same media as listed in the method, inform the Director of Project Management immediately.

7.3.3.6 After the above information for all samples is complete, the work order is ready for approval.

7.3.3.7 Return to the main window of the work order.

7.3.3.8 Enter the date and time that you are approving the login review.

7.3.3.9 You will be prompted to enter your password. Enter your password and the work order will now appear in the "work to be completed" list.

7.4 A Corrective Action Report is generated in LIMS for any sample receiving non-conformance. Section 13 of this Manual describes the Corrective Action Process in detail.

7.5 Health and Safety

7.5.1 All samples should be considered to be hazardous. Until a sample is analyzed, it is impossible to determine what type of contamination is involved. With this in mind, always wear the following safety equipment when handling samples.

7.5.1.1 Safety Glasses: OSHA approved safety glasses must be worn when working with samples. Safety glasses prevent an invasion of the sample into the eye and protect the eyes in case of a sample explosion.

7.5.1.2 Latex Gloves: Latex Gloves must be used when handling samples. Latex gloves protect the hands from the effects of corrosive materials, such as strong acids or bases. In addition, gloves prevent the introduction of hazardous materials into the body by absorption through the skin.

7.5.1.3 Sensible Clothing: Long pants and close-toed shoes (no sandals) must be worn at all times while working in the sample receiving area. Many of the samples received by the laboratory are 1 liter or greater in size. A liter of water weighs slightly more than 2 pounds. Dropping a liter of water on an unprotected toe from waist height can fracture the toe. Never wear any clothing that you are not afraid to ruin. Many of the preservatives used in the laboratory are acidic and will eat a hole in most natural materials. If the fiber is man-made, such as nylon, any strong solvent will melt it.

7.5.1.4 Lab Coat: Required when in the laboratory or handling samples or chemicals. Not only does it protect your clothing, but it also provides an additional cloth barrier against splashes and spills.

7.6 Sample Custody

7.6.1 AES has implemented sample chain-of-custody procedures to provide accurate, verified, and traceable records of sample possession and handling, from sample container shipment through laboratory receipt and sample disposition.

7.6.2 Documentation of sample collection, shipment, laboratory receipt and custody is accomplished utilizing a chain-of-custody record. A sample is considered in custody if the following conditions have been met.

7.6.2.1 The sample(s) are in the physical possession of the sampler or courier.

7.6.2.2 The sample(s) are in view after being in the physical possession of the sampler or courier.

7.6.2.3 The cooler(s) or sample bottle(s) are sealed, so that sample integrity is maintained, while in the possession of the sampler or transferee.

7.6.2.4 The cooler(s) or sample bottle(s) are in a secured area restricted to authorized personnel.

7.6.3 Custody Record Maintenance

7.6.3.1 Laboratory records, including copies of the chain-of-custody forms and any associated documentation, are maintained in a secure area with any associated project records.

7.6.3.2 Laboratory data are recorded in bound notebooks and entries are made in waterproof ink.

7.6.3.3 Laboratory data entry errors are deleted with a single-line through the error. The correction is initialed and dated by the analytical staff member making the change.

7.6.3.3.1 Correction tape or other substances designed to obliterate documentation are strictly prohibited in the laboratory and custody areas.

7.6.3.4 Laboratory information is documented on prepared forms. All forms for recording laboratory data include a space for the date and for initials that must be completed by the data recorder. Laboratory documentation not recorded on pre-prepared forms is also dated and initialed.

7.6.4 The sample custodian, under either routine or special legal chain-of-custody procedures, receives all samples. Legal custody is a special type of sample custody in which all events associated with a specific sample are documented in writing.

7.6.5 Laboratory Provided Sample Containers

7.6.5.1 Sample containers provided by AES are manufactured from EPA-designated materials, contain EPA-prescribed preservatives, and are affixed with an AES identification label.

7.6.5.2 Pre-cleaned sample containers are purchased by AES. When deemed necessary by the Technical Director, containers from each lot are pre-certified in house prior to use. A lot number is affixed to each container for purpose of traceability.

7.6.6 Chain of Custody Documentation, Traceability, and Sample Integrity

7.6.6.1 Formal chain-of-custody procedures are initiated by a sample custodian responsible for the organization and relinquishing of sample containers to the client or field personnel.

7.6.6.2 Properly record all fields of information on the chain-of-custody form. Proper completion of the form is the responsibility of the client's field sampling manager and is required prior to relinquishing the samples.

7.6.6.3 If the site location is different from the client address, the site location is recorded in the "Project Name" space on the chain-of-custody form, or on the right hand side of the form if additional space is required. The sample identifications assigned in the field are recorded in the "Sample Identification" column.

7.6.6.4 Common carriers may identify themselves by signing the "Relinquished By" space on the chain-of-custody form.

7.6.6.5 Maintain chain-of-custody for samples transported from the field to the laboratory by common carrier. Completed custody forms must accompany each sealed cooler by placing them in a plastic bag taped to the inside lid of the cooler.

7.6.6.6 Maintain a copy of each air bill package tracking form associated with a shipment of samples in the appropriate client files.

7.6.6.7 The custody-technician is responsible for the inspection of shipping containers upon laboratory receipt for overall integrity to ensure that the contents have not been altered or tampered with during transit. If tampering is apparent, the sample custodian immediately contacts the assigned project manager who is responsible for notifying the client.

7.6.6.7.1 The cooler inspection form, filed by the sample custodian, describes the deficiency and annotates any corrective action required by the client. Document any appropriate changes on the accompanying project chain-of-custody form, which is dated and signed by the sample custodian or project manager.

7.6.6.8 If shipping containers arrive intact, the sample custodian in the receiving area immediately opens them. The chain-of-custody form and temperature bottle are removed for inspection. Upon receipt, the container temperature is documented in a sample registry or, if requested by the client, documented on the chain-of-custody form.

7.7 Continuous Chains of Custody

7.7.1 A "Continuous Chain of Custody" sets protocols for keeping an unbroken, or continuous, chain of custody. The intent of this procedure is to enable AES employees to track samples from the time and date of receipt to the time and date of disposal, particularly where legal cases are involved. In doing this, a constant record is kept of when and by whom samples are removed from the Sample Receiving Department. AES will use its standard Chain of Custody (CoC)internally as a "Continuous Chain of Custody" if requested by a client.

7.7.2 Project Managers will notify the Sample Receiving Department when jobs require this unbroken Chain of Custody.

7.7.3 A sequential laboratory identification number is assigned to the project and recorded on the chain-of-custody form, on each sample container submitted with the project, and in the Sample Registry.

7.7.3.1 Accurate and complete sample documentation must be provided on the chain-of-custody form in order to log samples into the sample registry. The sample registry includes all information necessary to maintain chain-of-custody including laboratory ID, client (field) ID, and initials of the sample receipt custodian.

7.7.3.2 Ancillary information, such as sample collection date and requested analyses, is transferred directly from the chain-of-custody form into the LIMS and appears on the client project-specific acknowledgement.

7.7.4 Once the chain of custody is verified, the project is logged into the LIMS to transfer the desired work order request to the laboratory.

7.7.4.1 The sample custodian checks the information on each sample's label against that on the chain-of-custody form for discrepancies.

7.7.4.2 The sample custodian also inspects all samples for leakage or obvious seal (if provided) tampering. All samples are unpacked in a well-ventilated sample receipt area.

7.7.4.3 Samples received in plastic containers, or those that appear to be accumulating or evolving gas, are treated cautiously and inspected under a chemical hood since they may contain toxic fumes or be of an explosive nature.

7.7.4.4 A "Cooler Receipt Form" is completed to document custodial concerns at sample login.

7.7.5 Custody discrepancies noted by the sample custodian are transmitted to the project and sample manager and are resolved with the client prior to laboratory work assignment. Discrepancies are documented on the Anomaly Report.

7.7.5.1 The Project Manager and the Sample Custodian attempt to resolve custody discrepancies expeditiously to avoid holding time compromises. After a decision concerning a sample has been made, the Project Manager or Sample Custodian makes an initialed note in the work order narrative. The person, who was notified, time, date, and resolution, if applicable, is documented. This information is also documented on the Sample Custody Excursion form.

7.7.5.2 A faxed or hard copy of custodial resolutions or project order alterations is secured from the client prior to work initiation. Copies of this documentation are mailed to the client and maintained in the client file.

7.7.6 After addition of the project sequential identification number, the samples are distributed to the appropriate sample storage areas. Sample storage temperature logs are maintained for all sample storage refrigerators to assure proper temperature maintenance throughout the analytical process.

7.7.7 As soon as possible, all samples received by AES are checked, by the appropriate preparation or analytical department, for proper pH adjustment. The pH of each sample is measured, documented, and adjusted if necessary. To avoid compromising sample integrity, volatile samples are checked for proper pH adjustment only at the time of analysis. The pH of volatile samples is not adjusted.

7.7.8 Only authorized personnel are permitted within the laboratory areas where sample access is possible. Sample storage areas are designed to segregate volatile and non-volatile samples. Standards and extracts are also departmentally controlled and stored separately.

7.7.9 The set of analyses required for a group of samples is project-dependent. After sample registry login and verification, samples are transferred from the receiving area to the appropriate sample preparation area. Those samples not requiring preparation are immediately sent to the sample analysis storage area. Using LIMS-generated sample preparation worksheets for guidance, samples are extracted, digested, or distilled as appropriate. The extracts, digestates, or distillates are then transferred to the appropriate analysis section, where analysis is performed.

7.7.10 For projects where the client requires in-laboratory custody records, the AES project manager informs the sample custodian that they need to coordinate custody activities prior to sample receipt. For these samples, staff complete department-specific in-laboratory sample tracking forms. Samples and sample preparations are stored in approved sample storage areas.

7.7.11 Sample holding times are tracked via the LIMS. Sample collection dates are routinely entered into the LIMS with all sample logins. This information allows holding times specific to each departmental analysis to be tracked by department managers, supervisors, chemists, and analysts through the use of daily status sheets, reference sheets, and preparation worksheets.

7.7.11.1 Date analyzed is recorded via instrument outputs as an integral part of the raw data.

7.7.11.2 The date of analysis is entered into the LIMS and compared to the date sampled to validate that holding times were not compromised.

7.7.12 Upon completion of analytical work, custody of unused sample portions, extracts, or digests is relinquished to a central secured storage area. Here the samples, digests, or extracts await disposal, which is performed with assistance of the LIMS. The LIMS stores client specific disposal instructions, compiles results from the analyses of composite samples, prepares sample disposal lists, invoices for disposal and sample return costs, and provides a disposal record for all excess samples.

7.7.13 By careful assignment of user passwords and file access/lock codes, AES maintains a high level of data security in the LIMS. Thus, only authorized AES personnel can access client files to view data. In addition, data entry and editing is restricted to highly trained data management personnel.

7.7.13.1 Data may be downloaded in a variety of standard formats including ASCII, spreadsheet, database, and text files, such as *.ASC, *.WK1, *.DBF, *.TXT, etc.

7.7.13.2 Additionally, laboratory data may be formatted to match client-specific requirements. These requirements are defined and agreed upon prior to project commencement.

7.7.13.3 Laboratory data is thoroughly reviewed prior to preparation of electronic or disc deliverables. The download process includes electronic and logical error check routines to confirm that the data files delivered are consistent with the client's format and data content needs.

7.7.13.4 A signed digitally signed electronic report is provided with diskette deliverables and an

electronic and documentation audit trail of each download event are maintained.

7.8 Data Security

7.8.1 Client information is confidential and should be protected during electronic storage and transmission of results. In order to ensure data integrity and security, all files selected for data downloads are transferred from the LIMS to an isolated PC computer system. Access to downloaded files is then controlled via required matches of employee log-on sequences and confidential passwords. The entire download process is regularly reviewed and maintained by the computer department for system performance.

7.8.2 The LIMS manager maintains internal documentation for all LIMS programs. This documentation includes descriptions of any program additions, deletions, or modifications, the dates of revisions, and the initials of the responsible programmer. To verify proper functioning of the program hardware and software, a simulation account is maintained. When hardware or software is modified, the LIMS uses actual data in the simulation account to verify that the modifications are functioning as anticipated. Anti-virus software serves as an additional protective measure.

7.8.3 Data is entered into the LIMS through direct instrument interfaces and manual entry of data from the chemists' worksheets. Immediately following data entry, approval sheets are printed with the entered data as it appears in the LIMS. Assistant project managers compare all data on the approval sheets against the chemists' worksheets for data transcription errors.

7.8.4 Data worksheets, data approval forms, and final reports are routinely printed for verification and signatures. Hard copies of final reports, field data, chain-of-custody forms, and any ancillary documentation pertinent to the project are kept in a secured storage area and placed chronologically within alphabetically arranged client files.

7.8.5 AES maintains a security policy. Under this policy, all external doors are either visually monitored by AES staff or kept locked. Visitors are required to sign in. They are accompanied at all times by an AES staff member.

7.9 Container Receipt

7.9.1 When the laboratory receives containers, they are entered into the Received Container Logbook. An AES ID Container number unique to that case of containers is issued. Contamination is checked for in containers that do not include a Certificate of Quality Environmental Compliance.

7.9.2 The following is a step-by-step guide for entering all information associated with the container:

7.9.2.1 A unique AES ID # is given to each box of containers. This number is given in numerical sequence by adding one to the previous number.

7.9.2.2 Under "Container Description", enter a brief description of the bottle type. Include: bottle size, plastic or glass, clear or amber, preservatives, and pre-cleaned, if noted.

7.9.2.3 Enter the date that the containers were received at the laboratory in the "Date Received" box.

7.9.2.4 Under "Vendor Name", enter the name of the vendor that the containers were ordered from. The sample-receiving manager has this information.

7.9.2.5 Enter the vendor lot number under the "Vendor Lot #" box. This number is found on a vendor provided label on the outside of each case of bottles.

7.9.2.6 Under "Date Expires", enter the date that the containers will expire. This date will be one year after the containers were received at the laboratory, unless otherwise stated by the manufacturer.

7.9.2.7 Enter the number of containers in each case under the "No. of Containers in Lot" box. This information is found on a vendor provided label on the outside of each case of bottles.

7.9.2.8 A Certificate of Quality Environmental Compliance is found inside of each box of glass containers. This information is filed in the sample-receiving department. All plastic containers will be checked for contamination in each new lot that is received by the laboratory. The AES lab number will be written in the "Contamination check OK" box. The information for the contamination check will be found in the LIMS system.

7.9.2.9 Enter the initials of the person that received the containers in the "Initials" box.

7.9.2.10 After each case of containers has been properly entered into the Received Container Logbook, the AES ID # and the expiration date should be written clearly on each case of containers in permanent ink. The containers should then be placed in the for use bottle storage area.

7.9.3 A logbook of records shall be kept in the sample-receiving department. It should be checked periodically by the sample receiving department manager to ensure that it is properly maintained.

7.10 Subcontracting to Other Laboratories

7.10.1 Subcontract Laboratories

All subcontract laboratories are required to supply the Quality Assurance Manager, upon written request, with adequate proof of accreditation in applicable state, AIHA-LAP, LLC, TNI, or other programs, depending upon the client and origination of the samples. Documents shall be requested from all subcontract laboratories. The requested documents will include, but may not be limited to, a current Quality Assurance Manual, the scope of approved testing, proof of insurance, and AIHA-LAP, LLC, TNI and/or other applicable state accrediting authority certificates.

7.10.1.1 A list of subcontract laboratories can be found in Attachment 7.

7.10.2 Protocol for subcontracting work received at the laboratory to another facility.

7.10.2.1 When samples are received which have testing requirements that cannot be performed in-house, the samples must be sub-contracted to another laboratory. The laboratory will advise the client that samples will be subcontracted via email to get approval. The laboratory is responsible to the customer for the subcontractor's work in that due diligence shall be done to confirm the subcontractor is accredited by AIHA-LAP, LLC (or the appropriate regulatory authority) for the parameters that will be performed and the laboratory shall retain records demonstrating that this requirement was met.

7.10.2.2 The sample-receiving department prepares an aliquot and a chain-of-custody to send the sample(s) to the sub-contracted facility. This chain-of-custody will be submitted to the sub-contract facility. All information, including project name, project number, sample ID, collection date, collection time and analysis must be included on the COC. The project manager must review the chain-of-custody before the sample is sent out. Also, a purchase order number must be obtained from the accounting department and placed with the COC.

7.10.2.3 If the client did not provide sufficient sample to send out, the sample must be split. See the procedure for splitting samples to correctly obtain a representative portion of the sample contained within individual standard operating procedures (SOPs).

7.10.2.4 The client must be contacted in writing of the intent to subtract any portion of the testing to another party. The results from the subcontracted laboratory must be reported utilizing a copy of the original report received from the subcontract laboratory.

7.10.2.5 The project is entered into the LIMS system in the Sample Login Procedure with a note in the

comment section "SUB OUT."

7.10.2.6 Fill out a FedEx label with the name, address, and phone number of the subcontracting facility, and all the necessary information for the shipper. Prepare a cooler with packing material to ensure that the containers will arrive at the facility unbroken and in a condition that meets the method requirements.

7.11 Purchasing Services and Supplies

7.11.1 Procurement Document Control
Vendors of analytical supplies to AES Inc. are regarded as a resource to and an extension of the laboratory. Standards for quality identified in this document shall be applicable to vendors.

7.11.2 The purpose of the procurement control document is to assure the quality and traceability of procured items (equipment, materials, or services) in instances in which the specifications could affect the quality of the services provided by AES, Inc. This includes such quality related items as the calibration of instruments by outside laboratories, purchase of standards, subcontracted services, and materials requiring testing before use.

7.11.3 Control of purchased materials, equipment, and services is a system designed to insure products and services conform to the procurement requirements. This system includes provisions for vendor evaluation and selection, objective evidence of quality furnished by the vendor, and examination of products or services upon delivery. Prior to the use of such products and services, documented evidence of conformation to the procurement requirements must be provided. This evidence is maintained in the analytical department office records.

7.11.4 It is the responsibility of the Accounting Department to insure the development and implementation of procedures to control purchased products and services. It is the responsibility of the purchasing agent to specify quality objectives for procured items and services. Purchased materials that fail to meet established criteria are documented by Non-conformance reports issued by the purchaser.

7.11.5 Procedures and Responsibilities

7.11.5.1 It is the responsibility of the purchasing agent to provide assurance, when required, that all applicable regulatory requirements, industry codes, and standards appear with the purchase documentation for the affected services and products.

7.11.5.2 The Purchasing Department retains Purchase Orders for control purposes.

7.11.5.3 Purchased items which do not meet the minimum standards set forth by the purchasing agent are processed according to procedures set forth in Section 13.0, "Corrective Action."

7.11.5.4 The appropriate manager or supervisor and QA Manager review purchase orders to ensure that quality related services or products meet the criteria of the laboratory's accreditations.

7.11.5.5 Purchase orders for standard catalog items do not require QA review unless they include thermometers, thermistors, hydrometers, pipettors, or analytical balance weights.

7.11.5.6 Where possible, reference materials (such as calibration standards) are purchased from a supplier that conforms to ISO Guide 34 in combination with ISO/IEC 17025, accreditation by an ILAC recognized signatory. External Calibration services shall, wherever possible, be obtained from providers accredited to ISO/IEC 17025 by an ILAC recognized signatory.

8.0 ANALYTICAL PROCEDURES

8.1 Method Sources and supporting procedures include the following:

8.1.1 Analytical methods used are currently accepted and approved by the US EPA, NIOSH, and "Standard Methods".

8.1.2 Other reference procedures for non-routine analyses including methods stipulated by specific states, such as Underground Storage Tank methods, or by ASTM.

8.1.3 Appendix XI includes the list of controlled outside reference documents maintained by AES. Control and updating of the reference document is completed annually by the Technical Director. Electronic document updates or web links to current revisions are posted to the laboratory portal server library, and Appendix XI is updated with the annual update to the QA Manual.

8.1.4 The laboratory has a procedure (for the AIHA-LAP, LLC program) in the form of a Standard Operating Procedure (SOP) for the validation of methods in the event a laboratory designed method or a non-standard method is used.

8.1.5 Laboratory Standard Operating Procedures (SOPs) are located on the company's intranet archival system, commonly referred to as the "portal server". These procedures contain the description of the preparation, calibration, analysis and/or verification test procedures.

8.2 Document Control. This section describes the procedures for control and maintenance of documentation through a document control system, which ensures that standard operating procedures, manuals, and reference documents clearly indicate the time period during which the procedure or document was in force. Regardless of which analytical procedures are used in the laboratory, the methodology shall consist of carefully documented Standard Operating Procedures (SOPs) and approved methods which may be periodically modified, updated or replaced entirely due to advances in technology or changes in regulatory protocols. Some clients may require pre-approval of method revisions before modifications are used to generate data. Documentation of analytical procedures for generating laboratory data shall be clear, concise, adequately referenced, and reflect the actual steps employed by the analyst.

8.2.1 Procedures
Methodologies employed in the laboratory are documented by the creation of an SOP. This document provides the analyst with the information necessary to perform the analysis. Every SOP is created in accordance with this QA document. It follows the intent of the method it is patterned after, but provides any additional information essential to the specific instrument instructions, specific quality concerns, etc.

8.2.1.1 If an SOP is not available for a specific analysis, the analyst will follow EPA, Standard Methods, NIOSH, or other regulatory methodology as required. Deviations are not allowed.

8.2.1.2 Before a new method is accepted for routine use, adequate performance must be demonstrated. This includes an MDL study, IDOC, and related QA/QC procedures as required by the method.

8.2.1.3 Appropriate management personnel evaluate the merits of all new methods and recommend approval or rejection based on the available data. This committee includes, at a minimum, the Laboratory Manager and Technical Director. If the method is approved, a Standard Operating Procedure is created and the procedure is implemented.

8.2.1.4 All analytical procedures must provide documentation so that the complete process used to produce data can be reconstructed.

8.2.1.5 All deviations from an approved analytical procedure are authorized and documented by the Technical Director.

8.2.2 All changes to an approved procedure require, at a minimum, an Interim Change Notice. A complete revision and re-issuance of the SOP may be required. SOPs are reviewed at least annually.

8.2.3 A list of all current SOPs including their review and revision status is maintained electronically on AES_server\L\Current SOP\SOP Masterlist. Current SOPs are maintained electronically on the AES Portal Server in the Technical Management folder. All controlled documents are in "Read Only" format and password protected. The Vice-President of Operations, QA Manager, Technical Director and their appointees are the only laboratory employees with edit access to these folders. In addition, a master list of controlled documents is maintained for documents other than SOPs. This includes various forms, software, references, etc. It is located at AES_server\L\Current SOP\ Documents_Master_List_Non-SOPs.

8.3. Instructions and Procedures

It is the policy of AES Inc. that all analyses and operations are performed using approved written procedures which are to be available to the personnel conducting the analysis /operation. The procedures assume one of two general formats. These formats are "Temporary Procedures" and "Standard Operating Procedures."

8.3.1 Temporary procedures are designed to accommodate the transition from a developing analytical service or method to an established procedure in the most efficient manner. They are less than formal procedures but are adequate to document the procedural treatment of samples. Effective dates and expiration dates are documented. Temporary Procedures, approved by a manager and the Technical Director, can be handwritten procedures and contain at a minimum the following information:

8.3.1.1 Health and safety requirements to perform procedure (if necessary).

8.3.1.2 Actual analytical method (step by step).

8.3.1.3 Materials list (if necessary).

8.3.1.4 Reagents (if necessary).

8.3.1.5 Calculations needed to perform procedure.

8.3.1.6 Reference sources from which procedure was developed.

8.3.2 Standard Operating Procedures (SOPs) are a formal treatment of an analytical or administrative procedure. Analytical SOPs shall be generated using nationally recognized procedures and incorporate AES, Inc., operations and instrumentation. The SOPs are revised as required by the appropriate Managers and are reviewed and authorized for continued use at least annually. Analytical SOPs contain the following information:

8.3.2.1 Title, issue date and revision number

8.3.2.2 Approval signatures

8.3.2.4 Sample preparation, handling, storage and disposal

8.3.2.5 Definitions

8.3.2.6 Responsibilities

8.3.2.7 Hazards and safety requirements

8.3.2.8 Materials and equipment

8.3.2.9 Standardization and calibration requirements

8.3.2.10 QC sample frequency and performance criteria

8.3.2.11 Operating instructions

8.3.2.12 Example calculations and data sheets

8.3.2.13 References

8.3.3 Administrative Procedures contain the following sections

8.3.3.1 Contents Page

8.3.3.2 Purpose and scope paragraphs

8.3.3.3 Text

8.3.4 Emergency procedures are divided into three sections:

8.3.4.1 Symptoms

8.3.4.2 Immediate actions

8.3.4.3 Subsequent actions

8.3.5 Amendments of Documents by Hand:

8.3.5.1 SOPs are only amended via a permanent or temporary Interim Change Notice (ICN).

8.3.5.2 Spreadsheets, checklists, logbooks, and other documents that are templates which are filled in with data may be amended by a department manager, technical director, QA manager, or laboratory manager's approval. The manager/director should write the change on the document, then initial or sign and date the document.

8.4 Electronic Document Control

The laboratory SOPs are maintained electronically by the Technical Director through the electronic document control system. Hard copy signed originals of the procedures are Maintained by the Technical Director or appointee. Any staff member may request revision to the procedures.

8.5 Creating and Maintaining Standard Operating Procedures

"Standard Operating Procedures" describes the system for preparation, issue, implementation, and revision of formal Standard Operating Procedures for Analytical Environmental Services, Inc. Standard Operating Procedures are defined as written procedures for personnel to perform analyses, technical operations, tests, processes, administrative operations and tasks, or inspection of samples submitted to Analytical Environmental Services, Inc.

8.5.1 Procedures are tracked, issued, revised, and filed.

8.6 Responsibilities

All technical and administrative staff is familiar with the requirements of this procedure and is responsible for its implementation. To ensure uniform and accurate procedures, the following personnel are assigned with the stated responsibilities:

8.6.1 SOP Author - The Author, when writing SOPs ensures the following:

8.6.1.1 The SOP meets applicable regulatory requirements.

8.6.1.2 The SOP includes the actual instruments and materials associated with AES, Inc.

8.6.1.3 The SOP follows the requirements of the published standard method(s).

8.6.1.4 The SOP conforms to guidelines established in this document.

8.6.1.5 The SOP meets the applicable requirements of the laboratory's QA Manual.

8.6.1.6 That he responds to reviewer(s) comments in a timely manner.

8.6.2 Section Supervisor - The Section Leader is responsible for the following:

8.6.2.1 Review all new SOPs originating within their section.

8.6.2.2 Ensure the personnel in their department are aware of the SOP and understand their responsibility pertaining to the SOP.

8.6.3 Technical Director - The Technical Director is responsible for the following:

8.6.3.1 If a new SOP needs to be created, the Technical Director may assign the task of drafting SOPs to qualified individuals who possess the requisite experience and good communication/writing skills. The Technical Director may elect to write the SOP.

8.6.3.2 Ensures SOPs are in compliance with current regulations and established methods.

8.6.3.3 Reviews and approves all SOPs.

8.6.3.4 With the assistance of the QA Manager, maintains the SOP development, review, approval, and distribution system as stated in this procedure.

8.6.3.5 With the assistance of the QA Manager, maintains a protected archive of old SOP versions and current versions (controlled document system) for obsolete SOPs.

8.6.4 Laboratory Manager - the Laboratory is responsible for the following

8.6.4.1 Ensures that all sample analyses requested by the client have a current SOP. If a current SOP does not exist, the Laboratory Manager shall initiate a procedure for creation of an SOP.

8.6.5 QA Manager - the Quality Assurance Manager is responsible for the following:

8.6.5.1 With the assistance of the Technical Director, assists in SOP development, review, approval, and distribution system as stated in this procedure.

8.6.5.2 Ensures SOPs are in compliance with current regulations and established methods.

8.7 Definitions

8.7.1 Interim Change Notice (ICN) - A document accompanying any SOP or manual as a mandatory change, but is not included in the original text of the manual or SOP until the next revision.

8.7.2 Controlled Copy - A copy of an AES Document or SOP that is updated when revisions are issued. All controlled documents are electronic files.

8.7.3 Uncontrolled Copy - A printed copy that is labeled "uncontrolled" and is not updated when revisions are issued.

8.7.4 Technical SOPs - Any SOP that directly addresses the laboratory analysis procedure.

8.7.5 Non-Technical SOP - Any SOP that is used at AES but does not directly address the laboratory

analysis procedures. Examples are QA SOPs, QC SOPs, Project Management SOPs, and Administrative SOPs.

8.8 New Procedure Initiation

8.8.1 Immediate Procedure Initiation

A Temporary SOP should be written when the laboratory receives projects which have requests for analytical procedures that do not have an SOP and the staff feels that the laboratory can perform the requested test procedure in-house.

8.8.2 Planned Procedure Initiation

The department manager/section supervisor, the Laboratory Manager, and the Technical Director determine the need for a new SOP.

8.8.3 As part of the New Procedure Request Form, the QA Manager and the Technical Director complete the following:

8.8.3.1 The Technical Director assigns the appropriate SOP number.

8.8.3.2 The Technical Director completes a Draft SOP or assigns an alternate author.

8.8.3.3 The draft SOP is forwarded to the affected laboratory personnel for review (see Section 8.11). The draft includes all of the text, tables, and attachments formatted as outlined in this SOP.

8.8.3.4 After review by the affected personnel, the Technical Director finalizes the SOP. A hard copy of the SOP is produced for signature and placed into a folder in the QA Managers office. Controlled electronic copies are made available to laboratory staff in "Read Only" format on the AES Server and Portal Server.

8.9 Standard Operating Procedure Formatting

8.9.1 Title Page

8.9.1.1 Standard Operating Procedure Title Page Format. (Every procedure is preceded by the Procedure Title sheet. See Attachment 2).

8.9.1.2 Title - The procedure is given a concise, descriptive title. When appropriate, Operational Procedure titles should include the parameter(s) analyzed, sample type, method (if applicable), and analysis technique description (e.g., "Fluoride in Water by Ion Selective Electrode, based on EPA Method 353.3").

8.9.2 Comments - This section includes any reasons for revisions and additional comments as necessary.

8.9.3 Approval Signatures

8.9.4 Header

8.9.4.1 All SOPs have the following header on each page:

AES, Inc.	SOP No:	XX - #####
3785 Presidential Pkwy	Date Initiated:	MM / YY
	Date Revised:	MM / YY
Atlanta, GA. 30340	Revision No:	#
	Page No:	## of ##

8.9.4.3 The following header fonts are used:

	Font	Font Size
AES, Inc.	Times New Roman – Bold	12
Address	Times New Roman	8
SOP No, etc	Times New Roman	9

8.9.4.4 Each procedure is uniquely identified by a five digit number preceded by one of the following identifiers to indicate the type of procedure:

Identifier	SOP Type	# Assignments
QA	Quality Assurance	01000 – 01999
AD	Administrative	02000 – 02999
HS	Health & Safety	03000 – 03999
EM	Emergency	04000 – 04999
QC	Quality Control	05000 - 05999
PM	Project Management	06000 – 06999
GL	General Laboratory	08000 – 08999
SR	Sample Receiving	09000 – 09999
OA	Organic Analytical	11000 – 11999
IA	Inorganic/Metal Analytical	13000 – 13999
LP	Leaching Procedure	14000 – 14999
MB	Microbiology	15000 – 15999
ABS	Asbestos	01000 - 01999
WM	Waste Management	17000 - 17999

8.9.4.5 Revision - The first issue of a procedure is not assigned a revision number. It is assigned an "N/A" entry. As revisions are made to the procedure, the revision number is increased sequentially starting with Revision 1 (one).

8.9.4.6 Effective Date - The date when the procedure becomes effective. Use following format: 12/97.

8.9.4.7 Revision Date - The date that the current revision became effective. Use the following format: 12/97.

8.9.4.8 Number of Pages - The correct form for this is, Page No.: x of y. Example the fifth page of a 24 page document would be formatted as: Page No.: 5 of 24.

8.10 Table of Contents

Section and sub-sections are listed in the Table of Contents using the font in the body of the SOP. See Attachment 5 for an example of an SOP. In addition, all Tables and Attachments are included in the Table of Contents.

8.10.1 Each Manual has a Table of Contents that includes the following information: SOP document number(s), name(s) of the SOP, date(s), revision number(s), and associated Method Number. When SOPs are revised, this list is edited to reflect the changes.

8.10.1.1 The Title of each SOP is Centered, All Capital letters, and in Boldface type on the Table of Contents page.

8.10.2 SOP Body - Technical Procedures.

8.10.2.1 All procedures are formatted using this section numbering system:

1.0 SECTION
1.1 Sub-Section
1.1.1 Sub-Sub-Section
1.1.1.1 Sub – Sub – Sub – Section
2.0 SECTION

8.10.2.2 To keep all the SOPs uniform, use Times New Roman, Font Size 12 for the document.

8.10.2.3 Each Section is underlined and all capital letters.

8.10.3 All Technical SOPs include the following sections in the same order:

TABLE 8-1 Technical SOPs

Section Number – Title	Purpose	Required Information
1.0 SCOPE AND APPLICATION	- Describes what the method does - Describes the matrices to which a method applies. -May also describe when the method is to be employed.	1. All matrices which may be analyzed using the method. 2. Analytes the method is capable of quantifying. 3. Quantitation range of analytes. 4. Reference to sample
2.0 SUMMARY OF METHOD	Provides a brief description of the procedure or method and the type of chemistry / instrumentation employed by the laboratory in performing the method.	
3.0 INTERFERENCES	List most common interferences which affect performance of the method. For preparative methods, include interferences which affect the sample analysis.	
4.0 SAMPLE COLLECTION, PRESERVATION , AND HOLDING TIMES	List preservation, storage, and holding time requirements for each matrix listed in Section 1.0.	1. Preservatives 2. Holding Times 3. Acceptable container types.
5.0 REAGENTS AND STANDARDS	List all reagents and standards.	1. Purity of reagents. 2. All concentrations of reagents and standards required. 3. Detailed preparation instructions for each reagent and standard to include initial concentration(s), aliquot volume(s) or weight(s), final volume, final concentration(s), and expiration dates. 4. Listing of the Vendor(s) used to purchase the reagent including the catalog number, vendor address, and telephone number.
6.0 APPARATUS AND MATERIALS	List all apparatus, materials, and equipment, inclusive of data collection and reduction systems.	List make and models or equivalents that might be used in the laboratory
7.0 PROCEDURE	1. This section defines the analytical procedure from start to finish. 2. Address QA/QC requirements when they are appropriate in the overall sequence of activities. 3. Addresses specific record keeping requirements (i.e. when and where to	Includes at a minimum: 1. Instrument set-up and conditions. 2. Calculations of retention times if applicable. 3. Initial calibrations. 4. Continuing calibrations 5. Analysis sequence, including QC

	record specific information in run logs and other required laboratory documentation). 4. Includes the handling and disposal of waste when appropriate in the overall sequence of activities. 5. Calculations are included in the text where applicable following the example of SW-846 methods.	requirements. 6. Calculations – inclusive of conversions for solids. 7. Units required for reporting.
8.0 QUALITY ASSURANCE REQUIREMENTS	Defines additional QA requirements which must be met in addition to all criteria previously listed in the SOP.	Includes a minimum: 1. Blank requirements. 2. Laboratory Control Sample (LCS) requirements. 3. Matrix spike requirements 4. Matrix spikes duplicate or sample duplicate requirements. 5. Any method specific requirements (e.g. MSA for GFAA metals, surrogates for GC/MS procedures, tracers for alpha spectroscopy methods). 6. Corrective actions required when requirements are not met. 7. Frequency of QC samples
9.0 HEALTH AND SAFETY	Details specific health and safety requirements for the method and references any general health and safety requirements which may apply.	1. Protective clothing required. 2. Special hazards associated with chemicals or equipment used in the procedure. 3. Storage and / or disposal of all sample extracts and chemicals used.
10.0 DATA REPORTING	Defines the method for data reporting by the staff to clients.	Includes a minimum: 1. Reporting limits in LIMS. 2. Rounding of data.
11.0 FILE MAINTENANCE	Defines the procedures for data transfer and archiving of data for long term storage.	1. Frequency of data transfer from local computer to server. 2. Method used to transfer data to server. 3. Data storage requirements
12.0 INSTRUMENT MAINTENANCE	Defines the procedures for routine instrument maintenance and entry into logbooks.	
13.0 METHOD PERFORMANCE	Describes the acceptance criteria published in the method.	1. Spike, duplicate precision and accuracy.
14.0 POLLUTION MANAGEMENT	Describes the procedures required to dispose of hazardous wastes.	1. Waste disposal from received samples. 2. Waste disposal from laboratory generated wastes. 3. Required forms to be completed.
15.0 DEFINITIONS	Provides a definition for terms that are used in the SOP.	

16.0 REFERENCES	Provides the source(s) of the information from which the SOP was derived.	
17.0 VALIDATION DATA	Provides the location of information for method validation data.	

Note: The author may add any subsections that are necessary and do not fit in any of the above categories.

8.10.4 Copies of any forms or logbook pages used in conjunction with the SOP and unique to the SOP are attached as Tables or Attachments and sequentially numbered and referenced in the body of the SOP.

8.11 SOP Body - Non - Technical (Administrative)

8.11.1 See Sections 8.10 and 8.11

8.11.2 The author may add any subsections that are necessary.

8.11.3 Copies of any forms or logbook pages used in conjunction with and unique to the SOP are attached as Tables or Attachments, sequentially numbered, and referenced in the body of the SOP.

8.11.4 SOP Body - Immediate SOP (See section 8.8.6 for the definition of "Immediate SOP").

8.11.5 Copy the Regulatory Method

8.11.6 Attach a procedure title sheet

8.11.7 Complete the following sections: 1.0 Health and Safety, 2.0 Reagents and Supplies, and 3.0 Step by Step Procedure. If these sections are included in the regulatory method, the following note can be included under each section: "See Regulatory Method attached section_____".

8.11.8 This is forwarded to the QA Manager who then initiates a new procedure, as described in 8.2.3.

8.12 Procedure Review And Revision

Procedures undergo periodic review and are updated whenever regulatory, programmatic requirements or internal process change.

8.13 Technical Review

8.13.1 A technical review of the draft SOP is performed by affected laboratory personnel and addresses the following items:

8.13.1.1 Does the SOP comply with the technical requirements of the regulatory agency (EPA, USACE, etc.) method?

8.13.1.2 Does the SOP state the step by step procedure of how AES completes the procedure?

8.13.1.3 Does the procedure formatting follow the procedures outlined in this section?

8.13.2 Comments are written directly on the Draft SOP or on another sheet of paper if needed.

8.13.3 The reviewer(s) discuss comments with the Technical Director and arrive at a finalized document.

8.13.4 The Technical Director makes the necessary changes electronically. The changes include any Interim Change Notices (ICNs) that have been generated for the SOP and are incorporated as stated in the ICN. The electronic copy is stored in the server in the appropriate year labeled folder.

8.13.5 The reviewed SOP is printed and all approval signatures are obtained on the original hard copy.

8.13.6 The approved SOP is electronically placed in the "Current Revisions" folder by the Technical Director. All employees have access to these files in a "read only" format.

8.13.7 SOP Acknowledgement forms (Attachment 1) are distributed to all area supervisors to distribute to all employees who will be using the procedure.

8.13.8 Employees using the new procedure sign SOP Acknowledgement forms and return them to their Supervisor who forwards them to the Technical Director for final approval and scanning.

8.14 Procedure Changes

8.14.1 Analysts, supervisors, or management have the ability to request changes to procedures as part of the continuing procedure maintenance using the "Interim Change Notice" (ICN) form (See Attachment 4).

8.14.2 To complete an ICN, make the required changes to a copy of each affected procedure page. Revise and edit these copies using appropriate standard editor's marks and symbols.

8.14.3 The employee requesting the change ensures the department manager signs the ICN and forwards the ICN to the Technical Director.

8.14.4 The Technical Director signs the ICN, supplies a copy to each applicable department supervisor, ensures that a copy is placed in the controlled SOP folders (see section 8.2), and files it with the controlled QA SOP files.

8.15 Standard Operating Procedures Electronic Document Control Process

8.15.1 All controlled documents are electronic files which are password protected and managed by the Technical Director or designee.

8.15.2 All laboratory personnel have access to a controlled, electronic copy of the SOPs applicable to their job description.

8.15.3 Only uncontrolled documents are issued to clients.

8.15.4 The electronic document control files are arranged such that laboratory personnel have access to only current revisions of controlled documents. All archived revisions, draft procedures, etc. are accessible only to authorized QA or Technical Direction personnel via password access.

8.16 Uncontrolled copies of Standard Operating Procedures are printed, working copies of the documents, and in that regard, are not monitored or tracked.

8.17 Procedure Archive

The Technical Director is responsible for archiving any procedures that are no longer used at AES.

8.17.1 Historic hardcopies of SOPs not in use are kept in the Technical Director's office. For SOPs associated with AIHA-LAP, LLC accreditation, the documents are marked "Void" so it is clear they are not in use.

8.17.2 Retired electronic SOPs related to the AIHA-LAP, LLC are marked as "Obsolete" via a watermark. All electronic SOPs are moved by the Technical Director to the designated archive directory.

8.17.3 The Technical Director removes the folder from the "active" files and places it in the archived files.

8.18 Temporary Change

Temporary changes to an SOP may be required for the following reasons: a sample matrix does not permit the SOP steps to be followed as written, or if a client desires a change to an SOP that is currently in use at AES.

8.18.1 The Temporary Change Notice is completed and approved prior to the use of a revised procedure. See Attachment 4.

Attachment 1

QUALITY ASSURANCE MANUAL
STANDARD OPERATING PROCEDURE
ACKNOWLEDGEMENT

Name (Printed): _____

SOP Title: Quality Assurance Manual

SOP Number: QA-01000 Rev. No. 25

The laboratory analyst signature on this approved SOP signifies the following: The analyst has read the SOP in its entirety and has read the analytical methods referenced in the SOP.

The analyst understands that the SOP is to be followed explicitly. Any deviation from the SOP must be noted in writing. Furthermore, the deviation from the SOP must be approved in writing by the laboratory supervisor and the QA staff prior to the analyst's adoption of the deviation from the SOP.

The controlled electronic copy of this SOP is located on the portal server at: Documents: Quality Assurance: QA Manuals: QA Manual: 2020_QA_Manual_Rev_25.pdf. If a hard copy is desired, you may request one from the Supervisor.

Do not make a copy or print out the QA Manual yourself. Printed copies are uncontrolled documents.

Print Name: _____ Date: _____

Analyst's Signature: _____ Date: _____

Department Manager Signature: _____ Date: _____

Technical Director's Signature: _____ Date: _____

Attachment 2
Example SOP Title Page

APPROVAL OF ATTACHED DOCUMENT FOR IMPLEMENTATION

NOTE: THIS IS A CONTROLLED ELECTRONIC DOCUMENT

PRINTED COPIES OF THIS DOCUMENT ARE UNCONTROLLED

ORIGINAL SIGNED DOCUMENT RESIDES IN AES QA OFFICE

DOCUMENT TITLE: STANDARD OPERATING PROCEDURES FOR FILTERABLE RESIDUE (TDS) BY SM2540C

DOCUMENT CONTROL NUMBER: Rev. 9

DOCUMENT DISTRIBUTION NUMBER: GL-08078

ELECTRONIC DOCUMENT LOCATION
AES Portal Server: http://Procedures/Standard Operating Procedures

The attached Document has been reviewed by the individuals listed below. By signature, each of these individuals acknowledges that the document is ready for distribution, in a controlled manner, to all responsible parties for use and/or reference.

By definition, a "Controlled Copy" of a document cannot be changed without review and approval by designated members of management. At no time may a "controlled copy" be written on or otherwise defaced with notes or other unauthorized additions.

If an uncontrolled copy of this document is desired, please see the Quality Assurance or Laboratory Manager. They will issue you an uncontrolled copy. DO NOT MAKE THE COPY YOURSELF.

By signature below the following employees of Analytical Environmental Services, Inc. have approved this document for distribution.

Technical Director: Date:

Laboratory Manager: Date:

Quality Assurance Manager: Date:

Department Supervisor: Date:

Attachment 3

Example SOP

STANDARD OPERATING PROCEDURES FOR FILTERABLE RESIDUE (TDS) BY METHOD SM2540C

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION

1.1 This procedure is applicable to drinking, and saline waters, domestic and industrial wastes.

1.2 The practical range of the determination is 10 mg/L to 20,000 mg/L.

2.0 SUMMARY OF METHOD

2.1 A well-mixed sample is filtered through a standard glass fiber filter. The filtrate is evaporated to dryness in a pre-weighed dish and dried to constant weight at 180°C. The increase in dish weight represents the total dissolved solids in the sample.

2.2 If Non-filterable Residue is being determined, the filtrate from that procedure is used for this procedure.

3.0 INTERFERENCES

3.1 Highly mineralized waters containing significant concentrations of calcium, magnesium, chloride, and/or sulfate may be hygroscopic and will require prolonged drying, desiccation and rapid weighing.

3.2 Samples containing high concentrations of bicarbonate will require careful and possibly prolonged drying at 180°C to ensure that all of the bicarbonate is converted to carbonate.

3.3 Too much residue in the evaporating dish will crust over and entrap water that will not be driven off during drying. Limit sample to no more than 200 mg residue.

3.4 Results for residue high in oil or grease may be questionable because of the difficulty of drying to constant weight in a reasonable time.

4.0 SAMPLE COLLECTION, PRESERVATION, AND HOLDING TIMES

4.1 Use glass or plastic bottles provided that the material in suspension does not adhere to container walls.

4.2 Refrigerate samples at 4 ± 2°C to minimize microbiological decomposition of solids. Bring samples to room temperature before analysis.

4.3 Preservation of the sample is not practical; analysis should begin as soon as possible. The maximum holding time is 7 days form the time of sampling.

5.0 REAGENTS AND STANDARDS

5.1 DI water with conductivity less than 1 µmhos.

5.2 Demonstration of Capability Standard (DOC), certified conductivity standard. Any certified standard with TDS concentration of 100 – 500mg/L may be used.

6.0 APPARATUS AND MATERIALS

6.1 Glass fiber filter discs, 4.7 cm or 2.1 cm, without organic binder such as Whatman grade 934AH, Gelman type A/E, Millipore type AP40, E-D Scientific Specialties grade 161 or any other equivalent product.

6.2 Filter holder, membrane filter funnel or Gooch crucible adapter.

6.3 Suction flask of sufficient capacity for sample size selected.

6.4 Beakers or any equivalent evaporating dishes, 100-mL volume.

6.5 Drying oven with temperature set at 105°C ± 2°C.

6.6 Drying oven with temperature set at 180°C ± 2°C.

6.7 Conductivity Meter (Orion 150)

6.8 Desiccator.

6.9 Analytical balance capable of weighing to 0.1 mg.

6.10 Assorted graduated cylinders and volumetric pipettes.

7.0 PROCEDURE

7.1 Preparation of Glass Fiber Filter Disc

7.1.1 Place the disc on the membrane filter apparatus.

7.1.2 Apply vacuum and wash the disc with three successive 20-mL volumes of reagent grade water.

7.1.3 Remove all traces of water by continuing to apply vacuum after water has passed through. Discard washings.

7.2 Preparation of beaker

7.2.1 Mark each beaker with a distinctive identification number.

7.2.2 If Volatile Residue, is also to be measured, heat a clean ceramic dish to 550 ± 50°C, for one hour in a muffle furnace. If only Filterable Residue is to be measured, heat the clean dish to 180 ± 2°C for one hour.

7.2.3 Cool in desiccator and store until needed.

7.3 Analytical Procedure

7.3.1 Record sample numbers and all initial information on to the TDS log book page. The typical analytical batch is arranged as follows:

-Method Blank
-Maximum of 20 samples
-Sample duplicate every 10 samples (at a frequency of 10%)

7.3.2 Perform conductivity on each sample. Use Table 7-1 to select the appropriate volume to filter for each sample.

Table 7-1
TDS Volume Selection

Conductivity (umhos/cm)	Volume (mL)
2000 or less	100
2000-4000	50
4000-8000	25
8000-20000	10
20000-40000	5
>40000	1

7.3.3 Weigh pre-dried beaker. Record weight in TDS log book.

7.3.4 Assemble the filtering apparatus and begin suction.

7.3.5 Thoroughly mix sample immediately before pouring aliquot for filtration.

7.3.6 Measure appropriate volume of WELL MIXED SAMPLE into a graduated cylinder for volumes ≥ 25mL or pipette for smaller volumes.

7.3.7 Record volume in TDS log book.

7.3.8 Quickly transfer and filter the sample through the glass fiber filter.

7.3.9 Remove all traces of water by continuing to apply vacuum after sample has passed through.

7.3.10 With suction on, rinse the graduated cylinder and filter funnel wall with three 20mL portions of de-ionized water allowing complete drainage between rinsing. Remove all traces of water by continuing to apply vacuum after sample has passed through.

7.3.11 Transfer all of the filtered sample plus rinsate to the weighed beaker.

7.3.12 Evaporate to dryness in the drying oven overnight at 105°C ± 2°C.

7.3.13 Dry the evaporated sample at 180°C ± 2°C for at least one hour.

7.3.14 Remove from the oven, cover and air cool for about 15 minutes.

7.3.15 Then cool in the desiccator for at least 30 minutes and weigh to 0.1mg.

7.3.16 Record weight as first weight.

7.3.17 Repeat steps 7.3.13 through 7.3.15until a constant weight is obtained or until the weight loss is less than 0.5mg (0.0005g).

7.3.18 Record final weight in the TDS log book.

7.4 Calculation

7.4.1 Calculate TDS (filterable residue) as follows:

$$\text{Filterable residue, mg/l} = \frac{[(D + S) - D] \times 1{,}000{,}000^*}{C}$$

where:

D + S = weight of dried residue + dish (g)
D = weight of dish (g)
C = volume of sample filtered (ml)

Note: In the above formula * 1,000,000 represents the unit conversion factor from g/mL to mg/L. The converting formula is presented below.

$$\frac{\cancel{g}}{\cancel{mL}} \quad \frac{1000\cancel{mL}}{L} \quad \frac{1000mg}{\cancel{g}}$$

Table 7-2
Checklist for TDS Analysis (SM2540C)

____ Record sample numbers and all initial information on the log book page.

____ Perform conductivity on each sample (See Table 7-1 to determine volume to filter).

____ Weigh pre-dried beaker. Record weight in TDS log book.

____ Assemble the filtering apparatus and begin suction.

____ THOROUGHLY MIX SAMPLE IMMEDIATELY BEFORE POURING ALIQUOT FOR FILTRATION.

____ Measure appropriate volume of WELL MIXED SAMPLE in a graduated cylinder for volume ≥ 25mL or pipette for smaller volume and quickly pour into filter apparatus. Record volume in TDS log book.

____ Remove all traces of water by continuing to apply vacuum after sample has passed through.

____ With suction on, rinse the graduated cylinder and filter funnel wall with three 20mL portions of DI water allowing complete drainage between rinsing. Remove all traces of water by continuing to apply vacuum after water has passed through.

____ Transfer all of the filtered sample plus rinsate to the weighed beaker

____ Place in the dry oven overnight at 105°C± 2°C.

____ Dry evaporated sample at 180 °C ± 2°C for at least one hour.

____ Remove from oven, cover and air cool for about 30 minutes.

____ Cool in a desiccator for at least 15 minutes and weigh to 0.1mg. Record weight as first weight

____ Dry evaporated sample at 180 °C ± 2°C again for at least another hour.

____ Remove from oven, cover and air cool again for about 30 minutes.

____ Cool in a desiccator again for at least another 30 minutes and weigh to 0.1mg.

____ Record final weight in the TDS log book.

____ Calculate TDS (filterable residue) as follows:

$$\text{TDS, mg/L} = \frac{[(D+S) - D] \times 1{,}000{,}000}{C}$$

where:

D + S = final weight of dried beaker + dry residue (g)
D = initial weight of dry beaker (g)
C = volume of sample filtered (mL)

8.0 QUALITY CONTROL REQUIREMENTS

8.1 Each person using this procedure is required to comply with the formal quality control program specified by AES. The minimum requirements of this program consist of an initial demonstration of capability, and the periodic analysis of laboratory reagent blanks, fortified blanks, and other laboratory solutions as a continuing check on performance. The laboratory, through the analyst, is required to maintain performance records that define the quality of the data that are generated. Detailed quality assurance procedures can be found in SOP# QA-01000, "Quality Assurance Manual," Section 5. Subsequent sections define portions of the quality control program.

8.1.1 Demonstration of Capability. Each analyst must demonstrate proficiency for each method performed by performing Initial Demonstration of Capability (IDOC) prior to unsupervised analysis of analytical samples and Continuing Demonstration of Capability (CDOC) at least annually. Detailed descriptions of IDOC and CDOC requirements and acceptance limits can be found in Section 5 of SOP#QA-01000, "Quality Assurance Manual".

8.1.2 Method Detection Limit (MDL) is not practical or required for this analysis.

8.1.3 A Method Blank (MB) must be analyzed with every batch of samples. A batch is defined as 20 or fewer samples prepared for incubation in a 24-hour period. FOR SOUTH CAROLINA SAMPLES, EACH BATCH MUST BE CLOSED WITH NO FURTHER SAMPLES ADDED WITHIN 12 HOURS.

8.1.4 A Laboratory Control Sample (LCS) is not practical or required for this analysis.

8.1.5 Sample duplicate (Dup) must be analyzed at a frequency of 10% of all samples (1 dup per 10 samples). Duplicate determination should agree within 5% of their average weight (RPD). RPD's outside specified range must be handled in accordance with Sec. 8.2.

8.1.5.1 Calculate % RPD as follows:
where:

$$\%RPD = \frac{|S - SD|}{(S + SD)} \times 200$$

S = sample result (mg/l)
SD = sample duplicate result (mg/l)

8.2 Out of Control Conditions and Corrective Actions. Contingencies for handling out-of-control or unacceptable data are included in Section 5 of SOP# QA-01000, "Quality Assurance Manual". The tables in this section include corrective actions for failing QC and/or acceptance criteria.

8.3 Documentation of data. Document and record all analytical sequence, standard preparation, instrument maintenance, and any procedural deviations in appropriate logbooks.

9.0 HEALTH AND SAFETY REQUIRMENTS

9.1 Health and Safety: Safety glasses and latex gloves must be worn when dealing with any chemicals, samples, or reagents. Lab coats are also required. Close-toed shoes and clothing that covers the legs (no shorts or dresses) must be worn at all times an analyst is working in the laboratory.

9.2 All health and safety concerns for any chemicals are listed in the Material Safety Data Sheets (MSDS) provided by the supplier or manufacturer of these chemicals. A copy of any MSDS is available for review at any time.

9.3 Proper disposal of all wastes is essential. Containers are provided for all waste according to the type.

Section 17 of the Quality Assurance Manual discusses the disposal of various laboratory wastes in detail. Also, see Section 14.0 Pollution Management.

10.0 DATA REPORTING

10.1 The LIMS system automatically calculates the data based upon factors that are set up for each test code. Data for this test method is reported to three significant figures.

10.2 The estimated reporting limit is 10mg/L.

10.3 Out-Of-Control Data - Contingencies for handling out-of-control or unacceptable data are included in SOP #QA-01000, "Quality Assurance Manual" in Section 5 including corrective actions for failing QC and/or acceptance criteria.

10.4 As per NELAC Chapter 5, Appendix D.1.4.(a), a detection limit study is not required for any component for which spiking solutions or quality control samples are not available.

11.0 FILE MAINTENANCE

11.1 Data from this test is stored in logbooks. When the logbooks are complete, they are scanned and stored on the portal served for a period of 5 years.

11.2 New logbooks are either created or retired through the QA Manager.

11.3 Data is entered into the LIMS by the analyst performing the work

12.0 INSTRUMENT MAINTENANCE

12.1 Instrument logbooks. Instrument logbooks must be completed each time that any maintenance is performed upon the instrument.

12.2 Each instrument logbook must have a cover page that includes the following information.

Equipment name.	Example: GC-5
Manufacturers name.	Example: Hewlett Packard 6890 GC
Serial Number.	Example: 13226589A
Date Received.	Example: 11/01/00
Date Placed into Service.	Example: 11/05/00

12.3 Routine Maintenance: Typical routine maintenance consists of keeping the system clean.

12.4 Non-routine maintenance: Typical non-routine maintenance consists of repair to the drying oven.

13.0 METHOD PERFORMANCE

13.1 The Method Detection Limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is distinguishable from method blank results. The reporting limit RL is defined as the concentration of a substance that is above the level of uncertainty. A method detection limit cannot be determined for this test method.

13.2 Precision and accuracy are not available for this test method.

14.0 POLLUTION MANAGEMENT

14.1 All laboratory analysis generates wastes. Some wastes can be hazardous such as acidic wastes, alkaline wastes, metal bearing wastes, and organic wastes.

14.2 Some wastes are generated due to the test procedure such as organic extractions & acid digestions.

14.3 The following procedures should be adhered to when disposing of hazardous wastes.
14.3.1 Wastes with pH levels above 12 or less than 4 should be neutralized prior to disposal.

14.3.2 Wastes with other pH levels may be directly discharged into the sinks.

14.3.3 Sec. 17 of the QAM further discusses methods for disposal of samples and waste materials.

14.4 When disposing of laboratory wastes, the waste disposal log must be completed. To complete this log, supply the following information.

Sample Number
Method of disposal and treatment prior to disposal
Date of sample disposal
Name of person performing the disposal duty

15.0 DEFINITIONS

15.1 Primary Grade - Dry chemical dried at 250°C for 4 hours cooled and stored in a desiccator.

15.2 LCS - Laboratory Control Sample. A known amount of sought for analyte is added to distilled water or clean soil and the concentration is measured after all procedures are applied to the sample. The resulting determined concentration must fall within test specified limits.

15.3 DI water - De-ionized water

15.4 RSD - Relative Standard Deviation

15.5 MS- Matrix Spike. Procedure where a known amount of sought for analyte is added to a sample and the resulting concentration measured. The recovery is defined as the measured result of the spiked sample less the concentration of the same analyte in the unspiked sample multiplied by 100 percent.

15.6 MSD- Matrix Spike Duplicate.

15.7 CCV - Continuing Calibration Verification Standard. Must be varied thoughout the daily runs, that is the concentration must be low, middle, and sometimes at the upper end of the calibration curve.

15.8 ICV – Initial Calibration Verification Standard. This standard must be prepared from a second source than that used for the calibration curve. That is, it must be from a different manufacturer or lot that the calibration standard.

15.9 LCSD - Laboratory Control Sample Duplicate

16.0 REFERENCES

16.1 SM2540C-1997, "Total Dissolved Solids Dried at 180ºC", Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.

16.2 SM2540C-2011, "Total Dissolved Solids Dried at 180ºC", Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.

17.0 VALIDATION DATA

17.1 Method validation data in the form of IDOC/CDOC study data when applicable is available at AES Portal Server: http://portal/Technical Management/DOC and SOP Sign Forms.

18.0 SOP REVISION HISTORY

Revision Date	Revision #	Summary of and Reason for Changes/Updates	Responsible for Revision
5/29/2003	3	Update	Greg Jones
6/15/2005	4	Update	Greg Jones
4/28/2009	5	Update	Dana Till
10/3/2011	6	Update	Dana Till
4/22/2013	7	MUR II reference update; Biannual Update	Dana Till
8/7/2014	8	Update	Dana Till

Attachment 4

Temporary SOP or Interim (Temporary or Permanent) Change Notice (circle one as appropriate)

Date:
Employee Requesting Change:
SOP Number:
Reference Method Number:
SOP Title:
Permanent Change Requested:

Technical Director: Date:

Laboratory Manager: Date:

Quality Assurance Manager: Date:

Department Supervisor: Date:

9.0 CALIBRATION PROCEDURES AND FREQUENCY

9.1 Identification and Control of Materials, Parts and Components

General. Materials, components or items that are used directly in the production of samples or data that, if not controlled, could jeopardize data quality must be identified.

9.1.1 Traceability of Measurement Policy (for AIHA-LAP, LLC and other accreditations)

Under Analytical Environmental Services' various accreditations (i.e. AIHA-LAP, LLC accreditation), the laboratory shall demonstrate, when possible, that calibrations of critical equipment and hence the measurement results generated by that equipment, relevant to their scope of accreditation, are traceable to the SI (International System of Units) through an unbroken chain of calibrations.

9.1.1.1 External Calibration services shall, whenever possible, be obtained from providers accredited to ISO/IEC 17025 by an ILAC recognized signatory, a CIPM recognized National Metrology Institute (NMI), or a State Weights and Measures Facility that is part of the NIST Laboratory Metrology Program. Calibration certificates shall be endorsed by a recognized accreditation body symbol or otherwise make reference to accredited status by a specific, recognized accreditation body, or contain endorsement by the NMI. Certificates shall indicate traceability to the SI or reference standard and include the measurement result and if available the associated uncertainty of measurement.

If externally provided products and services that affect laboratory activities or are used to support the operation of the laboratory are necessary, the laboratory will ensure they are suitable. When such products and services are intended for incorporation into the laboratories own activities, they are provided directly to the customer by the laboratory, as received from the external provider.

9.1.1.2 Where traceability to the SI is not technically possible or reasonable, the laboratory shall use certified reference materials provided by a competent supplier, or use specified methods and/or consensus standards that are clearly described and agreed to by all parties concerned. A competent supplier is an NMI or an accredited reference material producer (RMP) that conform with ISO Guide 34 in combination with ISO/IEC 17025, or ILAC Guidelines for the Competence of Reference Material Producers, ILCA G12. Conformance is demonstrated through accreditation by an ILAC recognized signatory.

9.1.1.3 Reference materials shall have a certificate of analysis that documents traceability to a primary standard or certified reference material and associated uncertainty, when possible. Where possible, reference materials such as calibration standards should be purchased from a supplier that conforms to ISO Guide 34. When applicable, the certificate must document the specific NIST SRM® or NMI (National Metrology Institute) certified reference material used for traceability.

Calibrations performed in-house shall be documented in a manner that demonstrates traceability via unbroken chain of calibrations regarding the reference standard/material used, allowing for an overall uncertainty to be estimated for the in-house calibration.

Calibration shall be repeated at appropriate intervals, the length of which can depend on the uncertainty required, the frequency of use and verification, the manner of use, stability of equipment, and risk of failure considerations. Table 9-1 provides minimum frequencies.

Periodic verifications shall be performed to demonstrate the continued validity of the calibration at specific intervals between calibrations. The frequency of verifications can be dependent on the uncertainty required, the frequency of use, the manner of use, stability of the equipment, and

risk of failure considerations. Internal calibrations and verifications are performed at the stated frequencies in Table 9-1. Reference thermometers, hygrometers, and masses, will be repurchased at the stated frequency rather than recalibrated. This has been determined to be more cost effective.

The laboratory has procedures describing their external and internal calibration and verification activities and frequencies, and the actions to follow if equipment is found to be out of acceptable specification.

Laboratory staff performing in-house calibration and verifications shall have received documented training.

9.1.1.4 Standard tracking: Standards and reagents are tracked in the LIMS chemical inventory system for traceability and auditing purposes. The method of standard and reagent tracking is outlined in the subsequent sections.

9.1.1.4.1 When a standard or reagent is needed that is not already on the approved vendor / materials order list, supervisors forward purchase requests to the Technical Director and / or Laboratory Manager for approval. The standard or reagent is ordered from a reputable supply house (AES typically uses VWR).

9.1.1.4.2 The information supplied to the Technical Director and / or Laboratory Manager must have the supplier standard or reagent name, order number, size or amount of each unit, grade or purity, price, if possible, and quantity. Upon receipt, supplies (and services) are reviewed to ensure they comply with requirements. When a vendor has been approved for services, a note is placed in the comments field of the Vendors database within LIMS.

9.1.1.4.3 When the standard or reagent arrives, it is logged into the LIMS, usually by the department supervisor or by the sample custodian. All reagents and standards received are electronically tracked and documented by computer via the Laboratory Information Management System.

9.1.1.4.4 Each standard or reagent is given a unique chemical inventory number upon receipt. The next available number in the LIMS is automatically assigned, starting with #5001. The computer entry is completed by entering the correct information in the required fields.

9.1.1.4.4.1 The expiration date for neat standards and reagents is determined using the manufacturer's expiration date, if available. Otherwise, a 1 year expiration date is assigned to volatile organic compounds and standards and 5 year date for acids, dry chemicals, solvents, reagents, and other chemicals. Each standard and reagent is clearly and permanently labeled with its expiration date in indelible ink. The assigned expiration date for intermediate standards will not exceed the manufacturer's expiration date of the stock standard.

9.1.1.4.4.2 Secondary standard containers are labeled with the corresponding LIMS tracking number of the source material, the date the contents were prepared, the six month expiration date, the name of the analyte(s), the concentration of each component of the solution, the matrix and the initials of the person who prepared it.

9.1.1.4.4.3 The chemical inventory number must appear on both the standard and reagent container, and the upper, right-hand corner of the certificate of analysis. It must also be included, if applicable, in standard/preparation, analyses or sample preparation log books.

9.1.1.4.4.4 Secondary standard labels include the LIMS chemical inventory number, the standard name, intended use (spiking, surrogate, reference or calibration solution), and concentration with units, matrix, expiration date and initials of the person who prepared

it. As long as this is available, all other information can be found in the LIMS.

9.1.1.4.4.5 Spiking, surrogate, reference and calibration solutions and calculations are recorded in the appropriate "Standard/Preparation Log Book." Logbooks cover the following areas: Organics, Organics Preparation, Semi-Volatile Organics, Microbiology, Metals, Mercury & Wet Chemistry.

9.1.1.4.4.6 Some containers such as standards containers for organics are small and there may not be enough room to list all of the required information on the container. Should this occur, it is permissible to attach a label to the bottle.

9.1.1.4.4.7 When a standard or reagent is added to a sample for any reason, the LIMS chemical inventory number of that standard or reagent and the amount added must be recorded in the appropriate logbook. For example, if a stock standard MET #33-89-5431 of 1000 mg/L is diluted to 100 µg/L, the following line is entered: 1 ml MET #33-89-5431 to 100 ml DI water, 1 ml of 100x to 100 ml DI water, final conc. = 100 µg/L. (NOTE: "MET #33-89-5431" = Metals Department Standard/ Preparation Log Book 33, page 89, LIMS Chemical Inventory Number 5431).

9.1.1.4.4.8 If the standard is used as a stock standard and aliquots of it are diluted to produce working standards, the stock standard's LIMS chemical inventory number is used. The standard concentration or a designator such as "1" or "A" is used to differentiate between each serial dilution.

Table 9-1
Minimum Calibration / Verification Frequency Requirements (for AIHA-LAP, LLC and other accreditations)

Reference Standard / Equipment	Calibration Frequency	Verification Frequency
Balances	Initial and Annually	Each day of use
Mechanical Pipettors	Initial and when verification fails*	Quarterly
Reference Thermometers	Initial and every 5 years**	Not applicable
Reference Hygrometers	Initial and every 5 years**	Not applicable
Digital Thermometers	Initial and when verification fails*	Quarterly
Alcohol-Hg-Spirit Thermometers	Initial and when verification fails*	Semi-annual
Reference Masses	Initial and every 5 years**	Not applicable
Stage Micrometer	Initial, if damaged, and every 7 years	Not applicable

*Verified internally.
**These reference standards will be repurchased instead of recalibrated in-house.

9.1.2 Control of Materials, Parts and Components
When appropriate, identification of each item is maintained by part number, serial number, or other appropriate methods, either directly on the item, or by labels or records traceable to the item. The system is designed to prevent the use of incorrect or defective items and to maintain identify and control inventory. When appropriate, the system controls items by batch number rather than by individual item. Instrumentation not currently in use or equipment undergoing repair is labeled as "Out of Service."

9.1.3 Handling, Storage and shipping

9.1.3.1 General
This criterion establishes requirements for the proper handling, storage, preservation and shipping of materials, supplies and equipment.

9.1.3.2 Procedures and Responsibilities

All items affecting quality are handled and stored in such a manner as to prevent deterioration and damage to the quality. Items that require shipping are packed to prevent damage. Managers and supervisors are responsible for items under their control.

9.1.4 Procurement Document Control

9.1.4.1 General

9.1.4.1.1 Vendors of analytical material supplied to AES are regarded as a resource to, and an extension of the laboratory organization. The standards for quality identified in this document shall be applicable to vendors.

9.1.4.1.2 The purpose of the procurement control criterion is to ensure the quality and traceability of procured quality related items (equipment, materials, or services), whose specification could affect the quality of the services of AES. This includes such quality related items as the calibration of instruments by outside laboratories (when appropriate), purchase of standards, subcontracted services and materials requiring testing before use, as determined by the QA Manager.

9.1.4.2 Procedures and Responsibilities

9.1.4.2.1 It is the responsibility of the purchasing agent to provide assurance, when required, that all applicable regulatory requirements, industry codes and standards appear in the purchase documentation for affected services and products.

9.1.4.2.2 The Purchasing Department retains purchase orders for control purposes.

9.1.4.2.3 Purchased items which do not meet the minimum standards set forth by the purchasing agent are processed according to procedures set forth in Section 13, “Corrective Actions.”

9.1.4.2.4 The appropriate Manager/Supervisor and QA Manager review purchase orders, which may affect quality-related services or products.

9.1.4.2.5 Purchase orders for standard catalog items except those described herein, are exempt from QA review.

9.1.5 Non-conformance

The purpose of this criterion is to establish a system to control materials, parts, or components that do not conform to established requirements in order to prevent their inadvertent use. When significant deficiencies in analytical procedures, materials or components has or may lead to the release of incorrect analytical results to the customer, a Corrective Action Report (CAR) is issued.

9.1.5.1 Procedures and Responsibilities

The Laboratory Manager and the purchaser perform the inspection of the newly received material and equipment. Nonconforming items that fail incoming receipt inspection are identified and segregated until disposition is determined and documented by the Non-Conformance Report. Copies of these documents are maintained by the Purchasing Department or the QA Department, as applicable.

9.2 Instrumentation List

The laboratory maintains an Equipment List spreadsheet of all instrumentation used. The information documented in this spreadsheet sheet includes a unique AES ID number for each piece of equipment along with type of instrument, manufacturer, model, serial number, software and revision number, firmware, and date received. It also lists in-house standards of traceability such as certified analytical

balance weights and calibration thermometers.

In addition, the item, model, serial number, date received, and the date placed into service. Appendix III, "Equipment List," is a summary of the laboratory equipment spreadsheet (For the complete information see the Equipment List spreadsheet).

9.3 Measurement Traceability and Calibration / Procedures for achieving Traceability of Measurements

9.3.1 General

The purpose of this criterion is to assure that instruments and other measuring and testing devices used in activities affecting program quality are properly controlled, calibrated and adjusted at specified periods to maintain accuracy within design and/or procedure limits. Implementation procedures consist of the following as applicable:

9.3.1.1 Identification and control of the item

9.3.1.2 Creation of calibration schedules and procedures based on instrument type, planned use, and design limits and program requirements.

9.3.1.3 Development of any necessary calibration sources for use in confirming successful equipment operation.

9.3.1.4 Maintenance of equipment history records to indicate past and status, and to provide reproducibility and traceability of results.

9.3.2 Responsibility

Under the direction of the manager, the supervisors are responsible for the quality of measuring and test equipment under his/her control and for the maintenance of records of calibrations and checks.

9.3.3 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests shall be calibrated and/or verified before being put into service and on a continuing basis. The laboratory has an established program for the calibration and verification of its measuring and test equipment. This includes balances, thermometers and control standards.

9.3.4 Traceability of Calibration

9.3.4.1 The overall program of calibration and/or verification and validation of equipment ensures that, wherever applicable, measurements made by the laboratory are traceable to national standards of measurement.

9.3.4.2 Calibration certificates indicate the traceability to national standards of measurement and provide the measurement results and associated uncertainty of measurement. Certificates are maintained in the Quality Assurance office files.

9.3.4.3 The laboratory maintains calibration certificates that provide traceability to each standard chemical used within the laboratory. As these standards are purchased, the certificates that accompany the standards are stored in logbooks. Information included in the logbooks includes labels provided by the manufacturer, expiration date, lot number, etc. This information is stored separately for standards purchased by each department and can be accessed by all personnel within the department.

9.3.4.4 Where the traceability of national standards of measurement does not apply, AES shall provide satisfactory evidence of correlation of results by participation in a program of inter-laboratory comparisons, proficiency testing studies or independent analysis.

9.3.5 Reference Standards

9.3.5.1 Reference standards, as Class 1 weights or traceable thermometers, are used for calibration only and no other purpose, unless it can be demonstrated that their performance as reference standards will not be invalidated. AES, Inc., maintains certified Class 1 weights, thermometers which have been calibrated by outside agencies that can provide traceability to national standards of measurement. The stage micrometer will be calibrated by a NIST traceable reference.

9.3.5.2 The calibration and verification of reference standards occurs every five years for Class1 weights and thermometers and every seven years for stage micrometers.

9.3.5.3 Where relevant, reference standards and measuring and testing equipment shall be subjected to in-service checks between calibrations and verifications. These reference materials shall, where possible, be traceable to national or international standard reference materials. Table 9-2 lists the major standards (traceable to NIST) which are used in the laboratory and their sources.

Table 9-2

Chemical Standard	Manufacturer/Vendor
PAH Mix	VWR-Restek, Supelco
Toxaphene	ERA, Accustandard, Absolute Stds
Chlordane	ERA, Accustandard, Absolute Stds
Hexavalent Chromium	ERA, Accustandard, Absolute Stds
LAS (MBAS)	ERA, Accustandard, Absolute Stds
Calcium Carbonate	ERA, Accustandard, Absolute Stds
TSS	ERA
O&G	ERA, Accustandard, Absolute Stds
Aroclor Mix (PCB)	ERA, Accustandard, Absolute Stds
8260B Matrix Spike	VWR-EM Science
EPA 625 Kit	Restek
Sodium Nitroferricyanide	VWR-Mallinckrodt
Sodium salicylate	VWR-J.T. Baker
Phosphate (P) Standard	Labchem, Inc.; Ricca
Mercuric Oxide	VWR-J.T. Baker
Multi-element Metals Std	SCP
Chemical Standard	Manufacturer/Vendor
Antimony Standard	SCP
Furan	Aldrich Chemical
Herbicides Mix	ERA, Accustandard, Absolute Stds
DRO/GRO	ERA, Accustandard, Absolute Stds
EDB, DBCP	ERA, Accustandard, Absolute Stds
turbidity	ERA, Accustandard, Absolute Stds
8270C Mix	ERA, Accustandard, Absolute Stds
Semi-Vols Mix	RTC
1,2-diphenylhydrazine	Restek

9.3.6 Calibration- Calibration requirements are divided into two parts: 1) requirements for analytical support equipment, and 2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial instrument calibration and continuing instrument calibration verification.

9.3.6.1 Instrument Calibration - Analytical instruments are calibrated in accordance with the proper analytical procedure to determine the analyte(s) of interest. After initial calibration of an instrument, a continuing calibration standard is analyzed at specific intervals. The calibration standards must meet the specified QC requirements associated with each test

method (see Section 5).

9.3.7 Control of Measuring and Test Equipment

9.3.7.1 The purpose of this criterion is to assure that instruments and other measuring and testing devices used in activities affecting program quality are properly controlled, calibrated and adjusted at specified periods to maintain accuracy within design and/or procedure limits.

9.3.7.2 Equipment calibration specific to microbiological analysis.
The laboratory, under the direction of the section leader, determines and documents temperature stability, uniformity of temperature distribution, and time required to achieve equilibrium conditions in incubators and water baths. This procedure is performed during the following two conditions.

9.3.7.2.1 When new equipment is purchased

9.3.7.2.2 On an annual basis for existing equipment

9.3.7.3 Volumetric accuracy checks for disposable pipettes used in microbiological analysis. The laboratory, under the direction of the section leader, determines and documents volumetric accuracy of disposable pipettes. This is accomplished by checking 5 pipettes per case lot.

9.3.7.4 Mechanical timer accuracy checks. The laboratory, under the direction of the section leader, determines and documents the accuracy of mechanical timers. This is done by the following method and frequency.

9.3.7.4.1 Accuracy check is performed on an annual basis and is documented in the logbook.

9.3.7.4.2 Accuracy is compared against an electronic timing device such as a stopwatch.

9.3.7.5 General Responsibility

Under the direction of the manager, the supervisors are responsible for the quality of measuring and test equipment under his/her control and for the maintenance of records of calibrations and checks.

9.3.8 Reference Measurement Standard List

Reference measurement standards must originate, wherever possible, from sources traceable to NIST. Table 9-3 describes the major standards used in the laboratory and their sources:

Table 9-3
Reference Measurement Standard List

Chemical Standard	Manufacturer/Vendor
PAH Mix	VWR-Restek, Supelco
Toxaphene	ERA, Accustandard, Absolute Stds
Chlordane	ERA, Accustandard, Absolute Stds
Hexavalent Chromium	ERA, Accustandard, Absolute Stds
LAS (MBAS)	ERA, Accustandard, Absolute Stds
Calcium Carbonate	ERA, Accustandard, Absolute Stds
TSS	ERA
O&G	ERA, Accustandard, Absolute Stds
Chemical Standard	Manufacturer/Vendor
Aroclor Mix (PCB)	ERA, Accustandard, Absolute Stds
8260B Matrix Spike	VWR-EM Science
EPA 625 Kit	Restek
Sodium Nitroferricyanide	VWR-Mallinckrodt

Sodium salicylate	VWR-J.T. Baker
Phosphate (P) Standard	Labchem, Inc.; Ricca
Mercuric Oxide	VWR-J.T. Baker
Multi-element Metals Std	SCP
Antimony Standard	SCP
Furan	Aldrich Chemical
Herbicides Mix	ERA, Accustandard, Absolute Stds
DRO/GRO	ERA, Accustandard, Absolute Stds
EDB, DBCP	ERA, Accustandard, Absolute Stds
turbidity	ERA, Accustandard, Absolute Stds
8270C Mix	ERA, Accustandard, Absolute Stds
Semi-Vols Mix	RTC
1,2-diphenylhydrazine	Restek

10.0 PREVENTIVE MAINTENANCE

10.1 Instrument Maintenance

All instrument maintenance is recorded in an instrument specific logbook. Entries are dated and initialed by the analyst making the entry.

10.1.1 Routine

All analytical instruments have a routine schedule of maintenance specified by the manufacturer. Routine maintenance is designed to keep the instrument in good operating condition with as little "down-time" as possible. All Analysts should be proficient in maintaining the instruments for which they are responsible.

10.1.2 Non-Routine

Any maintenance which must be performed in order for sample analysis to proceed, but is not part of the systematic maintenance schedule, is considered non-routine. Non-routine maintenance must be reported to the Section Supervisor immediately so that is its impact on production can be determined. If the ability to analyze samples is adversely affected, the Section Supervisor notifies the Client Services Manager so that alternative action can be coordinated with the client.
(Note: See Appendix II for a complete instrument maintenance summary.)

10.2 Preventive Maintenance

10.2.1 Maintenance Schedule

AES is equipped with up-to-date computerized instrumentation. In order to gain maximum performance and minimize downtime, regular inspection, maintenance, cleaning, and servicing of all laboratory and field equipment is performed according to the manufacturers' recommendations.

10.2.2 A maintenance log is kept for each piece of laboratory and field instrumentation, detailing all maintenance performed on the instrument.

10.2.1.1 Routine repairs and maintenance are performed and documented by the analyst responsible for the particular instrument.

10.2.1.2 A log of non-routine maintenance is kept in the instrument repair logbook. As part of this information, the analyst or repair technician signs and dates the logbook.

10.2.1.3 Routine maintenance procedures for laboratory instrumentation are given in Appendix II. The service intervals listed in Appendix II are as follows: D = daily; W = weekly; M = monthly; Q = quarterly; SA = semi-annually; and AN = as needed. (A list of all laboratory equipment may be found in Appendix III.)

10.2.3 An extensive approved spare parts inventory is maintained for routine repairs at the facilities,

consisting of GC detectors, AA lamps, fuses, printer heads, flow cells, tubing, certain circuit boards and other common instrumentation components.

10.3 Glassware used in general laboratory operations must be of high quality borosilicate glass (e.g. Pyrex or Kimax). Volumetric dispensing glassware must be Class A wherever possible.

Glassware Cleaning. Laboratory glassware cleaning procedures & guidelines are described in Table 10-1.

TABLE 10-1
LABORATORY GLASSWARE CLEANING PROCEDURES

Analysis/Parameter	Cleaning Procedure (In Specified Order)
Extractable Organics (including	Solvents: 13, 1, 2, 3, 4, 7, (6 or 8 optional), 15, 17
Pesticides and Herbicides)	Or, Muffle Furnace: 13, 1, 2, 3, 4, 14, 15, 17
	Or, Oxidizer: 13, 1, 2, 3, 16, 3, 4, 15, 17
Analysis/Parameter	Cleaning Procedure (In Specified Order)
Purgeable Organics	1, 2, 3, 4, (7 optional), 11
	Or, 1, 2, 3, 4, (8 optional), 11
Trace Metals	1, 2, 3, 4, 10, 4
Nutrients, Other Wet Chemistry	1, 2, 3, 4, 9, 4
TKN	1, 2, 3, 4, 18, 4
Minerals, Demands, CN and Phenols	1, 2, 3, 4
Microbiology	1, 2, 3, 4
Residues	1, 2, 3, 4, 12

Key to Laboratory glassware cleaning procedures:

1 Remove all labels with sponge or acetone
2 Wash with hot tap water, scrub stopcocks, and other small parts with brush and inside labware using a laboratory-grade detergent
Organics – Liquinox, Alconox or equivalent
Inorganic Anions – Liquinox or equivalent
Inorganic Cations – Liquinox, Acationox, Micro or equivalent
3 Rinse thoroughly with hot tap water
4 Rinse thoroughly with Deionized (DI) water
6 Rinse thoroughly with pesticide-grade methylene chloride
7 Rinse thoroughly with pesticide-grade methanol
8 Rinse thoroughly with pesticide-grade hexane
9 Rinse thoroughly with Deionized (DI) water
10 Rinse or soak with 1:1 HCl
11 Rinse thoroughly with Deionized (DI) water
12 Rinse or soak with 10% HNO_3
13 Rinse thoroughly with Deionized (DI) water
14 Bake at 105°C for 3-4 hours (Note: Class A volumetric glassware must NOT be baked!)
15 Bake crucibles at 105 °C or 180 °C for 1 hour (prior to use, as per method)
16 After use, rinse with same solvent used

17 Drain, let air dry
18 then heat in muffle furnace for 15-30 minutes
19 Store inverted or capped with suitable material or container stopper
20 Soak in oxidizing agent: chromic acid or equivalent
21 Rinse with solvent used in analysis as the last step prior to use
22 Rinse or soak with 1:1 H_2SO_4

Note: Do not let it run continually while washing glassware due to a limited supply of Deionized Water.

10.4 Contamination Control

Monitoring for contamination is an important factor in order to ensure the highest quality analytical results. A documented routine monitoring program is in place to verify adequate contamination control. Monitoring is present in several forms.

10.4.1 Media (or Method) Blank is analyzed with every batch of samples to show that the extraction and analytical processes are free of contamination. Clean, unused sampling media undergoes the same preparation and analysis as the samples. The same acids, solvents, and other reagents are used as applicable, with each batch of samples. Typical media includes wipes, filters, and air cartridges.

10.4.2 Routine air monitoring is performed and documented monthly to monitor background levels of fibers (PCM) and fungal spores. Samples are collected in the appropriate locations, logged into the LIMS by the QA Department, and results are evaluated by the department managers.

10.4.3 In addition to Method Blanks, the Volatiles Department performs a daily DI water check for contaminants to ensure the starting water for the day meets acceptable criteria. This provides an indication that resin beds and charcoal are need of changing.

10.4.4 Work areas are routinely wiped down and cleaned to remove contamination. The laboratory performs quarterly lead dust wipe checks to ensure the cleaned areas are free from contamination. Dust wipes are logged in quarterly for designated areas determined by the QA Department. A 12 inch by 12 inch template is used to wipe down defined areas to check. If analytical results are unacceptable for any area, that location is thoroughly cleaned once again followed by re-sampling and analysis.

10.4.5 Hoods are also cleaned on a regular schedule to reduce the chance of contamination in the Asbestos, Metals, and Sample Receiving areas.

10.4.6 Certificates of Analysis and contamination checks received from media (bottle) suppliers are maintained on file by lot # to show items were contaminant free when used for sample collection. In addition, the laboratory performs testing of bottles for selected analysis.

11.0 QC CHECKS AND ROUTINES TO ASSESS PRECISION, ACCURACY AND METHOD DETECTION LIMITS

11.1 Control of Special Processes

11.1.1 In certain processes, the existence of a required level of quality cannot be assured by the examination of the end result alone. Such special processes that relate to the conduct of programs include performance of detailed chemical procedures, interpretation of raw data and the use of advanced data analysis techniques.

11.1.2 For such processes, quality assurance is obtained through the development of thorough analytical and operational procedures. QA is also obtained by personnel screening and documented training to ensure the necessary level of personnel qualifications and capabilities and by the use of QC samples. This section describes how personnel are qualified in accordance with specified requirements.

11.2 Quality Control in the Laboratory

11.2.1 Various types of quality control samples are used at AES, Inc., in each of the following areas:

- Bulk Asbestos
- Air Asbestos
- Gas Chromatography/Mass Spectrometry
- Gas Chromatography
- Inorganic Analysis
- Wet Chemistry
- Microbiology
- Sample preparation

11.2.2 Some of the activities used to qualify the procedures (and data) are described:

11.2.2.1 Standards

The Section Supervisor (or designee) is responsible for the preparation and documentation of stock standards and working standards. Standard reference materials are obtained from suppliers and have Certificates of Analysis to certify the analyte concentrations. When available, traceable reference materials are to be used. As a minimum, information on reference materials includes manufacturer, lot or batch number, date of receipt, expiration date, and any other accompanying preparation or assay information. The most recent release of the NIST standards library shall be used for mass spectral interpretation.

11.2.2.2 Calibration and Performance Check of Instruments

Different types of reference material are used to calibrate the various analytical instruments in the laboratory areas. For most of the analytical instruments used in the laboratory, calibration and performance checks are conducted at the beginning of an analytical run, periodically throughout the run and at the end of the run, (e.g., Atomic Absorption Spectrophotometers), while others are calibrated once then checked daily. The performance checks must be from an outside source, such as an alternate manufacturer, or may be from the same manufacturer as long as it originates from a different lot or batch. Calibration is also performed when the analytical method is initially set-up, when an instrument has been through major maintenance, or the instrument fails its QC check.

11.2.2.3 Inter-Laboratory Analysis of QC Samples

Client and method requirements determine the frequency and type of spikes, blanks, splits, method standards, surrogate standard, internal standard and external source analyses. These normally account for 10 – 20% of the data points generated by the laboratory.

11.2.2.4 Inter-Laboratory Analysis

AES, Inc. participates in various accreditation programs that require the analysis of either agency-supplied performance samples or proficiency test study samples purchased from a TNI or AIHA-LAP, LLC approved PT provider as required. Results of these performance results are reported and maintained in QA files. Results which are evaluated as “Not Acceptable” are documented and reviewed by the Quality Assurance department and resolved through discussion with analysts and their supervisors, examination of all raw data, re-assessment of sample preparation directions and techniques, and a review of data and calculations.

11.2.2.5 Computational Checks

Any hand calculations are checked by a second individual, in most cases the section supervisor. The person performing the crosscheck must be qualified in the relevant technical discipline. For computations performed automatically using verified software, and which contain a hard copy of the entered computation, only the entries are checked.

11.2.2.6 Review and Analysis of Data

The review and analysis of data for analytical measurements are performed on a timely basis using Quality Control checklists. The data is checked for reasonableness and consistency by the section Supervisor and/or the manager.

11.2.2.7 Detection Limit Studies

The detection limit of an analyte is defined as the smallest amount of an analyte that can be detected (for instrumentation, above the background noise) within a stated confidence limit. There are several types of detection limits that may be applicable to a given method. The Instrument Detection Limit (IDL) is the amount of analyte needed to produce an adequate response above an instrument's baseline noise. The IDL may be use to estimate a Method Detection Limit (MDL). The Practical Quantitation Limit (PQL), also called the Reporting Limit (RL) is defined as the lowest level of quantitation achievable during routine laboratory operations. Some agencies define the PQL more rigidly as 3.33 times the MDL. However, the PQL is highly matrix dependent.

11.2.2.8 Recovery of Known Additions (Spikes)

Recoveries of known additions of analytes are used to determine the effect of the sample matrix on the given analytical procedure. The Laboratory Control Sample (LCS) and sample Matrix Spike/Spike Duplicate (MS/MSD) are used to monitor and control the analytical process. The recovery of spiked analytes in the sample matrix gives a definitive measure of the sample preparation processes.

11.2.2.8.1 LCS data is used to monitor the laboratory's performance in respect to sample preparation and equipment operation. It is prepared in an analyte free matrix similar to the sample, i.e. water or soil. Recovery limits for the LCS are established by the laboratory through control charting of each analyte.

11.2.2.8.2 A matrix spike/matrix spike duplicate pair is analyzed to determine the effect of the sample matrix on extraction efficiency and analyte recovery. One MS/MSD pair should be prepared and analyzed in every batch of 20 or fewer samples when possible. In some cases, the client may specify which sample is to be used for the MS/MSD. If not, the laboratory picks a representative sample at random. Advisory MS/MSD recovery limits are established for aqueous and soil matrices. For TCLP analysis, a matrix spike is prepared and analyzed for each waste type (e.g. oil, solid) associated with a batch of 20 or fewer samples of similar matrix.

11.2.2.9 Surrogates

As a means of monitoring individual sample extraction efficiency, one or more surrogate compounds are added to each blank, LCS, client sample, and QC sample prior to preparation. Recovery limits for surrogate compounds are established by the laboratory through control charting of each analyte. Typically, one of the following actions will be required when a sample surrogate recovery is out of the established control limits.

- Re-extract and/or reanalyze the sample
- Flag the results as estimated

11.2.2.10 Clients may specify the required action to be taken for recovery failure. Client specific requirements are conveyed to the analytical sections through project management.

11.2.3 Tracking Internal QC Samples

The tracking of internal QC samples through the LIMS provides laboratory personnel with various types of information. This information is used for the following purposes:

11.2.3.1 Long term trends are monitored through the use of quality control charts. Any upward or downward change in the recovery of analytes signifies that some procedural change has taken place. If trending is observed, the Technical Director reviews all test procedures and makes any corrections as required.

11.2.3.2 The number of quality control samples as a function of total laboratory samples is monitored so as to ensure that the laboratory analyzes the adequate number of Quality Control samples for each extraction or analytical batch.

11.2.3.3 The following guidelines are followed when implementing and utilizing QC Charts:

11.2.3.3.1 Through LIMS the Technical Manager plots the percent recovery of the LCS analyte versus the date of preparation or analysis; whichever is most appropriate.

11.2.3.3.2 For organic analyses employing surrogates, the LCS surrogate % recoveries are monitored on QC Charts. The recovery of at least one target Aroclor (PCB) in the Pesticide/PCB LCS is monitored on a QC Chart (e.g. TPH).

11.2.3.3.3 For trace metals determined by inductively coupled plasma (ICP) at least three metals spiked in the LCS are monitored on QC Charts (e.g. Cd, Cr, Ni). For trace metals determined by graphite atomic absorption (GFAA) and cold vapor atomic absorption (CVAA), an LCS for each element is monitored on a QC chart.

11.2.3.3.4 For General Chemistry, an appropriate LCS for each method is used. Each LCS analyte recovery method is monitored on a control chart.

11.2.3.3.5 Each section, prior to the calculation of in-house limits, establishes initial control limits. These preliminary limits are derived from published method criteria if available. If no such criteria are available, the preliminary limits will be mutually set and agreed to by the Section Supervisor, Laboratory Manager, Technical Director, and Quality Assurance Manager. A minimum of 20 points is recommended to establish the initial calculated control limits. In some cases, it may be appropriate to use fewer data points to establish the first set of calculated limits, however, at no time should fewer than seven data points are used.

11.2.3.3.6 Control chart limits are updated periodically when sufficient additional data points are available. Typically, limits are updated for each set of 20 to 50 new data points. More frequent updates may be warranted in some cases

11.2.3.3.7 Each control chart has upper and lower warning limits established at ± 2 standard deviations ($2\sigma_{n-1}$) from the mean % recovery (centerline)

11.2.3.3.8 Each control chart has upper and lower control limits established at ± 3 standard deviations ($3\sigma_{n-1}$) from the mean % recovery (centerline).

11.2.3.3.9 The analyst performing the method enters the data into LIMS. The data is evaluated frequently to identify trends that might occur in an “out of control” situation

11.2.4 The method blank is an analyte–free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

For the method blank to be acceptable for use with the accompanying samples, the concentration of the blank of any analyte of interest can not exceed the method detection limit or required reporting

limit. Section 5 lists certain conditions in which contaminated blanks may be used for quality control purposes.

11.2.5 An instrument blank may be run after any sample that gives a response that exceeds the calibration range for the instrument to show that there is no carry-over to the next analysis. The instrument blank shall consist of high purity solvent (e.g. hexane for pesticide analysis by GC/ECD, methylene chloride for semi-volatiles analysis by GC/MS).

11.2.6 An Initial Calibration Blank (ICB) is analyzed before sample analysis begins to verify there is no carryover contamination or instrument drift. ICB samples usually accompany inorganic instrumental analysis.

11.2.7 The analysis of sample duplicates that contain detectable quantities of analytes is an effective means for assessing the precision of an analysis. Refer to the individual analytical procedures or LIMS test codes for guidance concerning the frequency and criteria for sample duplicate analyses.

11.3 Inter-laboratory Quality Control

Each section of the laboratory may be given blind and double blind samples to analyze for requested parameters. Blind samples may be assigned in containers to be diluted, digested, and/or extracted and analyzed by the appropriate laboratory section. Double-blind samples may arrive on a pre-scheduled basis from a "client" as real samples to be analyzed by designated analytical sections for specific analytes.

11.3.1 Blind QC Samples

Blind QC samples may be used as a test of proficiency for analysts needing certification and/or qualification for performing an analysis. The Section Supervisor should obtain the QC sample from either the Quality Assurance Department of from a source independent from the source of standards for the analysis.

11.3.2 Double - Blind QC Samples

Quality Control samples may arrive from a "Client" to be analyzed for specific analytes. These samples will arrive as real samples and will not be known to anyone outside Quality Assurance and Project Management. The results of these double-blind samples will be sent to the "client" to be compared to the true value of the samples. The laboratory's performance on these samples will be compared to other laboratories in the program. These results will be mailed to the Quality Assurance Department. Results are used to identify areas needing improvement.

11.4 Out-of-Control Conditions in Laboratory Control Samples

11.4.1 Any of the following control chart conditions indicates the loss of process control:

11.4.1.1 Any one point that is outside of the control limits.

11.4.1.2 Any three consecutive points that are outside one of the warning limits.

11.4.1.3 Any eight consecutive points on the same side of the centerline.

11.4.1.4 Any obvious cyclic or repetitive pattern seen in the points.

11.4.2 Reactions to "Out-of-Control" Conditions

In the event of an "out-of-control" condition, the analyst should respond to the condition in the following manner:

11.4.2.1 Stop analysis.

11.4.2.2 Investigate the root cause of the failure

11.4.2.3 Implement any required corrective action.

11.4.2.4 Document the situation in a non-conformance memo prior to initiating subsequent analyses.

11.5 Identification of Analytes

11.5.1 Organic Analyses

The identification of analytes is accomplished by comparison of unknown samples with known standards. All standards shall be traceable as specified by the applicable analytical procedure.

11.5.1.1 Gas Chromatography

All sample identifications are made by a comparison of the retention time of the standard peak to the retention time of the unknown peak. The identification of any analyte, which is identified during the primary analysis, is verified through the use of a confirmation column or by GC/MS unless specifically exempted in the applicable procedure.

11.5.1.2 Gas Chromatography/Mass Spectrometry (GC/MS)

For positive identification of an analyte by GC/MS, the spectrum of the analyte must conform to a spectrum of the authentic standard obtained after satisfactory tuning of the mass spectrometer. The appropriate analytical methods should be consulted for specific criteria for matching the mass spectra, relative response factors and relative retention times to those of authentic standards. Tentative identifications may be made based on conformance to published mass spectra in reference texts or spectral library databases.

11.5.2 Inorganic Analyses

The identification of analytes is accomplished by comparison of unknown samples with known standards. All standards shall be traceable as specified by the applicable analytical procedure.

11.5.2.1 Metals

The concentration of a metal analyte is based on the absorption or emission of light measured at a specific wavelength. The wavelength selected is in accordance with the applicable procedure. Standards used to generate the calibration curve are traceable to NIST or other nationally recognized (e.g. EPA).

11.5.2.2 Wet Chemistry

Standards used to prepare calibration curves or to standardize instruments are traceable to NIST or other national sources (e.g. EPA).

11.6 Quantitation and Reporting of Analytes

11.6.1 Reduction of Sample Data

Data reduction is defined as the processing of instrument generated numbers by an analyst to achieve a final result. Data reduction is used for sample analysis as well as for quality control criteria. Processing of numbers may be achieved using manual and/or computer aided calculations.

11.6.1.1 All data reduction follows calculations found in approved procedures for the analysis.

11.6.1.2 An analyst who is qualified to perform the analysis performs all data reduction. If a Section Supervisor performs data reduction, another qualified analyst reviews the data.

11.6.1.3 All numbers used in the reduction of data are present on data reports and are easily retrievable.

11.6.1.4 All computer-generated calculations are performed using a validated program/spreadsheet.

11.7 Reporting Data

11.7.1 Significant Digits

All digits in a reported result are considered to be definite, except for the last digit, which may be in

doubt. Such a number is said to contain only significant figures. If more than a single doubtful digit is carried, the extra digit or digits are not significant. The following rules apply to all reported analytical results from all laboratory sections:

11.7.1.1 All digits from a measurement are recorded. These numbers are used in the calculation of the results. After all calculations have been performed, the number is rounded to the required number of significant digits.

11.7.1.2 The number zero may or may not be a significant digit, depending on its placement of the reported result.

11.7.1.3 Final zeroes, after a decimal, are always significant (Ex. 9.80 has three significant figures).

11.7.1.4 Zeroes before a decimal point with non-zero digits preceding them are significant. Zeroes with no non-zero digits before them are not significant (e.g. 10.3 has three significant digits, 0.53 has two significant digits).

11.7.1.5 If there are no non-zero digits preceding a decimal point, the zeroes after the decimal point but preceding other non-zero digits are not significant. These zeroes only indicate the position of the decimal point.

11.7.1.6 The final zero in a whole number may or may not be significant.

11.7.1.7 When mathematical functions are performed on multiple numbers, the number with the least number of significant digits dictates how many significant digits the end result should have.

11.7.2 Rounding Rules

11.7.2.1 Once the number of significant figures obtainable from a particular analysis is established, data resulting from the analysis are reduced according to the standard rules for rounding which state: If the number value to be rounded is 5 or greater, round up. If the number value is less than 5, round down.

11.7.2.2 Rounding off numbers is a necessary operation in all analytical sections of the laboratory. It is automatically applied by the limits of measurement of every instrument and all glassware.

11.7.3 Reporting Units

The appropriate unit of measurement shall accompany all sample results reports.

11.7.4 Reporting on a Wet vs. Dry Weight Basis

When required, solid sample results are reported on a dry weight basis and documented in the report. When results are reported on a wet weight basis, the results are reported “as is”.

11.7.5 Reporting % Recovery and RPD

Unless otherwise directed by the customer, the Technical Director, or the QA Manager, the % Recovery and RPD are reported to one decimal place.

11.8 Storage of Quality Related Data

The laboratory retains all data and information that pertains to a project for a period of 5 years. The data may be stored electronically, as hard copy, or both.

11.8.1 Calibration Data

All calibration data, which pertains to a specific project, is stored in an easily retrievable manner. Easily retrievable manner is defined as retrievable in the same day for current projects, or within 24 hours for archived projects.

11.8.2 Quality Control Data

All quality control related data (i.e. blanks, blank spikes/duplicates, matrix spikes/duplicates, etc.) is stored in the associated project file. If more than one project is associated with the QC data, copies are made and stored with each associated project.

11.8.3 Logbooks (Notebooks)

Laboratory logbooks are kept in the laboratory while in use. Once completed, the logbooks are archived in an easily retrievable location.

11.8.4 QC Charts

While in use, QC charts are stored in LIMS. When the QC Chart is no longer being used, it is archived by the section in a central location in the Server.

11.9 Internal Performance Audits

Internal performance audits are a means for the Quality Assurance Department to determine the applicability, effectiveness, and utilization of procedures by all sections. Designated personnel perform the performance audits. At the beginning of each year, and on an on-going basis, a schedule of audits and surveillance is developed and updated by the Quality Assurance Section. Surveillance is performed on an unannounced basis with the sections so that objectivity may be maintained. Findings from audits and surveillance are documented and corrective actions are implemented. Additional surveillance is scheduled to ensure that all deficiencies are corrected.

11.10 Failure of Quality Control Indicators

When there is a quality control failure that impacts data quality, the event must be documented using the procedures described in Section 13 of this document.

12.0 DATA REDUCTION, REVIEW AND REPORTING

12.1 Introduction: In order to provide the highest quality data possible, an extensive system for data reduction, review, and reporting has been implemented.

12.2 Sample Analysis and Data Reduction

Through the use of the worksheets, the samples are prepared following the procedures given in each of the SOPs that follow EPA's approved methods. The preparation information is recorded in logbooks throughout the laboratory.

12.2.1 Data Reduction

Most sample concentration results are read directly from instrumentation without further reduction or calculations. Dilution factors are applied upon the dilution of samples having concentrations above the calibration range. In many cases, these are put into the computer and correct results are calculated automatically. In other cases, a manual calculation may be made. Data from methods requiring manual reduction prior to reporting include titrimetric methods, BOD, COD, conductivity, manual UV/VIS/IR and residue. All laboratory pH meters are temperature compensated.

The laboratory raw data containing the instrument-generated reports, manually calculated results, and all supporting preparation, calibration, and analytical data are scanned as pdf file and posted in laboratory archives (portal server).

12.2.2 Chromatographic and Data File Identification

Chromatograms and data files are given a unique alphanumeric identification by the chemists initiating the analyses in each section. These file identification numbers reflect either the date the sequence was initiated (GC sections), the order in which samples were analyzed (GC/MS sections), and/or the sample identification and log numbers given by the client and listed on the LIMS.

12.3 Data Transfer and Review

12.3.1 Data Transfer to LIMS

The analytical results are entered on the department worksheets after review or by direct electronic transfer from the instrument data system. The analysts enter the worksheet data into the LIMS. After the data is entered into the LIMS, approval sheets are printed and checked against the information entered into the LIMS for transcription errors and anomalies.

12.3.2 Data Review

Laboratory analytical results are reviewed by at least two analysts or a section supervisor prior to entering the reportable data into the LIMS. The review of the data includes checking the extraction, digestion, distillation, and other preparation logs, ensuring that all precision and accuracy requirements are addressed, and ensuring that all steps of the analyses have been completed. If any problems were indicated during the analysis of the sample batch, it is the responsibility of the analyst and the section supervisor to bring this to the attention of the project manager, section manager and QA manager through a written corrective action report.

12.3.3 Data flags

Data flags are used on reports as needed to inform the project manager and the client of any additional information that might aid in the interpretation of the data. The data flagging system incorporates data qualifiers which are similar to flags specified in the Contract Laboratory Program protocols, as well as additional flags used to help explain batch specific events.

12.3.4 Final Report

When data acquisition and reporting have been completed, the project manager reviews and prepares the final report. Because the project managers have extensive experience in evaluating analytical data, they have developed both objective and subjective techniques for data review. Each value reported is reviewed in the context of the respective environmental matrix and all available QC/QA data.

Final Reports shall include the following:

- Title (e.g. Transmission Electron Microscopy Analysis Report)
- Name and address of the laboratory
- Unique identifying number
- Name and contact information of the customer
- Identification of the method used
- Sample description and if necessary, condition of it
- Date of sampling and receipt
- Date the test was performed
- Date report was issued
- A statement that the results relate only to the items tested as received
- Units of measure, where appropriate
- Deviations from the method
- Reports from Subcontract Laboratories included as they were received

The laboratory is responsible for information provided in the report, except when information is provided by the customer. Data provided by the customer will be clearly identified. A narrative will be added to the report information supplied by the customer can affect the validity of the results.

12.3.4.1 The QA Manager will periodically review test reports in compliance to AIHA-LAP, LLC LQSR prior to issuance and document this review via a tracking spreadsheet and by

adding a comment to the work order.

12.3.4.2 Abnormal values are carefully scrutinized, and samples are reanalyzed if the abnormalities cannot be explained.

12.3.4.3 If the results from spiked samples suggest interferences (low or high bias), attempts are made to remove the interferences, or the data is flagged and/or a project narrative is included with the report. Laboratory qualifiers are defined as follows:

* - Value exceeds maximum contaminant level
B - Analyte detected in the associated method blank
BRL - Below Reporting Limit
E - Estimated (Value reported above quantitation range)
H - Holding times for preparation or analysis exceeded
J - Estimated value detected below Reporting Limit
N - Analyte not NELAC (TNI) certified
Narr - See Case Narrative
NC - Not Confirmed
R - RPD outside accepted recovery limits
Rpt Lim - Reporting Limit
S - Spike recovery outside accepted recovery limits
> - Greater than Result value
< - Less than Result value

12.3.4.3 Clients are instructed to provide sufficient sample for the analysis of Matrix Spike and Matrix Spike Duplicate analysis, however there are times when the laboratory does not receive sufficient aqueous sample volume to perform these analyses. If an aqueous sample batch is analyzed without the inclusion of a spike/spike duplicate sample(s), this fact is added to the report narrative per TNI requirements. Example verbiage is as follows:

The TNI requirement for the analysis of a matrix spike/matrix spike duplicate could not be performed on Batch (#) due to insufficient sample volume submitted.

12.4 Special Project or Data Package Review

If the client requests special handling and/or data packages, the Laboratory Director, Technical Director, or Quality Assurance Manager may also review the project report and the raw data. This review includes checking holding time requirements and calibrations, reviewing all quality control data and/or control charts, and initiating any corrective actions or re-analyses that might be appropriate.

12.5 Quality Control Reports

AES, Inc. offers four levels of quality control reporting. Each level contains all the information provided in the preceding level, in addition to its own specific requirements. The quality control packages provide data in the following levels:

12.5.1 Level I - method references, preparation and analysis dates, surrogate(s) recoveries and reporting limits.

12.5.2 Level II - Level I information plus results for the blank, LCS and MS/MSD and sample duplicates.

12.5.3 Level III - Level I and II information plus all raw data associated with sample preparation, instrument calibration (if applicable) and sample analysis.

12.5.4 Level IV - Level I, II and III information in a CLP “look-alike” format, and all sample raw data.

12.6 Reporting Criteria

The final report is printed and signed by the Laboratory Manager, the Director of Project Management or a Project Manager after all review has been completed. The Laboratory Manager, the Director of Project Management and Project Managers serve as designees for technical director for report signing. The data flags that may appear in a project report are defined and any additional comments are included in the Case Narrative.

12.6.1 If requested by the client or a project specific QA Plan, custom reports or data packages can be provided. When data packaging is requested, a paginated data package is provided in addition to the project report. The format of the project report and/or data package can be adjusted to meet the needs of the client. All LIMS reports can be downloaded onto diskettes or to most clients' computers.

12.6.2 When the project report must meet TNI requirements, the report will include a certification statement indicating the results meet TNI standards, an estimated uncertainty statement, and a format that includes the total number of pages in the report.

12.6.3 AES, Inc., will not intentionally divulge to any person (other than a client or person designated by a client in writing) any information regarding the services provided by AES or any information disclosed to AES by the client unless required by law or authorized contractual arrangement. In these instances, the client will be notified unless prohibited by law. Any information *known* to be potentially endangering to national security or any entity's proprietary rights will NOT be released.

12.6.3 Test results are reported according to client requirements. If a client requests to have reports or information sent by fax, the client is notified in advance of the transmission, whenever possible, and all documents include a cover sheet with the following statement:

NOTICE OF CONFIDENTIALITY

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12.7 Record Keeping

Procedures are in place to ensure that all records required under TNI Chapter 5 and AIHA-LAP, LLC program requirements are retained. The laboratory maintains a record keeping system that can produce unequivocal, accurate records that document all laboratory activities.

12.7.1 When an analytical batch is prepped and analyzed, the analyst enters the data into the LIMS system and gives the raw data, quality control data and a copy of the prep log (if applicable) to the department manager to review.

12.7.2 Any problems encountered during sample preparation and analysis are corrected and brought to the attention 12.8.1 Sample Preparation, E of the department manager.

12.7.3 Once the department manager has reviewed the data, it is validated in the LIMS system for reporting to the client.

12.8 Records of Analysis

12.8.1 Sample Preparation, Extraction, Distillation, and Digestion

All steps of the preparation, extraction, distillation and/or digestion of samples are thoroughly documented. Documentation is determined by the QA Manager, Laboratory Manager, and the Technical Director and includes (if applicable):

12.8.1.1 Standard Identification

12.8.1.2 Dilution Factors

12.8.1.3 Sample Identification

12.8.1.4 Reagent Identification

12.8.1.5 Date the extraction, digestion, and or analysis was performed

12.8.1.6 Initials of the analysts performing the digestion, extraction, and or analysis

12.8.1.7 Volume/weight of sample used

12.8.1.8 Final volumes/weights

12.8.1.9 Initial and final review signatures, where required

12.8.1.10 Instruments used

12.8.2 Preparation of Standards and Reagents

12.8.2.1 The preparation of all standards and reagents are documented. The lot numbers of all standards associated with a particular project are traceable either through the instrument logbook, a QC check list, a worksheet, or another approved document.

12.8.2.2 Original vendor Certificates of Analysis are distributed by the Shipping and Receiving Office to the intended departments.

12.9 Standard and Reagent Traceability

Standards and reagents are tracked in the LIMS chemical inventory system for traceability and auditing purposes. The method of standard and reagent tracking is outlined in the subsequent sections.

12.9.1 When a standard/reagent is needed that is not already on the approved vendor/materials order list, supervisors forward purchase requests to the Technical Director and/or Laboratory Manager for approval. The standard/reagent is ordered from a reputable vendor (AES typically uses VWR). The laboratory attempts to use certified reference materials from providers who conform to ISO Guide 34.

12.9.2 The information supplied to the Technical Director and / or Laboratory Manager must have the supplier standard or reagent name, order number, size or amount of each unit, grade or purity, price, if possible, and quantity. Upon receipt, supplies (and services) are reviewed to ensure they comply with requirements. When a vendor has been approved for services, a note is placed in the comments field of the Vendors database within LIMS.

12.9.3 When the standard or reagent arrives, it is logged into the LIMS, usually by the department supervisor or by the sample custodian. All reagents and standards received are electronically tracked and documented by computer via the Laboratory Information Management System.

12.9.4 Each standard or reagent is given a unique chemical inventory number upon receipt. The next

available number in the LIMS is automatically assigned, starting with #5001. The computer entry is completed by entering the correct information in the required fields.

12.9.4.1 The expiration date for neat standards and reagents is determined using the manufacturer's expiration date, if available. Otherwise, a 1 year expiration date is assigned to volatile organic compounds and standards and 5 year date for acids, dry chemicals, solvents, reagents, and other chemicals. Each standard and reagent is clearly and permanently labeled with its expiration date in indelible ink. The assigned expiration date for intermediate standards will not exceed the manufacturer's expiration date of the stock standard.

12.9.4.2 Secondary standard containers are labeled with the corresponding LIMS tracking number of the source material, the date the contents were prepared, the six month expiration date, the name of the analyte(s), the concentration of each component of the solution, the matrix and the initials of the person who prepared it.

12.9.4.3 The chemical inventory number must appear on both the standard and reagent container, and the upper, right-hand corner of the certificate of analysis. It must also be included, if applicable, in standard/preparation, analyses or sample preparation log books.

12.9.4.4 Secondary standard labels include the LIMS chemical inventory number, the standard name, intended use (spiking, surrogate, reference or calibration solution), and concentration with units, matrix, expiration date and initials of the person who prepared it. As long as this is available, all other information can be found in the LIMS.

12.9.5 Spiking, surrogate, reference and calibration solutions and calculations are recorded in the appropriate "Standard/Preparation Log Book." Logbooks cover the following areas: Organics, Organics Preparation, Semi-Volatile Organics, Microbiology, Metals, Mercury & Wet Chemistry.

12.9.6 Some containers such as standards containers for organics are small and there may not be enough room to list all of the required information on the container. Should this occur, it is permissible to attach a label to the bottle.

12.9.7 When a standard or reagent is added to a sample for any reason, the LIMS chemical inventory number of that standard or reagent and the amount added must be recorded in the appropriate logbook. For example, if a stock standard MET #33-89-5431 of 1000 mg/L is diluted to 100 µg/L, the following line is entered: 1 ml MET #33-89-5431 to 100 ml DI water, 1 ml of 100x to 100 ml DI water, final conc. = 100 µg/L. (NOTE: "MET #33-89-5431" = Metals Department Standard/ Preparation Log Book 33, page 89, LIMS Chemical Inventory Number 5431).

12.9.8 If the standard is used as a stock standard and aliquots of it are diluted to produce working standards, the stock standard's LIMS chemical inventory number is used. The standard concentration or a designator such as "1" or "A" is used to differentiate between each serial dilution.

12.10 Standard Verification

12.10.1 Certificates of Analysis

12.10.3.1 Each department is responsible for maintaining all certificates of analysis received with its standards and reagents. The LIMS-assigned chemical inventory number is written in the upper, right-hand corner of each COA. The certificates are maintained on the portal server. The certificates are held for a minimum of five years.

12.10.3.2 Most accrediting authorities require that a certificate of analysis is kept on file for all standards used in the laboratory. If at all possible, a certificate for reagents should also be obtained. This documentation serves two purposes; 1) it gives further traceability for the

standard or reagent, and 2) it provides a manufacturer's guarantee that the standard is comprised of the compounds at the levels listed.

12.11 Estimation of Uncertainty (for AIHA-LAP, LLC accreditation)
Estimation of Uncertainty is the parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurement. A reasonable 'Estimation of Uncertainty' shall be based on knowledge of the performance of the method and on the measurement scope and shall make use of, for example, previous experience and validation data. It is monitored by the monthly checks, proficiency exam results and error rates. The estimate of day-to-day precision is determined by comparison of duplicate samples (or matrix spike duplicates). Results of the two analyses are compared by their relative percent difference, RPD: (A-B) / (Average of A and B)

Estimation of Uncertainty Limits may be method / program specified (e.g. AIHA-LAP, LLC ELLAP) or based on historical laboratory limits. Interim limits are used until enough data points have been generated to set representative limits. The actual limits are calculated annually and are posted on the portal server.

Estimation of Uncertainty Policy follows the AIHA-LAP, LLC Accreditation Program requirements with respect to the estimation of uncertainty measurement for tests associated with their scope of accreditation. The requirement which underlies this policy is found in ISO/IEC 17025:2017, Section 7.6).

AIHA-LAP, LLC Uncertainty and Uncertainty Limits Determinations
The Measurement Uncertainty (or Uncertainty of Measurement) is the result of the evaluation aimed at characterizing the range within which the true value of a test result is estimated to lie, generally within a given likelihood. Non-negative parameter characterizing the dispersion of the quantity values being attributed to the measurand, based on the information used.

12.11.1 Definitions of Terms used by the laboratory

Bias is the total systematic error manifested as a consistent positive or negative deviation from the true value.

Measurand is the quantity intended to be measured or analyte concentration.

Precision is the closeness of agreement between measured quantity values obtained by replicate measurements under the same conditions. Precision is commonly expressed as standard deviation or relative percent difference and can be evaluated by the analysis of duplicate samples or duplicate sampling media spikes.

Type A evaluation of measurement uncertainty: Evaluation of a component of measurement uncertainty by a statistical analysis of measured quantity values obtained under defined measurement conditions. This approach uses existing data from routine laboratory quality control samples such as certified reference material, laboratory control samples, duplicates, or data from method validation studies and proficiency testing (PT) study results.

Type B evaluation of measurement uncertainty: Evaluation of a component of measurement uncertainty determined by means other than a Type A. This approach involves the estimation and compilation of individual uncertainties for each contributing measurement.

Contributors to consider for measurement uncertainty are listed in Table 12-1.

12.11.2 The laboratory utilizes Type A approach for the Estimation of Uncertainty. One or more of the following options are utilized:
12.11.2.1 Uncertainty specified within a standard method. In those cases where well recognized test

method (such as NIOSH, OSHA, etc. method), specifies limits to the values of the major sources of uncertainty of measurement and specifies the form of presentation of calculated results, laboratories need not do anything more than to follow the reporting instructions as long as they can demonstrate they follow the reference method without modification and can meet specified reliability.

12.11.2.2 Laboratory Control Samples (LCS) and Matrix Spikes. In cases where matrix specific LCS (CRM or media spikes) and/or matrix spike data are available, include uncertainty estimated from the standard deviation of long term data collected from routine sample runs for existing test methods or from the standard deviation of the LCS or matrix spike data for method validation/verification studies for new test methods.

12.11.2.3 Duplicate Data. In cases where sub-sampling occurs and there are data over the reporting limit, include uncertainty estimated from long term duplicate data collected from routine sample runs for existing test methods or method validation/verification studies for new test methods.

12.11.2.4 Proficiency Testing (PT) Sample Data. In cases where the previous options are not available and where PT samples are analyzed with sufficient data above the reporting limit, pooled PT sample data can be used to estimate uncertainty.

12.11.3 Uncertainty determinations specific to each type of testing for AIHA-LAP, LLC is as follows:

12.11.3.1 Industrial Hygiene Chemical/Gravimetric Analysis.
The laboratory uses the Type A approach to Measurement Uncertainty. Acceptance limits are determined using historical LCS (CRM or media spikes) data for each procedure/target analyte. Once at least twenty values are available, the mean and standard deviation of the data set are calculated. Bias is noted and available for reporting. The data is evaluated for outliers using standard Grubbs Outlier calculations with statistical outliers omitted. Control limits are set at ±3 standard deviation and for measurement uncertainty k=2, or ± 2 standard deviation are used.

Where target analyte spiking is not applicable such as for gravimetric testing, only precision limits are used for uncertainty determinations. If less than 50 points are available for calculation, the limits are considered interim limits.

12.11.3.2 Industrial Hygiene Asbestos by PCM Analysis. Ranges of uncertainty for IH asbestos by PCM testing are determined for precision only using daily reference slide and blind recount analyses as described below.

12.11.3.2.1 The laboratory's set of reference slides includes slides from previous PAT rounds, Round Robins and field samples. The laboratory acceptance limits are determined from data accumulated from blind recounts of these reference slides and established at 95% confidence limits. From blind repeat counts of reference slides, Sr values obtained for 3 following ranges: 5-20 fibers in 100 graticule fields; 20.5-50 fibers in 100 graticule fields; 50.5-100 fibers in 100 graticule fields.

12.11.3.3 Environmental Lead Analysis for reporting under the ELLAP Program. Ranges for uncertainty for ELLAP testing for precision and accuracy are determined by the laboratory. Monitoring of method performance and bias is accomplished using statistical process control (charts or database) for monitoring AES laboratory performance with QC sample analysis (LCS/LCSD, MS/MSD). SOPs (Sec. 13) for Lead in Paint, Lead in Wipes, Lead in Soil (SW 7000D), and Lead in Airborne Dust describe the required minimum performance criteria for QC sample analysis and the method performance for the laboratory. Method performance and bias are evaluated on an annual basis by the QA Manager. If the calculated limits are outside those

listed in Table 3 of the current LQSR, an evaluation of them will be performed. All monitoring data in the form of control charts are maintained/posted to the portal server, the laboratory's archival system.

12.11.3.4 Quantifiable Fungal Analysis for reporting under the EMLAP Program. Ranges for uncertainty for quantifiable fungal testing are determined for precision only. Duplicate samples are counted for at least 5% of samples for inter-analyst precision monitoring and replicates samples are counted by different analysts for intra-analyst precision monitoring. Uncertainty ranges are determined using the mean of the range of the logarithm of each count obtained from a minimum of 20 duplicate/replicate pairs. This mean value is multiplied by 3.27 to obtain the final control limit. Once the control limit is determined, the logarithmic range for each ongoing duplicate/replicate pair is determined and must be < control limit value. Specific information used for control limits for each individual EMLAP test method are provided in Table 5-1.

The lab determines the measurement of uncertainty associated with Spore Trap Analysis by using the Type (A) methodology. QC reference slides are used that have varying spore count levels. 30 data points are used for each QC slide. From these counts the Mean and Standard Deviation are determined. Then the Coefficient of Variation (CV) is calculated for each set of data by dividing the standard deviation by the mean. Then the pooled CV is calculated by adding the squares of the CV values, averaging them and taking the square root. The expanded Measurement of Uncertainty (MU) is calculated by multiplying the pooled CV value by the appropriate coverage factor k. For a confidence level of 95%, k is approximately 2 for a data set of 30 points or more. This RSD value is then multiplied by the calculated or observed value of the sample to be expressed as a measurement of uncertainty. When reporting results for expanded Measure of uncertainty the test results and the expanded measurement of uncertainty are expressed in the same units.

Example with a calculated CV pooled of 0.114:

Expanded MU @ 95% C.L. (k=2) equals CV *pooled (.114)* X 2 = 0.23 (23% RSD)

Bias cannot be determined. No quantitative reference material available
Example analytical uncertainty for air sample with 500 spores/m3:

Expanded analytical uncertainty = 500 spores/m3 X 0.23 = 115 spores/m3
Example of reporting for air sample with 500 spores/m3:

500 spores/m3 with an analytical uncertainty of +/- 115 spores/m3 at the 95% confidence level

12.11.3.5 Qualitative Fungal Analysis for reporting under the EMLAP Program. In order to monitor consistency with regard to genus/species identification, acceptability criteria for taxon identification and taxon abundance ranking are described below. These are laboratory determined; interim criteria as no regulatory guidance or method specified criteria are available.

12.11.3.5.1 Taxon identification acceptability: On the replicate and duplicate analyses, daily reference slide analyses, monthly reference culture analyses and round robin study analyses with at least 3 different organisms present, 60% of all genus/species of fungi and/or genus/group of fungi identified on the original sample at levels >10x LOD should also be identified on the recount.

12.11.3.5.2 Taxon abundance ranking acceptability: On the replicate and duplicate analyses, daily reference slide analyses and round robin study analyses, the top three genus/species of fungi and/or genus/group of fungi by abundance and >10x LOD will be ranked. The recount data should identify these same fungi for the identification to be considered acceptable.

12.11.3.5.3 Consistent fungal ID is also monitored through participation in the Direct Exam Fungal Analysis PT programs administered by EMLAP. Acceptability limits are currently set at 85% correct identification by AIHA-LAP, LLC.

12.11.3.5.4 It should also be recognized that other, non-quantifiable factors may also add additional uncertainty. These factors may include media selection, organism competition, etc. and are not directly measurable.

12.11.4 The reporting procedure.

Typically, measurement uncertainty is reported per the client's request or when the *known compliance* to a specification limit is affected. The result and the expanded measurement uncertainty are reported in the same units. Both the result and expanded measurement uncertainty will be rounded to the same number of significant figures.

12.11.4.1 Reporting test results the Expanded Measurement Uncertainty

When the reporting of uncertainty is required or requested by a client to be included in the analytical report, the test result and the expanded measurement uncertainty will be reported in the same units. The test result and the expanded measurement uncertainty should both be rounded in a similar manner, meaning the same number of significant figures. A description of the coverage factor should be included as in the following example:

Total Lead in Air concentration of 50 ug/sample ±5.3 ug/sample at 95% confidence level (k=2)

Where bias is present, report it along with the uncertainty as a probable bias such as:

Total Lead in Air concentration of 50 ug/sample ±5.3 ug/sample at 95% confidence level (k=2) This method has an average recovery of 99 %, or a probable bias of -0.5 ug/sample.

An example template for the expanded measurement uncertainty calculation is in Table 12-2.

Table 12-1 Contributors to Measurement Uncertainty (Applicable AIHA-LAP, LLC methods SW700B, N7082, N7300, and N7303)

Example of Contributors to Measurement Uncertainty Chemical Analyses of Lead (Pb) using ICP-AES and FAA See Example Calculations (to the right of the table)

Contributors to Uncertainty	Representative and Applicable QC Data	Comments to Clarify Contributor Effects
Transportation/Storage/Handling		
shipping time, container & temperature	NA	No impact on bulk paint samples from transportation, storage or normal handling
lab storage time, conditions & temperature	NA	
contamination in lab storage areas	NA	
Laboratory Subsampling		
sample nonhomogeneity	DUP	Sample composition, etc.
blending techniques	DUP	Stirring, sieving, grinding, etc
sample size	DUP	Large enough to allow adequate subsampling
Sample Preparation:		
volumetric glassware	LCS, DUP	NA for Class A; applies for graduated tubes or cylinders, etc.
dispensing device	LCS, DUP	pipettes, and other types of dispensers not Class A
balance	LCS, DUP	balance error is often insignificant compared to other MU sources
temperature	LCS, DUP	Hot plate or ashing temperatures
sample extraction	LCS, DUP	Applies to LCS or DUP if goes through sample preparation
extractant background	LCS, DUP, MB	Analyte or interferant in acids, or other reagents
Lab Environmental Conditions:		
temperature variance	NA	No impact on bulk paint samples
humidity variance	NA	No impact on bulk paint samples
Analysts:		Analyst contributors affect all aspects of analysis from subsampling through data manipulation
different analysts	LCS, DUP	
analyst training level & experience	LCS, DUP	
data interpretation by analyst	LCS, DUP	
Measuring Instruments:		
instrument stability	LCS	Baseline drift, repeatability of averaged readings, etc
carry over effects	LCS, DUP	Impact of high samples on following sample readings; can be monitored by proper use of CCBs
day to day calibration differences	LCS	
interferences	DUP, MS	Due to matrix, inter-element effects, etc. Cannot be routinely determined for typical industrial hygiene sampling media
Calibration Standards/Reference Materials:		
preparation variances	LCS, DUP	Due to analysts, balances, dispensing devices used, etc
calibration stock material uncertainty	CERTIFICATE	Obtain from certificate or estimate
LCS reference material uncertainty	NA	Sample results not corrected for LCS recovery

Test Procedure Variations		
variation within and between reagent lots	LCS	Similar to extractant background effects under Sample Preparation above
extraction or digestion times and temps	LCS	May affect complete dissolution of analyte or loss of material in some cases
sample dependent modifications	LCS	Changes in conditions due to sample size, customer requests, etc
desorption efficiencies within and between lots for sorbent tubes	NA	
Data Manipulation:		
sampling media blank correction	NA	No sampling media with bulk samples
instrument blank correction	LCS	when allowed
Accuracy of calculations	LCS	Manual, spreadsheet, LIMS, etc

DUP = Duplicate, resulting from sub-sampling of a bulk (NOTE: NOT LCS/LCSD duplicate spiked sampling media)
FB = Field Blank
FS = Field Spike
LCS = Laboratory Control Sample, matrix matched and typically taken through the entire analytical process, with each sample batch
MB = Method or matrix blank
NA = Not Applicable

Table 12-1 Contributors to Measurement Uncertainty (AIHA-LAP, LLC methods Air SOPs MB-15019, MB-15022, MB-15028; Bulk SOPs MB-15020; and Surface Direct (SOP MB-15020) Exam

Example Contributors to Measurement Uncertainty – Direct Air Environmental Microbiology Analyses
(representative list - may not include of all contributors)
(QC sample types in this list are typical of those utilized in AIHA-LAP, LLC laboratories) See Example Calculations (to the right of the table) and tabbed sheets for additional examples

Contributors to Uncertainty	Representative and Applicable QC Data	Comments to Clarify Contributor Effects
Temperature, Storage, Handling:		
shipping time, container & temperature	NA	No impact on direct air exam samples
lab storage time, conditions & temperature	NA	No impact on direct air exam samples
contamination in lab storage areas	NA	No impact on direct air exam samples
Laboratory Subsampling:		
sample nonhomogeneity	NA	Not applicable to direct air exam samples
blending techniques	NA	Not applicable to direct air exam samples
sample size	NA	Not applicable to direct air exam samples
Sample Preparation:		
slides & coverslip contamination	MB	With proper care there should be no contamination of daily blanks; therefore, no impact
mounting medium	MB	With proper care there should be no contamination of daily blanks; therefore, no impact
Lab Environmental Conditions:		
seasonal background spore variances	MB	Samples are not exposed to air for any length of time; therefore there should be no impact
Analysts:		
different analysts	RS	Reference slides analyzed by multiple analysts
analyst training level & experience	RS	Reference slides analyzed by multiple analysts
data interpretation by analyst	RS	Reference slides analyzed by multiple analysts
Measuring Instruments:		
microscope magnification level used	RS	Reference slides analyzed with multiple microscopes
eye piece graticule & field of view calibration	RS	Reference slides analyzed with multiple microscopes
Test Procedure Variations:		
portion and fields of sample analyzed	RS	Varies by analyst
microbial density	RS	High concentrations or clumps of spores may impact results
interferences	RS	Debris level and resolution of spores in field of view
ranges (high, medium, low)	RS	Uncertainty may be concentration dependent. Lab should evaluate this as part of method validation.
Data Manipulation:		
reading, interpreting & reporting results	RS	
Accuracy of calculations	RS	Manual, spreadsheet, LIMS, etc
area or air volume sampled	NA	Typically provided by the customer. This is not part of analytical uncertainty, but must be considered by labs providing sampling and providing combined sampling and analytical uncertainty.

MB = Daily method blank
RS = Daily reference slides

Please note that the original column I (CV of the pair) of the "culturable analyses" tabbed worksheet had a formula incorrectly entered. The worksheet has been corrected and any affected values have been highlighted in yellow.

Table 12-2 Expanded Measurement Uncertainty Calculation Template

Examples of Analytical Measurement Uncertainty for Metals in Air

Metals in Air using hotblock acid digestion and ICP-AES Analysis by NIOSH 7300M/7303 Target LCS Recovery of Lead in Air AES 18434 at 50.0 +/- 0.40 ug, Total

Sample duplicate data in ug, Total for Metals in Air using hotblock acid digestion and ICP-AES by NIOSH 7300M/7303

Lead

LCS ug, Total	True value ug, Total	LCS % Rec	ug, Total LCS	ug, Total LCSD	Std Dev (S)	CV	CV2
51.9	50.0	103.8	51.9	52.9	0.7071	0.0135	0.0002
49.6	50.0	99.2	49.6	48.7	0.6364	0.0129	0.0002
48.5	50.0	97.0	48.5	50.6	1.4849	0.0300	0.0009
49.2	50.0	98.4	49.2	48.2	0.7071	0.0145	0.0002
50.9	50.0	101.8	50.9	51.7	0.5657	0.0110	0.0001
51.4	50.0	102.8	51.4	47.7	2.6163	0.0528	0.0028
47.4	50.0	94.8	47.4	47.1	0.2121	0.0045	0.0000
47.2	50.0	94.4	47.2	49.8	1.8385	0.0379	0.0014
47.6	50.0	95.2	47.6	47.8	0.1414	0.0030	0.0000
50.0	50.0	100.0	50.0	50.4	0.2828	0.0056	0.0000
50.2	50.0	100.4	50.2	50.8	0.4243	0.0084	0.0001
47.1	50.0	94.2	47.1	46.8	0.2121	0.0045	0.0000
48.3	50.0	96.6	48.3	46.0	1.6263	0.0345	0.0012
46.3	50.0	92.6	46.3	48.2	1.3435	0.0284	0.0008
45.8	50.0	91.6	45.8	49.1	2.3335	0.0492	0.0024
51.0	50.0	102.0	51.0	53.1	1.4849	0.0285	0.0008
47.9	50.0	95.8	47.9	47.7	0.1414	0.0030	0.0000
55.8	50.0	111.6	55.8	55.4	0.2828	0.0051	0.0000
47.8	50.0	95.6	47.8	49.3	1.0607	0.0218	0.0005
50.3	50.0	100.6	50.0	49.9	0.0707	0.0014	0.0000
52.6	50.0	105.2	52.6	49.0	2.5456	0.0501	0.0025
49.8	50.0	99.6	49.8	49.2	0.4243	0.0086	0.0001
48.5	50.0	97.0	48.5	51.8	2.3335	0.0465	0.0022
50.2	50.0	100.4	50.2	47.2	2.1213	0.0436	0.0019
49.2	50.0	98.4	49.2	49.8	0.4243	0.0086	0.0001
52.2	50.0	104.4	52.2	49.2	2.1213	0.0418	0.0018
48.1	50.0	96.2	48.1	48.2	0.0707	0.0015	0.0000
49.2	50.0	98.4	49.2	47.8	0.9899	0.0204	0.0004
48.1	50.0	96.2	48.1	46.7	0.9899	0.0209	0.0004
52.7	50.0	105.4	52.7	48.4	3.0406	0.0601	0.0036
	30 point Mean % Rec.	99.0				$\sum CV^2$	0.0246
	30 point Std Dev	4.4			CV *pooled* =	$\sqrt{(\sum CV^2/30)}$ =	0.0287
	RSD	4.4%					

Combined Rel. Std Dev (SDc) = √ [$SD1^2$ + SD 2.87% RSD

$SDc = \sqrt{[(4.4)^2 + (2.87)^2]} = 5.25\%$

Expanded MU @ 95% Conf (k=2) = 10.5%

Bias @ 99.0% Rec of LCS = -1.0%

Example analytical uncertainty for 50 ug, Lead in Air sample:
Expanded analytical uncertainty of 50 ug, Lead in Air = 50 X 0.105 = 5.25 ug, Total

Bias = 50 ug, Total X -0.010 = 0.500 ug, Total

Example of reporting for 50 ug, Total of Lead in Air:
50 ug, Total of Lead in Air with an analytical uncertainty of +/- 5.3 ug, Total at the 95% confidence level and a probable bias of -0.50 ug, Total

Table 12-3
Estimation of Uncertainty Requirements for non-AIHA-LAP, LLC

Method	Uncertainty Based On
SM2120B Color	NA
E120.1 Conductivity	Method Limits
SM4500H+B pH	NA
SM2540C TDS	NA
SM2540D TSS	NA
SM2540B TS	NA
E160.4 VS	NA
SM2540F Settleable Solids	NA
E1664B Oil and Grease_TPH	Method Limits
E180.1 Turbidity	Method Limits
E200.7 ICP AES Metals	Method Limits
E200.8 ICP MS Metals	Method Limits
E245.1 Mercury	Method Limits
E300.0 Anions by IC	Method Limits
SM2310 B Acidity	NA
SM2320 B Alkalinity	Method Limits
SM4500Cl G Residual Chlorine	Method Limits
SM4500CN G Amenable Cyanide	Method Limits
SM4500CN E Total Cyanide	Method Limits
E350.1 Ammonia	Method Limits
E351.2 TKN	Method Limits
E353.2 Nitrate_Nitrite	Method Limits
SM4500NO2B Nitrite	Method Limits
SM4500O G Dissolved Oxygen	NA
E365.1 Ortho Phosphorus	Method Limits
E365.1 Total Phosphorus	Method Limits
E365.3 Ortho Phosphorus	Method Limits
SM4500S2F Sulfide	Method Limits
SM4500SO3 B Sulfite	NA
SM5210B BOD	Method Limits
E410.4 COD	Method Limits
SM5310B TOC	Method Limits
E420.1 Total Phenolics	Method Limits
E420.4 Total Phenolics	Method Limits
SM5540C MBAS Surfactants	Method Limits
E615 Herbicides	Historical Limits
E624.1 VOCs	Method Limits
E625.1 SVOCs	Method Limits
FL-PRO	Method Limits
RSK-175 Dissolved Methane, Ethane, Ethene	Method Limits

Method	Uncertainty Based On
SM10200H Chlorophyll	Historical Limits
SM2340B Hardness	Method Limits
SM2540G Total, Fixed and Volatile Solids	NA
SM3500Cr B Hexavalent Chromium	Method Limits
SM3500Fe B Ferrous Iron	Method Limits
SM5210B CBOD	Method Limits
SM9222B Total Coliforms	NA
SM9222D Fecal Coliforms	NA
SM9223B E.Coli	NA
SW1010 Flash Point	NA
SW1030 Ignitability	NA
SW1311 TCLP	Historical Limits
SW1312 TCLP	Historical Limits
SW6010 ICP AES Metals	Method Limits
SW6020 ICP MS Metals	Method Limits
SW7.3 Reactive Cyanide	Method Limits
SW7.3 Reactive Sulfide	Method Limits
SW7196 Hexavalent Chromium	Method Limits
SW7470 Mercury in Water	Method Limits
SW7471 Mercury in Soils	Method Limits
SW7473 Mercury in Soils	Method Limits
SW8011 EDB DBCP	Historical Limits
SW8015 DAI	Historical Limits
SW8015 DRO	Historical Limits
SW8015 GRO	Historical Limits
SW8081 Pesticides	Historical Limits
SW8082 PCBs	Historical Limits
SW8151 Herbicides	Historical Limits
SW8260 VOCs	Historical Limits
SW8270 SVOCs	Historical Limits
SW8310 PAHs	Historical Limits
SW8315 Formaldehyde and Acetaldehyde	Historical Limits
SW9010_9012 Cyanide	Method Limits
SW9010_9014 Cyanide	Method Limits
SW9030_9034 Sulfide	Method Limits
SW9038 Sulfate	Method Limits
SW9040 pH in Water	NA
SW9041 pH by Paper	NA
SW9045 pH in Soil	NA
SW9050 Conductivity	Method Limits
SW9056 Anions by IC	Method Limits
SW9060 TOC	Method Limits

Method	Uncertainty Based On
SW9065 Total Phenolics	Method Limits
SW9070 Oil and Grease_TPH in Water	Method Limits
SW9071 Oil and Grease_TPH in Soils	Method Limits
SW9081 Cation Exchange Capacity (Sodium)	NA
SW9095 Free Liquids by Paint Filter	NA
TO-14A, TO-15	Method Limits

12.12 Recommended Storage Conditions

The locations for the storage of all standards, reagents, and working solutions are based upon compatibility of the material with other materials, flammability, and intended use of the material. The following general guidelines apply to the storage of standards and reagents.

12.12.1 The locations for the storage of all standards, reagents, and working solutions are based upon compatibility of the material with other materials, flammability, and intended use of the material. The following general guidelines apply to the storage of standards and reagents.

12.12.2 The recommended storage conditions are included in the chemical inventory of LIMS when adding information pertaining to new standards and reagents.

12.12.3 Each department maintains storage locations for standards, reagents, working solutions, and samples. Department supervisors ensure that all chemicals are properly kept. Department supervisors periodically audit storage areas for possible hazards and violations.

12.12.4 Samples are never stored in the same location as standards or reagents.

12.12.5 The following major categories of chemicals, compressed gases, and samples determine standard and reagent storage conditions in the laboratory:

12.12.5.1 Flammables

12.12.5.2 Oxidizer

12.12.5.3 Acids

12.12.5.4 Bases

12.12.5.5 Compressed flammable gas cylinders

12.12.5.6 Compressed non-flammable gas cylinders

12.12.5.7 VOC Samples

12.12.5.8 Inorganic and SVOC Samples

12.12.6 The certificate of analysis or Material Safety Data Sheet provides relevant information regarding recommended storage conditions for all standards and reagents.

12.13 Handling Standards and Reagents

12.13.1 Safety glasses and latex type gloves must be worn at all times when handling chemicals, samples, standards or reagents. A lab coat is also highly recommended. Closed-toe shoes and clothing that cover the legs (no shorts or dresses) must be worn whenever an analyst is working in the lab.

12.13.2 The toxicity or carcinogenicity of each reagent used in the laboratory has not been fully established. Each chemical should be regarded as a health hazard and exposure to it should be

kept as low as reasonably possible. All health and safety concerns for these and any other chemicals are listed in the Material Safety Data Sheets (MSDS) provided by the supplier or manufacturer of these chemicals. A copy of any MSDS is available for review at any time in notebooks maintained in the Sample Receiving Department.

12.13.3 Proper disposal of all wastes is essential. Containers are provided for all waste according to the type. Follow the waste disposal guidelines found in Section 17.0 for disposing of chemicals.

12.14 Record Keeping Definitions

12.14.1 Prep Log: A prep log is defined as a log of the preparation process that is applied to samples before they are analyzed. This log includes initial volume/weight, final volume, date prepped, batch number, spike amount, all spike information and any comments pertaining to the sample preparation.

12.14.2 Back Log Report: A backlog report is defined as a list of all the samples that need to be analyzed for a specific department. This list is generated from the LIMS system. The list is used by each department manager to create a batch for analysis.

12.14.3 Extraction or Digestion Log: An extraction or digestion log is defined as a log of samples that are either extracted or digested for subsequent analysis. This log includes initial volume/weight, final volume, date prepped, batch number, spike amount, all spike information and any comments pertaining to the sample preparation.

12.15 Procedures for Record Keeping

12.15.1 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data. All raw data (including Quality Control information) from the instrumentation is both posted to the laboratory archive system, referred to as the "Portal Server", and backed up weekly by the IT Department. In addition, instrument sequences are posted to the portal server by instrument, year, month, and sequence. Prep log sheets are posted by batch number, while logbooks are additionally scanned and posted by the QA Department as a backup copy. In addition, electronic data associated with each instrument is periodically stored off site.

12.15.1.4 Project Management: Each project manager has a project folder with the COC and sample receipt checklist (SRCL) in their office until the project is completed. Once the project is completed, either a hardcopy or PDF file of the report and invoice are printed, along with a cover letter and case narrative (if necessary). If everything is correct, the project is reported to the client via email or hardcopy mailing. The PDF files of the COC, Sample Receiving Checklist and invoice are posted to the portal server by work order number, year, and month. Any revisions are posted in the same folder with the revision having "REVISON" in the file name. The reason for the change needs to be documented in the narrative. The reason for the change needs to be documented in the narrative. The reason for the change needs to be documented in the narrative. If the client requires an Electronic Disc Deliverable (commonly referred to as an EDD) or a Data Package, this information is also posted on the Portal Server. Reports are kept for five years.

12.15.1.5 LIMS System: The LIMS system holds all the information relevant to each project that is received at the laboratory, including all client information, and prep and analysis information for each test preformed. LIMS data is backed up daily onto CDs. Copies are stored both on and off site.

12.15.1.6 Entries in manually recorded records are not obliterated by methods such as erasures, overwriting, whiteout or markings. All corrections to record-keeping errors are made by

one line marked through the error. The individual making the correction initials and dates the correction.

12.15.1.7 Corrections to electronic records are made by a manual notation that indicates the change to the record. This notation is kept with the affected record.

12.16 Record Storage

12.16.1 All records for each project that is received at the laboratory must be held for a minimum of five years (also, now 5 years for lead analysis records per AIHA-LAP, LLC). Final reports are maintained electronically on computer hard drives and daily back-up tapes.

12.16.3 Electronic records are stored by department on the laboratory's portal server after scanning or converting the documentation to a PDF file format using Adobe Acrobat®. Customer Service stores the client reports by work order number. Laboratory data is downloaded and stored by department (Asbestos, Inorganic Chemistry, Metals, Microbiology, Sample Prep, Semi-Volatile Organics, Volatile Organics, and Wet Chemistry). Data contained in the Laboratory Information Management System (LIMS) and on other servers is backed up daily onto CDs. There is also a second server that contains a duplicate of this information.

12.16.4 Archive areas are protected against fire, theft, loss, environmental deterioration and vermin. Electronic records are also protected from electronic or magnetic sources. Access to recent records is limited and maintained by logon and password. In addition, a portion of the portal server has been designated specifically as an "Archive area". These Archive areas house information that that is older and has additional access restrictions. Archive areas are regularly inspected as part of the Internal Audit program. Representatives of an accrediting authority may have access to archived information.

12.16.5 In the event that AES, Inc. transfers ownership, the new proprietors retain sole custody and responsibility for all records. If AES were to close, records shall be maintained at a commercial archive facility or maintained by another laboratory within the network. Records may also be transferred back to clients, if requested.

12.17 Quality Assurance Records

Where necessary, records are generated and maintained for all quality associated activities conducted during all phases of the analytical work. QA records provide sufficient evidence that all specified QA requirements have been accomplished and satisfied and provide sufficient documentation to substantiate all reported findings and conclusions. These records are retained by AES, Inc. after the initial issuance of the report for a minimum of five years in accordance with AIHA-LAP, LLC and TNI requirements. This ensures the availability of the QA historical information. The following types of records shall be identifiable and retrievable:

12.17.1 General QA Records - Records pertaining to procurement activities; results of reviews & audits; qualifications of personnel; Standard Operating Procedures and Document Control Records.

12.17.2 Inspection and Test Data Records - Records pertaining to in-process inspection and tests, Equipment Logs and Maintenance Logbooks.

12.17.3 Generated raw data, reports, etc.

13.0 CORRECTIVE ACTION AND NON-CONFORMANCES

Deficiencies or non-conformances in analytical procedures, materials, components or methodology may lead to the release of incorrect analytical results to the customer. Once a deficiency or non-conformance has been identified, corrective actions must be implemented to insure proper data

qualification and narration on the final client report and, when possible, prevent the deficiency being repeated. To document and track the non-conformance, a Corrective Action Report (CAR) is issued through the LIMS system. An example of a Corrective Action Report is contained in Appendix VII.

13.1 Standard Procedure for Defining, Implementing, and Closing a Corrective Action Report (CAR).

13.1.1 Non-conformance: A non-conformance is defined as any situation that is either outside acceptable limits (data) or does not comply with the procedure/method in some way (preservation, matrix, etc.). The following are examples of situations considered non-conformances for which the completion of a CAR report is required.

13.1.1.1 Contamination in the Blank: The presence of target analytes in the blank that are above the reporting limit or in some cases, the MDL.

13.1.1.2 Failing Laboratory Control Sample (LCS): When the percent recoveries of target analytes in an LCS fail to meet the acceptable limits for an analysis.

13.1.1.3 Failing Matrix Spike (MS): When the percent recovery of a target analyte in a MS fails to meet the acceptable limits of analysis.

13.1.1.4 Failing Duplicate: When the relative percent difference (RPD) of results between two aliquots of the sample exceed the maximum allowable RPD.

13.1.1.5 Improper sample preservation: When a sample does not have the correct preservation (usually this involves temperature or pH).

13.1.1.6 Exceeding EPA recommended holding time: When a sample is prepared (extracted or digested) and or analyzed after holding time has expired.

13.1.1.7 Sample integrity has been compromised: When a sample container is broken, is improperly sealed, is inappropriate for the analysis, or has headspace (volatiles).

13.1.1.8 Surrogates/Internal standards fail (organic analysis): When a surrogate(s) or internal standard fails to meet the acceptable quality control limits associated with the test method.

13.1.1.9 Dilution test (metals analysis): When the sample dilution test fails to meet the acceptable quality control limits associated with the test method.

13.1.1.10 Failure to meet batch requirements (insufficient sample volume for MS/MSD, etc.)

13.1.1.11 Poor chromatography or missing analytes.

13.1.1.12 Expired standards and reagents.

13.1.1.13 Failed Proficiency Test (PT) analyte.

13.1.2 Procedure for the issuing, completing, and closing of an analytical or technical related CAR.

13.1.2.1 When a non-conformance occurs, the employee performing the work, the initial data reviewer, a Project Manager, or the Department Manager must issue a CAR in the LIMS system as indicated below.

13.1.2.1.1 From the “Categories” menu select “Quality Control”. Then from the “Options” menu select “Corrective Action Reports”.

13.1.2.1.2 Click “Add” and the LIMS will create a new CAR and automatically number it. Fill in the fields for “Department”, “Instrument ID”, “Batch ID”, “Initiated By” and “Initiated On” as appropriate.

13.1.2.1.3 Fill in the "Summary" field with a brief description of the non-conformance.

13.1.2.1.4 Fill in the "Complete Description of Non-conformance" field with a detailed description of the non-conformance including batch numbers, affected samples by number, recoveries and control limits if applicable, etc.

13.1.2.1.5 The complete data file or log book is then forwarded to the Dept. Manager for review. This file must include raw data, prep information, review checklists, etc. and a reference to the CAR by number.

13.1.2.1.6 The Dept. Manager brings the Corrective Action Report to the Laboratory Manager, who determines whether the non-conformance is a "deficiency" or "anomaly". An anomaly is an occurrence that affects only the group of data in the associated batch or sequence. Human errors or mistakes are usually anomalies. A deficiency is an occurrence that is system related and may affect more than the batch and may require more extensive corrective actions which could include retraining, replacing equipment, revising SOPs, etc. If the CAR is anomaly, the Department Manager is instructed to document required corrective action in the "Corrective Action Required" field. If the CAR is a deficiency, enter a statement in the "Corrective Action Required" section that the CAR will be forwarded to the QA Manager for review. The QA Manager performs an investigation and documents the root cause investigation in the "Corrective Action Required" section of the CAR form. Monitoring requirements of actions and the need for additional audits are also documented in this section. If no root cause investigation is required, the QA Manager may instead comment with a "QA Statement". When the QA Manager completes the review, the CAR is closed or Laboratory Manager or Technical Director is notified to review the data and perform the required corrective action (which is documented in the "Corrective Action Required" field).

13.1.2.1.7 These corrective actions may include narrating the non-conformance to the affected jobs, sending affected samples to be re-prepped and/or reanalyzed, performing instrument maintenance, etc. Non-conformances may also be referred directly to the QA Dept. for more extensive action if necessary. The person filling in the "Corrective Action Required" field then fills in the "Completed By" and "Date" fields.

13.1.2.1.8 If the non-conformance is determined to be an anomaly, the Dept. Manager completes the "CAR Closed By" and "Date" fields at the end of the CAR form.

13.1.2.1.9 If the non-conformance is determined to be a deficiency, full QA review and documented corrective action to prevent recurrence is required. A root cause will be identified for deficiencies. Root cause analysis typically addresses those issues which historically have been addressed again and again with quick fixes but it may also be applied in those instances where a process or methodology is affected. Working harder and faster on the same items does not increase efficiency. Root cause analysis allows one to think through the problem and address the causes rather than its effects. By eliminating the root cause, time and money are saved.
Steps for a root cause analysis include:

1. Identifying the problem. You must define the problem accurately to address the true root cause.
2. Understand the problem. Check the data regarding the problem to gain a clear understanding of the underlying issues. This can be accomplished by using

several root cause analysis techniques such as brainstorming, use of control charts, or the "5 Whys" technique.

a. With the Brainstorming technique, ideas are collected from people associated with problem. All ideas should be considered and more is better because of not knowing what might work. Brainstorming utilizes a set time limit. Discussion about the ideas takes place after brainstorming is complete. Those involved build on the ideas to resolve the root cause.
b. Control Charts can be used to study trends associated with data over time to draw conclusions as to whether a process is consistent (within defined limits) or is unpredictable (outside of defined limits). Where applicable, control charts can pinpoint when a problem started and/or stopped.
c. "5 Whys" refers to the practice of asking, 5 times, why the failure has occurred in order to get to the root cause of the problem. Each "Why" brings one closer and closer to the root cause. It should be noted that sometime more or less "Whys" are required to get to the root cause. The use of five is a guide.

3. Corrective Action. Determine the probable underlying cause(s) of the problem. Take corrective action(s) to eliminate the causes.

Root causes will be categorized as one of the following: personnel, (LIMS) database, Quality Control, procedure, or laboratory controls.

13.1.2.1.9.1 Personnel: Root causes attributed to personnel may require training or retraining to insure individuals understand their responsibilities in the process.

13.1.2.1.9.2 Database: A Root cause from a database issue primarily refers to the Laboratory Information Management System (LIMS). This type of nonconformance will require the database to be updated. This may include method information (test codes), client information, project information, login entries, calculations, audit trail, and reports among others. Database root cause will also include individual instrument databases and software (GCs, ICPs, AA, Lachat autoanalyzers, etc.)

13.1.2.1.9.3 Quality Control: QC root causes result from incorrect QC acceptance ranges in logbooks, LIMS or are the result of trend changes. These will be reviewed and updated as necessary.

13.1.2.1.9.4 Procedure: This root cause covers procedures, policies, checklists, standard operating procedures (SOPs) that will be reviewed for modifications.

13.1.2.1.9.5 Laboratory Controls: Root causes from instrumentation, software and equipment will be investigated. These may require maintenance, repair, or updates.

13.1.2.1.9.6 A deficiency may require halting analysis on the affected test, notifying clients when previous data may have been affected or other significant corrective actions.

13.1.2.1.10 Once the required corrective actions associated for a deficiency have been completed, fully documented and systems deemed back in control the QA Dept or Technical Director will close the CAR and affected procedure may again be used. The CAR is then printed out, signed by the Technical Director or QA Manager, placed with the data and scanned and posted to the portal server.

13.1.2.1.11 The Technical Director, QA Manager, or any employee may determine that a potential nonconformance requires a preventive action report. Preventive actions are

potential sources of nonconformance and needed improvements. "Preventive Action Report" can be initiated by an employee from the results of employee suggestions, data review, audits, etc. and then reviewed by the Technical Director or the QA Manager. Preventive actions are incorporated in the corrective action template (due to software limitations). When the corrective action template is to be used for a preventive action report, the phrase 'PREVENTIVE ACTION' is typed in the "QA Action" field. This distinguishes a preventive action template from a corrective action template. Where appropriate, action plans shall be developed; implemented and monitored that will reduce the likelihood of nonconformance. Action plans shall include the application of controls to ensure that actions taken are effective, and may involve the reanalysis of data, additional auditing, control charts and trends, additional proficiency or QC testing, and issuance of correspondence to clients.

13.1.2.2 The CAR must be prepared at the time the analytical batch has been calculated. Do not wait until all data from the batch is completed. This will lead to unnecessary delay in reprocessing the batch (if necessary) and informing laboratory management, project management, and the client.

13.1.2.3 When completing a CAR, include all accompanying data, information, etc in a "Data Package" along with the NCR and submit this to the Technical Director or Quality Assurance Manager for review. Data packages include the following information.

- Digestion or extraction bench sheets
- ICP and other instrument data such as LACHAT printouts
- All chromatograms within the analytical batch including CCVs
- GC/MS tune criteria
- Analytical "run logs"
- MB, LCS, MS, CCV, post dilution spikes, etc which clearly indicate the results and or percent recoveries (where applicable).
- Any other test specific quality control criteria such as surrogate recoveries and method of additions results

13.1.3 Circumstances for initiating a customer service or project management related CAR.

13.1.3.1 The following types of client complaints or problems will be referred to as <u>Laboratory CARs</u> and should be brought to the Vice President of Operations or the Laboratory Manager. These include but are not limited to:

13.1.3.1.1 Customer Service related complaints

13.1.3.1.2 Comments regarding laboratory services provided

13.1.3.1.3 Any requests after analyses have been completed and files archived

13.1.3.1.4 Client is questioning the results

13.1.3.1.5 Confirmation request

13.1.3.1.6 EDD or Data Package issue

13.1.3.1.7 H flags need to be removed

13.1.3.1.8 Question regarding method used

13.1.3.1.9 Carry over issue

13.1.3.1.10 Questions from regarding an unusual sample or matrix received

13.1.3.2 CARs are also required for internal issues. These must also be brought to the Vice President of Operations or the Lab Manager and will be referred to as Internal CARs:

13.1.3.2.1 Test code issue

13.1.3.2.2 Problem with LIMS

13.1.3.2.3 EDD Problem

13.1.3.3 Certain issues will be handled by the Assistant Vice President of Operations and not by the Vice President of Operations. These will be referred to as Customer Service CARs.

13.1.3.3.1 Reporting limits are missing

13.1.3.3.2 Analyses times incorrectly entered (especially for short holding time tests)

13.1.3.3.3 Discrepancies and errors found in the QC report

13.1.3.3.4 Analytes reported twice or missing from the report

13.1.3.3.5 Pricing or invoice error

13.1.3.3.6 Login error

13.1.3.3.7 Client wishes to add an analyte or test

13.1.3.3.8 Incorrect bottle order

13.1.3.3.9 Shipping Issues

13.1.3.3.10 Courier issues

13.1.3.3.11 In certain instances, as determined by the Assistant Vice President of Operations, a corrective action report will be initiated when jobs with 'Rush' turnaround times or some with routine turnaround times are 48 hours past due.

13.1.3.4 Summary of Procedure:

13.1.3.4.1 When any of the instances listed in the Scope and Application chapter of this SOP take place, corrective action should be initiated in LIMS (Laboratory Information Management System).

13.1.3.4.2 Each Corrective Action has unique control number automatically assigned by LIMS when form is initiated.

13.1.3.4.3 Project Manager initiates a corrective action and identifies the type as either 'Laboratory CAR', 'Internal CAR', or 'Customer Service CAR'. These types must be recorded in LIMS in the CAR Summary so responsibility of the person who is to address the CAR is established. The CAR should include details of the issue, incident or client's request, and forwards report with all supporting documents to either the Vice President of Operations/Laboratory Manager or the Assistant Vice President of Operations as outlined above. After decisions on how to handle the corrective action are made, information will be relayed to the client and necessary follow up are performed.

13.1.3.4.4 Corrective action number must be entered into the comments section of the

appropriate work order number in LIMS.

13.1.3.5 Responsibilities: It is the responsibility of each project manager to ensure the following

13.1.3.5.1 Be pro-active and initiate CAR in a timely manner

13.1.3.5.2 Enter CAR number into the comment section of the work order number in LIMS. Initials of the project manager and the date should accompany it.

13.1.3.5.3 Gather all supporting information

13.1.3.5.4 Follow up on all open CARs to make sure all issues are resolved promptly

13.1.3.5.5 Once the Vice President of Operations or the Assistant Vice President of Operations review the CAR and make their recommendations, write down these actions under "Corrective Action Required" area. Remember to mark the 'Notify Clients' box in the CAR and include the name of the individual who did so. There is also a space for a comment, if needed. If follow-up is required by the QA Manager or the Technical Director as instructed by the Vice President of Operations, enter a statement in the "Corrective Action Required" area that the CAR will be forwarded to the appropriate person, who will then address their portion and close the CAR and notify the Assistant Vice President of Operations.

13.1.3.5.6 If no action is required by the QA Manager or Technical Director, the Project Manager will notify either the Vice President of Operations or the Assistant Vice President of Operations for review depending on what type of CAR it is. The Vice President of Operations will close all Laboratory and Internal CARs while the Assistant Vice President of Operations will close all Customer Service CARs.

13.1.3.6 It is the responsibility of the Assistant Vice President of Operations to ensure the following:

13.1.3.6.1 Review CARs and all supporting paperwork on a daily basis

13.1.3.6.2 As appropriate, come up with necessary decision/recommendations and document them in the Corrective Action Required field in LIMS.

13.1.3.6.3 Review "Corrective Action Required" completed by PM

13.1.3.6.4 Make sure CARs promptly closed upon resolution

13.1.3.6.5 Review all CARs on an ongoing basis to assure all CARs have been closed and necessary follow up took place (follow up with QA Manager and Technical Director, if needed)

13.1.3.7 Procedure to generate CAR in LIMS, follow the following steps:

13.1.3.7.1 From Main Menu go to Quality Assurance

13.1.3.7.2 Select Corrective Action Reports

13.1.3.7.3 Click "Add" and number will be automatically assigned through the LIMS

13.1.3.7.4 Enter PM under Department

13.1.3.7.5 Enter Client ID

13.1.3.7.6 Fill in the "Summary" field by writing short description of the CAR

13.1.3.7.7 Fill in the "Initiate By" and "Initiated On" fields

13.1.3.7.8 Write a complete and thorough description of the Nonconformance in the "Complete Description of the Non-Conformance" field. The following details must be included for all CARs:

13.1.3.7.8.1 Client's company name

13.1.3.7.8.2 Work order number and all sample number(s).

13.1.3.7.8.3 Date, time and name of all communications with client representative regarding this issue.

13.1.3.7.8.4 If the problem is internal, make sure to include laboratory department involved and names of laboratory analysts, etc.

13.1.3.7.8.5 If CAR is related to the bottle order or quote, please make sure to include bottle order or quote number

13.1.3.7.8.6 If a credit needs to be issued please make sure to include explanation why, prices used, new prices and documentation supporting new prices, such as quotes, or previous invoice, etc.

13.1.3.8 Once CAR number is assigned, this number must be entered in the comment section of LIMS under work order/work orders associated with the CAR! (please note that in some cases, no work order may be associated with the CAR)

13.1.3.9 Every CAR must be detailed and contain supporting documentation. This documentation must be present in order for the CAR to be closed. CAR that has missing info or details will be returned to the PMs and will not be closed until all the info is provided. Complete CAR must be forwarded to the Assistant Vice President of Operations or Laboratory Manager in case of the Assistant Vice President of Operations' absence. These are some of the examples for the supporting documentation required:

13.1.3.9.1 In case of CAR about additional analytes requested after final report has been mailed to the client, please do the following:

13.1.3.9.1.1 Describe client's request in the CAR and e-mail the Assistant Vice President of Operations (when possible, forward the client's email).

13.1.3.9.1.2 the Assistant Vice President of Operations will review the CAR and determine if AES can fulfill the request

13.1.3.9.1.3 If AES can fulfill the request, the Assistant Vice President of Operations will e-mail to PM to make necessary changes in the log in

13.1.3.9.1.4 Assistant Vice President of Operations will then email the appropriate lab manager referencing the CAR number, and the requested changes to be made.

13.1.3.9.1.5 After changes are made, necessary corrections will be made to the report.

13.1.3.9.1.6 Once corrections are made, the Assistant Vice President of Operations will inform PM to proceed with report revision. Make sure to issue revision note on the cover letter. We are required by NELAC and other certifying / accrediting agencies to document any changes that were made after final copy of the report is mailed to the client.

13.1.3.9.1.7 If revision reflects in a price change, M invoice must be generated or old invoice amended, depending on the arrangements made with a client. It is PM's responsibility to list any additional charges when submitting CAR and provide a decision if new M invoice or changes to an old invoice are required.

13.1.3.10 In case of CAR about incorrect prices or invoice please make sure to provide the:

13.1.3.10.1 Old invoice

13.1.3.10.2 COCR

13.1.3.10.3 Copy of COC

13.1.3.10.4 Price quote (if any)

13.1.3.10.5 If invoice is being changed in the LIMS system please make sure to save as a revised invoice on portal. The revised invoice, and COCR are then email to Accounts Receivable, referencing the CAR number. Accounts receivable will then update Peachtree, COCR, and add comments to CAR indicating this.

13.1.3.11 For a CAR about bottle order or shipping, provide a copy of the bottle order tracking number and any other documentation that will support the CAR, such as client's fax, etc.

13.1.3.12 The Assistant Vice President of Operations will address issues that involve pricing, inclusion of an additional analyte from the existing method, addition of another test to the work order, or a request for another report format (i.e. MDL Report). All other issues should initially be brought to the Vice President of Operations or Laboratory Manager for review. When the Vice President of Operations or Laboratory Manager has assessed the corrective action report, he will either give it back to the Project Manager with the action to resolve the issue or forward it to another person to continue the investigation. Typically, these CARs will go to the Department Directors, the Technical Director, or the QA Manager.

When CAR is completed by the laboratory personnel, the CAR file will be returned to the

PM for client resolution (i.e. price changes, report reissued, etc.). The Assistant Vice President of Operations must be notified about the completion of all PM CARs. All PM CARs that have not been closed by the QA Manager or Technical Director are closed by the Assistant Vice President of Operations.

13.1.4 Per AIHA-LAP, LLC LQSR section 4.8, complaints about the quality of reported results may be referred to the accrediting body if such complaints cannot be resolved directly with the customer.

13.2 General Procedures and Responsibilities for Corrective Action Reports Involving Deficiencies.

13.2.1 When the QA Dept. or Technical Director issues a corrective action report (CAR) for a non-conformance classed as a deficiency, the Laboratory Manager, Assistant V.P. of Operations or Technical Director will be informed immediately.

13.2.2 The QA Manager will track the completion of the corrective actions required to correct the deficiency. The assigned personnel are responsible for completing the corrective action within the specified time frame.

13.2.3 The chain of custody and the Sample Receipt Forms are used to document non-conformance during log-in.

13.3 Method Suspension or Restriction

13.3.1 In some cases, it may be necessary to suspend or restrict the use of a method that constitutes significant risk and or liability to AES. Suspension or restriction procedures can be initiated by the Quality Assurance Manager, Technical Director, Laboratory Manager, or VP of Operations.

13.3.1.1 Prior to suspension or restriction, confidentiality is respected, the problem and the required corrective action is stated in writing on the associated CAR and presented to the Laboratory Manager.

13.3.1.2 The Laboratory Manager, Technical Director, Quality Assurance Manager, and the affected supervisor are notified.

13.3.1.3 The Laboratory Manager arranges for the operations people to speak with the Quality Assurance Manager or Technical Director the day of notification. This meeting is held to confirm that there is a problem and that suspension/restriction of the method is required.

13.3.2 The suspension or restriction meeting will conclude with a discussion of the steps necessary to bring the method or test fully back on line if the method is suspended or restricted. The Quality Assurance Manager will also specify any documentation necessary to verify that corrective action has occurred.

13.3.3 After suspension or restriction, the laboratory will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. It is the responsibility of the Laboratory Manager to hold all reports. Clients will not generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

13.3.4 Upon completion of the required corrective actions per the CAR, laboratory management will determine if the affected systems are back in control. Once documentation and data associated with the CAR have been reviewed and approved by upper management, the VP of Operations, Laboratory Manager, Quality Assurance Manager, or Technical Director will notify laboratory personnel to resume testing. At that time, reports can be released. If systems are still deemed out of control, further corrective actions are required. A team, with all principals involved can devise a start up plan to cover all steps from client notification through compliance of method and release of reports.

13.3.5 If the QA Dept. or Technical Director recommends client notification regarding affects on past or current data quality, all associated information is forwarded to the Laboratory Manager and VP of Operations. They will review the data and determine appropriate actions.

13.3.6 Client notifications are the responsibility of the Laboratory Manager and VP of Operations.

13.4 Procedure for the issuing, completing, and closing of a Project Management or Customer Service related CAR.

13.4.1 CAR should be opened for the following reasons:

a) Any client complaints regarding prices, customer and laboratory service provided, courier service, bottle orders, shipping, invoices, analyses, additional requests after reports have been issued and files archived, etc.

b) Any situation that might have occurred within the laboratory such as results not reported on time, missing information (i.e. reporting limits, analysis dates and times, missing samples, missing analytes, etc.).

13.4.2 CAR must be generated through LIMS as follows:

a) From Main Menu go to “Quality Assurance”
b) Select Corrective Action Reports

c) Click "Add" and number will be automatically assigned through the LIMS
d) Enter PM under Department
e) Enter Client ID
f) Fill in the "Summary" field by writing short description of the CAR
g) Fill in the "Initiate By" and "Initiated On" fields
h) Write a complete and thorough description of the Nonconformance in the "Complete Description of the Non-Conformance" field. For all CARs details must include: client's name, work order number, date, time and name of the person spoken to. If the problem is internal, make sure to include laboratory department involved and names of the laboratory analysts, etc. If CAR is related to the bottle order or quote, please make sure to include bottle order or quote number. If a credit needs to be issued please make sure to include explanation why, prices used, new prices and documentation supporting new prices, such as quotes, previous invoice, etc.

13.4.3 Once the CAR number is assigned, this number must be entered in the comment section of LIMS under Work order / Work orders associated with the CAR.

13.4.4 Every CAR must contain supporting documentation. This documentation must be present for the CAR to be closed. CARs that are missing information or details will be returned to the PM. Complete CARs must be forwarded to the Director of Project Management or Laboratory Manager if Director of Project Management is absent.

13.4.4.1 Examples of supporting documentation are as follows:

13.4.4.1.1 In case of NCR about incorrect prices or invoice please make sure to provide following info: old invoice; Chain of Custody Record (COCR), copy of COC, price quote. If invoice is being changed in the LIMS system please make sure to issue revision note on the cover letter. We are required by TNI and AIHA-LAP, LLC to document any changes that were made after final copy of the report is mailed to the client. This cover letter is for in-house purposes only unless requested by client. All revised documents must be given to receptionist for rescanning.

13.4.4.1.2 In case of NCR about bottle order or shipping please provide a copy of the bottle order, tracking number and any other documentation that will support the NCR, such as client's fax, etc.

13.4.5 After all the facts and documents are gathered, they must be turned in to Director of Project Management or the Laboratory Manager. They will review all the information and come up with the decision that will be recorded under "Description of the Corrective Action". QA Manager is notified, if QA Action is required. All Project Manager or Customer Service CARs must be closed by the Director of Project Management or his designee within 3 business days.

13.5 Exceptionally Permitted Departures from Documented Policies and Procedures

13.5.1 Due to the frequently unique nature of environmental samples, it may be necessary to depart from documented policies and procedures when dealing with the sample(s). When the analyst encounters this type of situation, he presents the problem to his supervisor for advice. The supervisor may elect to discuss it with the Technical Director or have a technical representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst notes it in the raw data folder. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

13.6 Addressing Complaints

13.6.1 Addressing complaints is a normal function of conducting business and a valuable tool to improve

services to and relationships with clients. The goal of AES is to provide expeditious resolution of complaints. At AES, the supervisor and the management team handle complaints related to sample results. Client Services resolves specific complaints concerning container orders, shipping, expected report dates, and results. This information is documented in LIMS. The procedure used for addressing complaints follows the Corrective Action Report.

13.6.2 In the event that a complaint is related to the laboratory's compliance with its own policies and procedures, the rules of an accrediting agency, or the validity of data, the Quality Assurance Manager and or Technical Director initiate an internal audit of the areas involved. These personnel document the complaint, audit findings and recommendations.

13.7 Immediate and Long Term Corrective Action

Immediate corrective actions are necessary to correct or repair non-conforming equipment and systems. This type of corrective action is usually identified by the section supervisor through the use of calibration checks and QC sample analysis.

13.7.1 Long term corrective actions are necessary to eliminate causes of non-conformance. The need for such actions may be identified by audits. Examples of this type of action include:

13.7.1.1 Staff training in technical skills or in implementing the quality assurance program.

13.7.1.2 Rescheduling of laboratory routines to ensure analyses are performed within holding times.

13.7.1.3 Identifying vendors to supply reagents of sufficient purity.

13.7.1.4 Revision of quality assurance system or replacement of personnel.

13.7.2 Various auditing authorities may also initiate a corrective action, when deemed necessary.

13.7.3 For either immediate or long term corrective actions, the steps comprising a closed loop corrective action system are as follows:

13.7.3.1 Define the problem.

13.7.3.2 Assign responsibility for investigating the problem.

13.7.3.3 Investigate and determine the cause of the problem.

13.7.3.4 Determine a corrective action plan to eliminate the problem.

13.7.3.5 Assign and accept responsibility for implementing the corrective action.

13.7.3.6 Establish effectiveness of the corrective action and implement the correction.

13.7.3.7 Verify that the corrective action has eliminated the problem.

13.7.3.8 Update risks and opportunities determined, if applicable

13.7.3.9 Make changes to the management system, if necessary

13.8 Responsibility for Document Control

The QA department is responsible for document control for the laboratory. Critical documents include the QA Manual, the SOPs, the Corrective Action forms and reports, internally used forms and information, the training files, the MDL studies, the retention time studies, safety training files, performance evaluation reports, certification correspondence and manuals, audit reports and responses, and traceability certificates.

14.0 PERFORMANCE AND SYSTEM AUDITS

14.1 Purpose

The purpose of conducting audits is to monitor and verify compliance and overall effectiveness of the QA Program. Communication of audit findings to management is required for timely consideration and implementation of corrective actions.

14.2 External Audits

14.2.1 External audits are performed when certifying agencies or clients conduct on-site inspections. It is AES' policy to cooperate fully with certifying agencies. It is also AES' policy to comply fully with system audits conducted by regulatory agencies and clients.

14.2.2 The laboratory is involved in external performance audits conducted semi-annually through the analysis of Performance Testing (PT) samples provided by a third party. EPA performance testing studies have been referred to as Water Pollution Study (WP) and Water Supply Study (WS). Additional PTs including soil studies are analyzed per the requirements of TNI and AIHA-LAP, LLC.

14.2.3 During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment".

When information is claimed as business confidential, the laboratory must place on, or attach to, the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend, or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents must always be clearly identified. Confidential business considerations may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. Sample identifiers may not be obscured from the information.

14.3 System Audits

14.3.1 It is the responsibility of the Quality Assurance Manager to plan and organize audits as required by a predetermined schedule and as requested by management. Such audits are carried out by trained and qualified personnel who are, whenever resources permit, independent of the activity to be audited.

Laboratory audits are split into smaller audits that are performed within the calendar year at the specified frequency. Audits are performed monthly, quarterly and annually by the Quality Assurance Manager, the Quality Assurance Officer, Department Managers, or an appointed representative. These audits are performed using the laboratory monthly, quarterly, and annual checklists along various regulatory program checklists.

These audits provide information on whether the management system:

- conforms to the laboratory's own requirements for its management system (including the laboratory activities)
- conforms to the requirements of ISO/IEC 17025:2017 and Assessment Checklists
- is effectively implemented and maintained

Additional audits may be necessary throughout the year to address specific project requirements or issues that arise from other audits. Findings of all audits and their associated corrective actions are presented in management reports and posted to the portal server.

14.3.2 Routine report audits are the responsibility of the laboratory Quality Assurance Manager. The Quality Assurance Manager performs an independent systems review of reports generated by the laboratory. Comments from this review are recorded on Figure 14-1.

14.3.2.1 The reviewer is not expected to pursue the correctness of every reference in the file contents, but instead concentrates on the internal consistency of the data package.

14.3.2.2 Areas that are reviewed include the chain-of-custody, correspondence with the analytical request, batch QC status, completeness of any corrective action statements, calculations, format, holding time, sensibility and completeness of the project, and file contents. A list of reports reviewed is maintained in an audit file.

14.3.3 Internal audits are planned and conducted in accordance with a schedule developed by the QA Manager. Unscheduled audits or surveillance are also conducted when senior management deems it necessary.

14.3.4 The responsible management personnel are required to make all personnel, records, reports and documents available to the audit team.

14.3.5 Responsible management of the areas audited is required to provide prompt corrective action in accordance with the provisions of this manual.

14.3.6 Follow-up audits or surveillance is performed, as required, to verify the implementation of corrective action.

14.3.7 When the required corrective action is not implemented within the specified time period, the QA Manager notifies the Vice-President of Operations. A Corrective Action Notice form is used for this purpose. The Vice-President of Operations performs any required corrective actions.

14.3.8 Audit planning and findings are recorded and filed as part of the QA records.

14.3.9 At the discretion of the Vice-President of Operations, impacted clients are notified in writing if the audit result findings indicate any reported data has been compromised.

14.4 Blind Sample Audits

14.4.1 Blind sample audits are performed through the submittal of QC samples to the analyst along with the sample true values, which are only made known to the analyst after the test is complete. Blind sample audits are carried out by the Quality Assurance Manager, Technical Director, clients and certifying agencies as necessary to assure the laboratory is capable of achieving success with a blind QC sample. For continuing TNI and AIHA-LAP, LLC accreditation, the laboratory must, on a continuous basis, successfully complete two of the last three consecutive proficiency rounds for a given PT field of testing.

14.4.2 In addition to the PT samples submitted to the laboratory through third party vendors, the laboratory may also participate in a company-wide internal PT program to evaluate methods that are not commonly included in the semi-annual PT studies. These studies usually occur between January and February and more frequently if deemed necessary.

14.4.3 It is recognized that PT samples are often not representative of "real world" samples either in their form (e.g., vials), content (e.g., multiple target analyte hits), or documentation (e.g., no chain of custody) and, as such, present the laboratory with special challenges.

14.4.4 It is the policy of AES that PT samples are treated as typical samples in the normal production process wherever possible. Further, if PT samples present special or unique problems in the normal production process, then they should be treated differently, as would any special or

unique request submitted by any client. Holding time begins when the vial is opened. Full volume PT samples follow normal holding time procedures and storage requirements.

14.4.5 Login obtains the normal COC information from the documentation provided with the PT samples with review by QA or other designated staff.

14.4.6 Vials are prepared as required in the instruction set provided with the samples. After preparation to full volume, the samples may be spiked, digested, and or concentrated as necessary in a manner similar to normal samples received at the laboratory.

14.4.7 In special cases, the following procedures may be required for the analysis and reporting of PT samples.

14.7.7.1 PT samples will not undergo multiple preparations, multiple runs, multiple methods (unless they are being used to evaluate multiple methods), or multiple dilutions, unless these are the procedures that are normally applied to typical client samples.

14.7.7.2 PT sample(s) will not be subjected to special reviews by operational staff or QA unless this would be normal laboratory practice. To the degree that special report forms or login procedures are required by the PT supplier, it is reasonable that the laboratory would apply special review procedures as would be performed for any client requesting unusual reporting or login processes.

14.4.8 Special QC samples can be included in any analytical run.

14.5 Quality Systems and LIMS Management Review

At least annually, either President or Vice-President of Operations conducts a formal management review to evaluate the effectiveness of the laboratory's quality systems, management system, and LIMS to ensure their continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. During this process, the laboratory identifies opportunities for improvement and implements the necessary actions. Inputs to the management review and opportunities for improvement can be identified by suitability procedural and policy review, fulfilment of objectives, internal and external issues, actions from previous management reviews, internal and external audit findings, corrective actions, recurring issues, suggestions from personnel, feedback from Client Satisfaction Survey, complaints, changes in volume/type of work, adequacy of resources, effectiveness of improvements, training, risk assessment, and Proficiency Test results among others. Following the review, the Quality Assurance Manual or SOPs may be revised to reflect any significant changes made to the quality systems.

14.5.1 The quality systems and LIMS management review uses information generated during the preceding year to assess the total laboratory and ensures that routine quality actions taken and reviewed on a quarterly basis are not components of larger systematic concerns. The quarterly review (see section 15) is designed to keep the quality systems current and effective.

14.5.2 Significant issues from the following documentation are summarized by the Quality Assurance Manager prior to the review meeting:

14.5.3.1 Matters arising from the previous annual review.

14.5.3.2 Prior Quarterly Quality Assurance Reports.

14.5.3.3 Review of report reissue requests.

14.5.3.4 Minutes from prior management and staff meetings

14.5.3.5 Minutes from prior senior management meetings that discuss adequacy of staff, equipment and facility resources.

14.5.3.6 Prior customer service or business development meeting information.

14.5.3.7 Internal and external audits, including computer audits performed during the past year.

14.5.4 The annual review can occur anytime during the year. Based upon the annual review, a report is generated by the Quality Assurance Manager. This report includes the following information.

14.5.4.1 The date of the review and the names and titles of participants.

14.5.4.2 References to the existing documents and topics that were covered in the review process.

14.5.4.3 Quality system or LIMS changes/improvements that will be made as a result of the review.

14.5.4.4 Decisions and actions shall be documented.

14.5.4.5 The effectiveness of the management system and its processes will be included.

14.5.4.6 Provision for required resources.

14.5.4.7 Needs for change and a schedule including assigned responsibilities for the changes.

14.5.5 Following any review, the Quality Assurance Manual or SOPs may be revised to reflect any significant changes made to the quality systems.

14.6 Corrective Action

14.6.1 All deficiencies found during audits are reported to the Laboratory Manager, Quality Assurance Manager, and the Technical Director (see Section 15, “Quality Assurance Reports to Management”). The Laboratory Manager, Technical Director, and Quality Assurance Manager agree upon a time frame for correction. The laboratory's response and corrective action procedures are evaluated by the Quality Assurance Manager and when acceptable, are attached to each audit and filed. If issues arise that may require method suspension or restriction, the procedures outlined in Section 13, “Corrective Action,” are followed.

14.6.2 External audits often require written reports that include proof of correction. The Quality Assurance Manager coordinates the written response to the external auditing facility.

14.6.3 Written responses to PT results are required. The response must address the reason for any unacceptable or "Check for Error" result. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

14.6.4 Whenever a laboratory fails a study, it shall determine the root cause for the failure and take any necessary corrective action. If a laboratory fails two out of the three most recent studies for a given PT field of testing, its performance is considered unacceptable under the TNI and AIHA-LAP, LLC standards for that field. The laboratory shall then need to meet the requirements of initial accreditation. For initial studies, the PT samples shall be analyzed at least 15 days apart. The laboratory must successfully complete two PT studies out of the most recent three rounds attempted for each requested PT field of testing. If analytes are on the Experimental Fields of Testing, participation is mandatory but passing the PT studies is not.

Figure 14-1
Internal Audit Checklist (Annual)

Month: Year:

Balances Maintenance	Performed (√)	Date	Certificate Posted	Type
AES #1089	____	_____	____	Top Loader
AES #1700	____	_____	____	Analytical
AES #1717	____	_____	____	Analytical
AES #1999	____	_____	____	Top Loader
AES #2003	____	_____	____	Analytical
AES #2004	____	_____	____	Top Loader
AES #2005	____	_____	____	Top Loader
AES #2065	____	_____	____	Analytical
AES #2067	____	_____	____	Analytical
AES #2249	____	_____	____	Top Loader
AES #2250	____	_____	____	Analytical
AES #2332	____	_____	____	Analytical - low
AES #2381	____	_____	____	Analytical - low
AES #2382	____	_____	____	Analytical - low
AES #2485	____	_____	____	Top Loader
AES #2514	____	_____	____	Top Loader
AES #2515	____	_____	____	Top Loader
AES #2522	____	_____	____	Analytical
AES #2526	____	_____	____	Analytical

•1.0 g & 0.002 g weights used for 1664 O&G / TPH should be checked twice daily in the logbooks

Annual Incubator Temperature Study	Performed (√)	Date	Posted	Comments
	____	_____	____	

Annual TSS Manifold Cleaning	Performed (√)	Date	Verified in Maintenance Log
	____	_____	____

Define Linear Portion of Non-Linear Curve	Performed (√)	Date	
IC2 Chloride		____	_____
IC2 Sulfate		____	_____
IC3 Chloride		____	_____
IC3 Sulfate		____	_____

Annual PTs per Analyst (Drinking Water)

Study	Analyst	Method	Date	Passed	Posted
_____	_____	SM9223B	_____	____	____
_____	_____	SM9221D	_____	____	____
_____	_____	SM9223B	_____	____	____
_____	_____	SM9221D	_____	____	____

Annual Laboratory Water Acceptance Criteria:

Heavy Metals	Performed (√)	Date	Passed	Posted	Comments
Cd, Cr, Cu, Ni, Pb, Zn	____	_____	Y or N	____	

Heavy Metals	Performed (√)	Date	Passed	Posted	Comments
Aggregate	____	_____	Y or N	____	

Bacterial Growth Ratio	Performed (√)	Date	Passed Y or N	Posted	Comments
	____	_____		____	

Computer Audits	Performed (√)	Date	Posted	Comments
Software	____	_____	____	
Hardware	____	_____	____	

Annual Inhibitory Residue Test	Performed (√)	Date	Passed Y or N	Posted	Comments
	____	_____		____	

Stage Micrometer Calibration	Date Last Calibrated	Due for Calibration	Performed (√)	Date
	3/18/2014	3/18/2021	____	_____

Imhoff Cone (E160.5) Annual Calibration	Date Calibrated	Performed (√)	Posted
	_____	____	____

Annual Spectrophotometer Wavelength Verification	Performed (√)	Date	Posted
	____	_____	____

IDL (Instrument Detection Limit)	Check Performed (√)	Posted	Comments
EPA 6020 (ICP/MS-TJA)	____	____	
EPA 6020 (ICP/MS-Agilent)	____	____	
EPA 6010 (ICP_Agilent)	____	____	
EPA 6010 (ICP_Varian)	____	____	

	Performed (√)	Posted	Updated in LIMS
Annual QC Limits Calculated	____	____	____
ELLAP: Limits outside Table 3 of LQSR require an Evaluation	____		

Update SOPs	Performed (√)	Date	Posted	Comments
QA Manual	____	_____	____	
Data Integrity SOP	____	_____	____	

Check for Outstanding Logbooks	Check Performed (√)
Email Sent & Logbooks Collected	____

Verify Compliance	Performed (√)	Date	Comments
ISO 17025 Standard	____	_____	Refer to Current ISO Guide
AIHA-LAP, LLC Requirements	____	_____	Refer to Site Assessment Checklist

SOPs Revised See Tech. Mgmt Summary

Annual Training	Performed (√)	Date	Posted	Comments
QA Manual	____	_____	____	
Legal & Ethical	____	_____	____	
Temp. Recording	____	_____	____	
Correction Factor	____	_____	____	

Annual Report to Management Submitted	Performed (√)	Date	Posted
	____	_____	____

Annual Management* Review Completed	Performed (√)	Date	Posted
	____	_____	____

* Remember to check the bullets in ISO 17025 (and AIHA Policy Modules) to make sure all items covered.

Subcontractor Info	Available (√)	Date	Posted
Current Certificate	____	_____	____
Current Scope	____	_____	____

NVLAP	Performed (√)	Date	Posted
Annual Bulk (PLM) Audit Checklist: Handbook 150-3	____	_____	____
Annual Airborne (TEM) Audit Checklist: Handbook 150-13	____	_____	____
Annual General Audit Checklist: Handbook 150	____	_____	____
Annual PLM Control Charts	____	_____	____
Annual PLM Point Count Comparison	____	_____	____
Annual Refractive Index Control Charts	____	_____	____
Annual PLM Precision and Accuracy	____	_____	____

Audit Performed by: Date:

Figure 14-1 (cont.)
Internal Audit Checklist (Quarterly)

Quarter: Year:

Balances	Calibrated Daily (√)	Failures Addressed (√)	Posted	Comments
AES #1089	____	____	____	Top Loader
AES #1700	____	____	____	Analytical
AES #1717	____	____	____	Analytical
AES #1999	____	____	____	Top Loader
AES #2003	____	____	____	Analytical
AES #2004	____	____	____	Top Loader
AES #2005	____	____	____	Top Loader
AES #2065	____	____	____	Analytical
AES #2067	____	____	____	Analytical
AES #2249	____	____	____	Top Loader
AES #2250	____	____	____	Analytical
AES #2332	____	____	____	Analytical
AES #2381	____	____	____	Analytical
AES #2382	____	____	____	Analytical
AES #2485	____	____	____	Top Loader
AES #2514	____	____	____	Top Loader
AES #2515	____	____	____	Top Loader
AES #2522	____	____	____	Analytical
AES #2526	____	____	____	Analytical

•1.0 g & 0.002 g weights used for 1664 O&G / TPH should be checked twice daily in the logbooks

Include copy of current Balance Weights Stage Micrometer Log

Weights	ID	Last Calibrated	Calib. Due	Schedule Calibration Circle Yes	Comments
Primary 20 mg	2269	8/16/16	Aug. 2021	Yes	
Primary 100 mg	2268	8/16/16	Aug. 2021	Yes	
Primary 1g	2328	9/21/17	Sept. 2022	Yes	
Primary 10 g	2270	8/16/16	Aug. 2021	Yes	
Primary 100 g	2271	8/16/16	Aug. 2021	Yes	
Primary 1000 g	2256	8/16/16	Aug. 2021	Yes	
Primary 2 mg	2377	4/30/18	Apr. 2023	Yes	
Backup 1 mg	2330	9/21/17	Sept. 2022	Yes	
Backup 20 mg	2220	2/9/16	Feb. 2021	Yes	
Backup 100 mg	2335	10/31/17	Oct. 2022	Yes	
Backup 1 g	2329	9/21/17	Sept. 2022	Yes	
Backup 10 g	2336	10/31/17	Oct. 2022	Yes	
Backup 100 g	2337	10/31/17	Oct. 2022	Yes	
Backup 1 mg	2331	9/21/17	Sept. 2022	Yes	

Thermometers	ID	Last Calibrated	Calib. Due	Schedule Calibration Circle Yes	Comments
Primary NIST	2403 (Serial 1018)	8/10/2018	8/10/2023	Yes	
Primary NIST Digital	2443 (181474656)	7/27/2018	7/77/2023	Yes	5 year expiration
Backup NIST	2550 (Serial 1067)	5/23/2019	5/23/2024	Yes	5 year expiration

Include copy of Current Thermometer Log

Evaluation of Critical Suppliers: Check with Managers and review vendor list against ISO 17025 Sec. 4.6.4 to determine if any additional suppliers should be identified as critical suppliers. Fill out evaluation for any identified.

Newly Identified Critical Suppliers	Evaluation Completed	Posted
_____	Y or N	____
_____	Y or N	____

Pipettors - Copy of Current Pipettor Log

Employee QA Training Forms	Performed (√)	Posted	Comments
QA Manual SOP Form	____	____	
QA Manual Training Form	____	____	
Data Integrity Training Form	____	____	
Employee Signature	____	____	

Bottle Checks	Check Performed (√)	Lot #'s	Posted	Comments
Micro Coliform	____	_____	____	Contamination
(See Sterility Checks)		_____	____	Also see next page
		_____	____	QT Sterility check
Certificate at Receipt		_____	____	
(See portal: QA>Bottles>Sample_Receipt_)		_____	____	
		_____	____	
		_____	____	
IC	____	_____	____	
(See portal: QA>Bottles>IC)		_____	____	Contamination or
		_____	____	Volume
		_____	____	
See Annual W.O for Metals & TOC		_____	____	
Metals	____	_____	____	
(See bottle check W.O.)		_____	____	Contamination or
		_____	____	Volume
TOC - for NC	____	_____	____	
(See bottle check W.O.)		_____	____	Contamination

AIHA-LAP, LLC 5% Inter/Intra Analyst Checks:	5% Inter	5% Intra	Posted
Air-Direct Exam (MB-15019, MB-15022, MB-15028)	____	____	____
Bulk & Surface - Direct Exam (MB-15020)	____	____	____

AIHA-LAP, LLC IH environmental micro	Performed (√)	Posted	Comments
Direct Exam Blank Tape Slide performed daily	____	____	

Mechanical Timers	Performed (√)	Posted	Comments
Autoclave Cycle Time is <45 minutes	____	____	
Mechanical Time checked vs. Digital Timer	____	____	

AIHA-LAP, LLC Controlled Documents	Performed (√)	Posted	Comments
Review & Update Documents Database	____	____	

UV Bulb Replaced	Check Performed (√)	Posted	Comments
UV Bulb	____	____	

Micro. Materials Checks	Performed (√)	Posted
Brilliant Green Media Lot	____	____
Dilution Containers Tolerance Check	____	____
EC Media Lot	____	____
EC Media w/MUG Lot	____	____
HACH P/A Broth Lot	____	____
IDEXX Colilert Media Lot	____	____
Lauryl Tryptose Lot	____	____
M-Endo Lot	____	____
M-FC w/Rosalic Acid Lot	____	____
Plated Media Lot and Reagents		
Positive Control / Negative	____	____
Media Check for Materials > 90 Days		
Positive Control / Negative	____	____
SIM Plate Broth Lot	____	____
Tryptic Soy Double Strength Broth Lot	____	____
Tryptic Soy Single Strength Broth Lot	____	____

Membrane Filter Sterility Checks	Check Performed (√)	Lot #'s	Posted	Comments
	____	_____	____	
		_____	____	
		_____	____	

Micro Aseptic Technique — Alcohol Burner Used
Double Check the use of sterilization of pipette tips — Y or N

Micro Use Test	Performed (√)	Date	Passed	Posted	Comments
Student t Test	____	_____	Y or N	____	

Audit Items from CARs

1. Remember to create CARs based on observations from internal audit
   CARs generated: _____
2. Follow up on previous CARs
   a. Ferrous Iron Narrative present — CAR 120097 — W.O. confirmed: _____
   b. — CAR _____ — W.O. confirmed: _____

Hotblock Temperature Distribution Studies

Performed for the Quarter	Posted
____	____

Quarterly Instrument Specific Checklists [see L Drive (192.0.0.190) > Equipment > Department folder
Quarterly checklist as a PDF file should be in each "---QChk" folder

Performed for the Quarter	Posted
____	____

Quarterly Control Chart Check for Infrequently Performed Tests

Test (e.g. 365.1_S TP)	QC Type (LCS, MS, MSD, etc.)	Trend Normal (circle)
_____	_____	Y or N
_____	_____	Y or N

TCLP Tumbler	Check Performed (√)	Posted	Comments
Rates Recorded	____	____	
Dates Recorded Properly	____	____	From 2018 NELAP Audit

Asbestos Checks	Last Performed	Date Performed	Frequency Required	Comments
PLM Refractive Index Liquid Calibration	_____	_____	Semi-Annually	

Environmental Checks	Check Performed (√)	Posted	Comments
Lead Wipe	____	____	

Linear Calibration Range	Check Performed (√)	Posted	Comments
LCR for 180.1 (Required Semi-annually)	____	____	Check performed with ea Batch

Other Observations: Review of CARs. Follow up on QA CARs and Action Plan from Preventive Actions.
General _____

Sample Receipt: Check login to confirm pH is recorded in LIMS for samples received the previous day.
_____

Check of Logbooks. Logbooks are reviewed for completeness after scanning and prior to posting.

Dept.	Logbook ID	Dept.	Logbook ID	Dept	Logbook ID
Microbiology	_____	Semi-Volatiles	_____	Metals	_____
Wet Chemistry	_____	IC	_____	Volatiles/TO-15	_____
Filtration	_____	General Chem	_____		

Review of QA'ed data

Dept.	Run ID	Dept.	Run ID	Dept	Run ID
General Chem	_____	Semi-Volatiles	_____	Metals	_____
Wet Chemistry	_____	IC	_____	Volatiles/TO-15	_____
Filtration	_____				

Ensure New Spreadsheets are locked

Spreadsheets that were found unlocked and then locked: _____

Check that Equipment that is not in Service is Tagged "Out of Service"

Equipment that has been tagged: _____

Audit Performed by: Date:

Figure 14-1 (cont.)
Internal Audit Checklist (Monthly)

Month: Year:

Temp. Checks	Unit ID	Recorded (√)	Post Logsheet (√)	Schedule Service (circle if needed)	
Hotblocks					
Wet Chem	1139	____	____	Yes	
Metals Prep	1511	____	____	Yes	
Metals Prep	1512	____	____	Yes	
Metals Prep	1691	____	____	Yes	
Metals Prep	1692	____	____	Yes	
Metals Prep	1849	____	____	Yes	
Wet Chem	2006	____	____	Yes	
Wet Chem	2017	____	____	Yes	
Wet Chem	2020	____	____	Yes	
Wet Chem	2147	____	____	Yes	
Wet Chem	2362	____	____	Yes	
Wet Chem	2374	____	____	Yes	
Metals Prep (Vulcan)	2307	____	____	Yes	
Metals Prep (Vulcan)	2394	____	____	Yes	
Incubators					
Semi-Volatiles	1084 (IN-1)	____	____	Yes	
Micro	1559 (IN-6, top shelf)	____	____	Yes	
Micro	1559 (IN-6, bottom shelf)	____	____	Yes	
Wet Chem	2007	____	____	Yes	
Micro	2057 (IN-2)	____	____	Yes	
Wet Chem	2063	____	____	Yes	
Micro	2088	____	____	Yes	
Wet Chem	2195	____	____	Yes	
Micro	2349	____	____	Yes	
Micro	2396	____	____	Yes	
Ovens					
Organic Prep	2018	____	____	Yes	for baking Na2SO4
Wet Chem	2158	____	____	Yes	
Wet Chem	2165	____	____	Yes	
Wet Chem	2225	____	____	Yes	for baking Na2SO4
Wet Chem	2317	____	____	Yes	
Filtration	2490	____	____	Yes	
Refrig/Freezers					
Semi-Volatiles	1074 (R-6)	____	____	Yes	
Volatiles	1076 (R-19)	____	____	Yes	
Wet Chem	1081 (F-3/R-5)	____	____	Yes	
Wet Chem	1541 (R-23)	____	____	Yes	
Semi-Volatiles	1631 (F-9/R-25)	____	____	Yes	
Air Lab	1705	____	____	Yes	
Sample Receipt	2027 (New Walk-In)	____	____	Yes	
Volatiles	2036 (Walk-in)	____	____	Yes	
Organic Prep	2041 (R-16)	____	____	Yes	
Filtration	2056	____	____	Yes	

Metals Prep	2078	____	____	Yes
Wet Chem	2245	____	____	Yes
Volatiles	2283	____	____	Yes
Organic Prep	2409	____	____	Yes
Micro	2420	____	____	Yes
IC	2431	____	____	Yes
IC	2432	____	____	Yes
Volatiles	2433	____	____	Yes
Semi-Volatiles	2438	____	____	Yes
Air Lab	2513	____	____	Yes
General Chem	2517	____	____	Yes
General Chem	2518	____	____	Yes

Waterbaths	Unit ID	Recorded (√)	Post Logsheet (√)	Schedule Service
Wet Chemistry	1934 (WB-2)	____	____	Yes
Organic Prep	2026	____	____	Yes
Organic Prep	2450	____	____	Yes

Asbestos				
Asbestos Lab	1915 (Counter)	____	____	Yes

TCLP				
Non-Volatiles	Metals Prep	____	____	Yes
Volatiles ZHE	Volatiles	____	____	Yes

Sonicator Check

Organic Prep	#1	2567	____	____	Yes
Organic Prep	#2	2255	____	____	Yes
Organic Prep	#3	1889	____	____	Yes
Organic Prep	#5	1890	____	____	Yes
Organic Prep	#6	2442	____	____	Yes

* #4 AES 2085 Retired November 2018

AIHA-LAP, LLC Monthly Blind Culture — Check Performed (√) ____ — Posted ____
Blind culture from collection Per Analyst

AIHA-LAP, LLC Periodic Check of Test Reports (Work Orders)
Work Orders: _____
_____

	Check Performed (√)	Post Logsheet (√)	Comments
Coliform Bottle Sterility Check	____	____	
Dilution Vessel Sterility Check	____	____	
Fluorescence Check	____	____	

Labware pH Check	Check Performed (√)	Posted	Comments
	____	____	

DUPs, Positive & Negative Checks	Check Performed (√)	Post Logsheet (√)	Comments
SM 9223			
Duplicate	____	____	
Positive Control	____	____	
Negative Control	____	____	
SM 9222D			
Duplicate	____	____	
Positive Control	____	____	
Negative Control	____	____	
SM 9222B			
Duplicate	____	____	
Positive Control	____	____	
Negative Control	____	____	
Quanti Try 2000 Sealer Leak Check	____	____	
UV Lamp Bulb Replacement Log	____	____	We opt to replace bulb rather clean the lamp

Monthly Water Quality Checks Performed (Should be submitted on Form)

Parameter	Performed (√)	<500 CFU/mL	Posted	Comments
Heterotrophic Plate Count (HPC)	____	Y or N	____	
	Performed (√)	<0.1 mg/L	Posted	Comments
Ammonia (NH_3)	____	Y or N	____	
	Performed (√)	<0.1 mg/L	Posted	Comments
Organic Nitrogen	____	Y or N	____	
	Performed (√)	<1.0 mg/L	Posted	Comments
Total Organic Carbon (TOC)	____	Y or N	____	
	Performed (√)	<0.2 mg/L	Posted	Comments
Chlorine	____	Y or N	____	

Daily Water Quality Checks Performed (Located in Logbooks or on Logsheets)

Volatiles Daily DI Water Check	Location	Check Performed	Posted Logsheets	Comments
Water Unit #1 for Contamination	Volatiles Shed	Y or N	____	3080 Shed
Water Unit #2 for Contamination	Filtration Lab for VAS	Y or N	____	Bldg B
Daily Centra DI Unit #1 Check	**Only** Volatiles Shed	Y or N	____	3080 Shed

Conductivity	Location	All <1.0 umhos	Schedule Service	Posted Logsheets (√)	Comments
Water Unit #1	Volatiles Shed	Y or N	Y or N	____	3080 Shed
Water Unit #2	General Chem	Y or N	Y or N	____	Bldg B
Water Unit #3	Filtration	Y or N	Y or N	____	Bldg B

Residual Chlorine	Checked Daily	<1.0 mg/L	Posted	Comments
In Micro Logbooks	Y or N	Y or N	____	
Test Strip Range 0-5 mg/L	Y or N			

Monthly Air Monitoring	Check Performed (√)	Posted	Comments
Micro Air Fungal (W.O. _____)	____	____	Posted w/ Health & Safety

Titration against Primary Standard	Performed (√)	Dates (From Logbooks)
Ferrous Iron	____	_____
0.025N Sodium Thiosulfate for BOD, CBOD, DO, Sulfide	____	_____

Hood Cleaning	Performed (√)	Posted	Comments
Metals Prep (6)	____	____	
PCM Asbestos Prep (1)	____	____	
TEM Asbestos Prep (1)	____	____	
Sample Receiving (1)	____	____	

Facilities Check

Periodic Monitoring of facilities to check for the following

1. Review of facility monitoring checks (Monthly PCM, Micro, and Water Quality Reports) ___
2. Any use of areas affecting laboratory activities. Y/N If Y, CAR # _____
3. Need for separation between areas with incompatible laboratory activities. Y/N If Y, CAR #_____

Asbestos Checks PLM	Required Frequency	Check Performed (√)	Posted
Instrument & Material for each microscope (Microscope Alignment Calibration)	Daily	____	
Contamination Control Testing (of instruments, blades, Petri dishes, etc.)	Daily	____	
Blind recounts (5% of daily analyses)		____	
Blank Contamination Control (Fiberglass / Cellulose check)	Weekly	____	
Monthly Precision Summaries (for each analyst)	Monthly	____	____
Summary of Monthly Accuracy (for each analyst)	Monthly	____	____

Asbestos Checks TEM	Required Frequency	Check Performed (√)	Posted
Monthly Quality Assurance Summary	Monthly	____	____

Asbestos Checks PCM	Check Performed (√)	Posted	Comments
Monthly PCM Air Check (W.O.# _____)	____	____	Posted w/ Health & Safety

Monthly Metals LCS / LCSD Checks - Since the concentrations in the test codes come from the standard in use, this check verifies that the lot number and concentrations have not changed.

Does the information in the comment section of the following test codes match the information on the current spikes used?

Test Code	AES ID # in LIMS Test Code	Expiration Date	LIMS info same as spike use
7420_S (7000B)	_____	_____	Y / N
PAINT_LEAD	_____	_____	Y / N
WIPE_MET_AA (Pb Only)	_____	_____	Y / N

If they do not match, double check the concentrations to make sure to update LIMS.

Include a copy of the original info in these LIMS test codes as well as the updated info with this audit report.

Audit Performed By: Date:

Software Audit (Part One)

LIMS

	Yes	No
1. Are quality control data referenced to sample results? (standards, blanks, calibrations, replicates, duplicates, spikes, instrument conditions, surrogates, internal standards, etc.)		
2. Are references to quality control data protected or can they be easily changed?		
3. Are references sufficient to associate quality data with individual sample results?		
4. Are data outside acceptance criteria flagged?		
5. Are the detection limits for target analytes clearly referenced in the LIMS data?		
6. Are the units correct?		
7. Can the results be traced back to the original data associated with a specific batch?		
8. Are all out of range results either prevented or flagged?		
9. Has security been maintained (old passwords, logons eliminated from the system)?		
10. Are data transfers periodically audited and documented?		

For data linked to an analytical instrument, is the following information available:
(Either in LIMS or with the instrument documentation)

	Yes	No
11. Date and time generated?		
12. Identification of instrument?		
13. QC flags indicating the level of acceptability of the data?		
14. Is there a computer generated record of the changed and unchanged data?		
15. Are all data quality flags defined? (QA Manual)		

	Yes	No
16. Are qualifying flags correct?		
17. Are printouts of report modifications routinely checked for accuracy? By whom: (Project Managers) _____		
18. Are final copies of reports properly archived with limited access, security, and protection against natural disaster (fire, flood, etc.)?		

Documentation

	Yes	No
19. Are there written backup procedure?		
20. Is there a disaster recovery procedure?		
21. Does the software management (LIMS) include validation? Vendor (Khemia)		
22. Have the mathematical calculations validated? How is this documented? Vendor (Khemia)		
23. Are software revisions tested to determine how the entire program is affected?		
24. Is there a logbook to document software revision implementation?		
25. Is a password required to access the system?		
26. Is there documented operator training? (Checklist)		

Backups

27. Are system backups performed? — Yes / No

What frequency? — Daily / Weekly

	Daily	Weekly
LIMS		
AES Servers		
Portal Server		

Who performs backups? (When not Automatically) _____

28. Are media storing backups properly labeled? — Yes / No

29. Is data from backups stored short term? — Yes / No

How is it stored? (Network Attached Storage)

30. Is data from backups stored long term? — Yes / No

How is it stored? (Written to External Hard Drive)

31. Is long term backup data stored off site? — Yes / No

32. Have report formats that are no longer in use been deleted or inactivated so that they are not mistakenly used? — Yes / No

33. Have past employees' names been removed for LIMS pick lists, internal email, and external email? — Yes / No

Hardware Audit (Part Two)

	Yes	No
1. Are there procedures for performing and documenting preventive maintenance?		
2. Is there regularly scheduled preventive maintenance?		
3. Is preventive maintenance documented?		
4. Is non-routine maintenance performed by in-house staff?		
5. How is it documented? (Logbook)		
6. If the system fails because of electrical glitches or power outage, what happens to the system? (UPS Backup System)		
7. Is a backup power source available?		
8. Are problems documented after a power outage?		

Audit Performed By: Date:

15.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

15.1 Internal Reports

The Quality Assurance Manager submits quarterly reports regarding the status of QA/QC activities to the Vice-President of Operations. Section 15.3 lists the minimum content of this report. The Quality Assurance Manager also submits an annual report to the Vice-President of Operations.

15.2 External Reports

Certain projects under regulatory review require establishment of explicit quality assurance objectives and quarterly summaries of QA conformance and corrective action. The laboratory technical and quality assurance staffs provide the necessary information required to establish quality assurance objectives for particular projects. Once the QA deliverables options are selected for the project, sufficient quality control data will be provided in the individual analytical report to allow a periodic assessment of the overall progress of the project. Upon request, any information or reports needed are provided by laboratory management with review by the QA Manager.

15.3 Quarterly and Annual Reports

The quarterly or annual reports to management include the following information.

15.3.1 SOP. The report indicates any changes to existing SOPs or any new SOPs.

15.3.2 Corrective action reports. The report contains information about any corrective action reports that may have been written during the time period since the last QA report.

15.3.3 MDL. Any changes in MDL should be included in the QA report.

15.3.4 Audits. The QA report includes the results of any audits performed during the time period since the last report.

15.3.5 PE samples. The report includes the results of PE samples analyzed since the last report. The PE report indicates the status of performance as it relates to current laboratory accreditations.

15.3.6 Certifications. Changes or additions to the laboratory's certifications are addressed in the reports.

15.3.7 The annual report is reviewed and signed by the Vice President of Operations, Laboratory Manager, and the Technical Director. A copy of this report is kept for 5 years.

16.0 REAGENT STORAGE AND DOCUMENTATION

16.1 Safety and Shelf Life

Reagents are stored with consideration for safety and maximum shelf life. Storage conditions and documentation maintenance status for various classes of reagents are given in Table 16-1 and Table 16-2, and are discussed below.

16.1.1 All acids, except those poured into small marked containers for immediate use and those that are standardized for specific purposes, are stored in the original containers in acid storage cabinets.

16.1.2 All bases, except those poured into small containers for immediate use and those that are standardized for specific purposes, are stored in the original containers within designated areas or storage cabinets.

16.1.3 All flammable solvents, except those poured for immediate use, are stored in original containers in approved, vented, flammable storage cabinets, which are located indoors.

16.1.4 Dry reagents are stored in designated cabinets in cool, dry areas. Reactive chemicals, cyanides and sulfides are labeled and isolated from other chemicals.

16.1.5 All acids used for metal sample digestions and all solvents used for semi-volatile sample extraction may be tested prior to initial use. Lot numbers used for digestions or extractions are recorded in bound notebooks in the appropriate departments.

16.1.6 Reagent blanks are analyzed with each sample batch for all methods, validating the purity of all reagents. All reagent containers are dated when received, and dated and initialed when opened (except high use items consumed in less than one week). Documentation is maintained to provide traceability of the reagents used with the analysis of any batch to specific reagent lot numbers.

TABLE 16-1
STORAGE OF REAGENTS AND CHEMICALS

i. CHEMICAL REQUIREMENTS	STORAGE
ii. Concentrated acids and bases	1
ii) Standards for metals analysis	2
Standards for extractable organics	3
Standards for volatile organics	4
Bulk dry chemicals	5
Working solutions containing organic compounds	6
Working solutions containing only inorganics	7
Flammable solvents	8
Non-flammable solvents	9

Table 16-2
(a) STORAGE REQUIREMENT KEY

1. Stored in the original containers in acid/base cabinets. All organics must be stored separately.
2. Stored at room temperature in the standards cabinet of the metals department.
3. Stored below 0° C in the department.
4. Neat standards are stored at room temperature in the standard cabinet in the department. Stock solutions and working solutions are stored in the freezer.
5. Bulk reagents are stored at room temperature in reagent storage cabinets located throughout the laboratory.
6. Stored refrigerated at 1-4° C in the department.
7. Stored at room temperature in the department; refrigeration is optional.
8. Stored in solvent cabinets in the organic extraction laboratory.
9. Stored separately from the flammable solvents in cabinets in the organic extraction laboratory.

17.0 WASTE DISPOSAL

17.1 AES operates as a conditionally exempt, small quantity generator.

17.2 All waste disposal is carried out in accordance with AES Waste Disposal SOP, HS-03005. These documents include procedures for identification, storage, personnel training, tracking forms, report forms and safety, as well as details of the disposal. Hazardous waste disposal procedures are discussed below.

17.3 Hazardous Waste Requirements:

17.3.1 Hazardous waste is stored in non-leaking containers that are in good condition with close-fitting lids. The lids are kept closed when wastes are not being added or removed.

17.3.2 Hazardous waste storage containers are labeled with waterproof labels. The labels specify the words “Hazardous Waste”, composition and physical state of the waste, hazardous properties

of the waste (e.g., flammable, reactive, etc.), and the name and address of the generator.

17.3.3 Each hazardous waste container is clearly labeled with the date the period of accumulation began. The date is also documented on the Hazardous Waste Tracking Log Form (see Section 17.5.8).

17.3.4 All containers are handled in a way that minimizes the possibility of spills and escape of wastes into the environment.

17.3.5 Wastes are stored in an area that is regularly inspected for deteriorating or leaking containers.

17.3.6 All wastes are segregated during temporary accumulation, storage, and for disposal. Prior to disposal, waste materials are carefully combined into categories or waste streams based upon their compatibility.

17.3.7 The following three types of waste are stored in 55-gallon drums.

17.3.7.1 Halogenated solvents such as methylene chloride (closed cap metal drum)

17.3.7.2 Non-halogenated flammable solvents (closed cap metal drum).

17.3.7.3 Heavy metals or other aqueous wastes except cyanide (poly drum)

17.3.8 All other wastes are stored in the original container or 4-liter glass bottles and disposed of via a "lab pack" (i.e., packed by a disposal company in 55-gallon open top drums).

17.4 Sample Disposal (See also AES SOP HS-03005)

17.4.1 After completion of the analysis, unused sample portions, extracts, or digests are transferred to a central secured storage area until they are disposed. Unless a client requests that the project manager save unused samples, digests, or extracts, disposal from the central storage occurs 30 days after submission for test results.

17.4.1.1 Summary of sample disposal procedure:

17.4.1.1.1 Samples are initially put into labeled bins in the walk-in cooler for 30 days in case client decides to add test(s) that require refrigerated storage. All bins must be labeled. Labels include storage location and date of disposal.

17.4.1.1.2 Sample reporting date is used to initiate the 30 day time period. Samples that were put on hold upon receipt should use the date associated with the earliest reported test result unless otherwise indicated by the client or noted by the project manager.

17.4.1.1.3 When attaching labels to the bin, use both the adhesive on the label as well as a piece of clear tape as a second measure to ensure the label does not come off.

17.4.1.1.4 Sample Management Supervisor (a.k.a. Bottle Prep Supervisor) maintains a list of bin disposal dates. Supervisor must sign and date this sheet in order for bins to be disposed. No bins are to be disposed of by disposal technician without management approval.

17.4.2 Requests for extended sample, digest or extract storage must be provided by the client to the AES project manager in writing (contract form) prior to sample receipt. Extended storage may result in the charging of additional fees by the AES project manager prior to sample receipt. AES is not responsible for evaporation or other deterioration of samples, extracts, or digests during extended storage periods.

17.4.3 Clients that desire the return of samples may pick them up at the laboratory, request shipment

by Federal Express (at the client's expense for packaged shipping), or utilize any other legal means that they choose. Clients requesting the return of samples should provide detailed shipping instructions.

17.4.4 If a client, by contract, specifies sample disposal by a hazardous waste contractor, the client's name and EPA ID number will be used on the manifest and the client will be invoiced for all disposal-related costs.

17.4.5 Other excess sample portions are composited by the laboratory according to matrix (solids, soils or aqueous). Composited soils, sediments & other solid samples are sub-sampled and analyzed for hazardous waste characteristics (ignitability, reactivity, (releasable cyanide and sulfide), corrosivity (pH), toxicity (TCLP by SW-846 Method 1311) and PCBs). If the pooled sub-sample is characterized as hazardous by any of the hazardous waste characteristics or contains greater than 50 ppm PCBs, the excess sample is disposed of through the use of a hazardous waste contractor. If the pooled sub-sample is not deemed hazardous based upon the results of these tests, the composited excess material is disposed of in an industrial/municipal landfill.

17.4.6 Aqueous samples are neutralized and disposed of via the municipal sewer system, following all discharge requirements outlined in 40 CFR Part 261.3 (a)(2)(iv)(E).

17.5 Organic Waste Disposal (See also AES SOP HS-03005)

17.5.1 Similar waste disposal procedures for samples from the volatile, semi-volatile and GC/HPLC pesticide laboratories are employed at AES.

17.5.2 All personnel should be familiar with the SOP prior to the disposal of wastes in the laboratory.

17.5.3 AES is considered as a Conditionally Exempt, Small Quantity Generator under 40 CFR Part 261.5 (a generator who generates no more than 100 kilograms of hazardous waste or 1 kilogram of acute hazardous waste in a calendar month and accumulates no greater than 1000 kilograms of hazardous waste). Hazardous waste storage is limited to quantity and/or accumulation and must comply with RCRA regulations as specified in 40 CFR. These wastes are packaged and separated according to compatible groups (e.g., solvents, acids, etc.)

17.5.4 The pH of the discharged waste MUST be between 5 and 10. If the pH of the discharged waste is out of this range, it is diluted with water or treated with the appropriate acid or base.

17.5.5 Apparatus and Equipment

17.5.5.1 Respirator and gloves

17.55.2 5-gallon plastic buckets with lids

17.5.6 Reagents and Chemicals.

17.5.6.1 Marble chips for neutralizing acid waste

17.5.7 Procedure

Prior to the disposal of any waste, the Health and Safety Officer provides a sample disposal list to the laboratory employee performing the task. Included in this list is the method of disposal and location of disposal for each sample. The Health and Safety Officer obtains this information from the AES LIMS system and categorizes the samples as hazardous or non-hazardous.

17.5.7.1 The procedure for the collection and disposal of expired organic chemicals and solutions is outlined in the subsequent sections.

17.5.7.1.1 Neat standards are sealed and labeled.

17.5.7.1.2 All stock standards, working standards and unused sample extracts are emptied into a properly labeled (contents are listed using the official waste storage labels) 4-L empty solvent bottle.

17.5.7.1.3 Waste standards or samples containing Silvex (2,4,5-TP), 2,4,5-T, or PCBs are stored separately from other waste standards. These compounds are potential dioxin wastes. All acid herbicide standards or sample waste are stored separately from other standard wastes.

17.5.7.1.4 HPLC/GC vials containing solvents, standards and extracts are stored in a labeled, 4-liter, empty solvent bottle.

17.5.7.1.5 Wastes are never allowed to accumulate in the laboratory for longer than 3 days. Wastes that are stored for longer time periods are stored in the waste storage room located at the back of the laboratory. All dated waste is disposed of in drums.

17.5.7.1.6 Each drum is labeled according to contents, i.e., chlorinated, non-chlorinated solvents, acid and mercury waste. Acid wastes are stored in the acid waste room that is separate from the solvent waste room.

17.5.7.1.7 All wastes are treated inside the fume hood using appropriate safety equipment such as a respirator, gloves, laboratory coat, and safety glasses.

17.5.7.1.8 The Safety Officer is notified in the event of any leaks or spills of hazardous wastes.

17.5.7.1.9 The waste drums available are:

Flammable Waste
Soil Waste
Acid Waste
Methylene Chloride Waste
Neutralized Waste

17.5.7.1.10 Autosampler vials full of sample waste are placed into an empty 4-liter solvent bottle, properly labeled, dated, and stored in waste room, where they are lab-packed.

17.5.7.1.11 High-level organic wastes are treated as hazardous substances and are placed in clearly labeled containers. Full containers are stored in the inorganic waste storage room.

17.5.7.1.12 Containers that have been used for the storage of high level wastes are not reused.

17.5.7.1.13 Soil samples are transferred to 55-gallon drums. When full, a composite sample is analyzed for TCLP and characterized for disposal through the use of a Hazardous Waste Contractor.

17.5.7.1.14 The contents of used VOC vials are neutralized prior to disposal in the sanitary sewer system.

17.5.7.2 The neutralization of alkaline or acidic wastes is performed with the following procedure.

17.5.7.2.1 A 5-gallon bucket with a strainer bottom is placed directly into a sink.

17.5.7.2.2 The bucket is filled with 6 to 8 inches of marble chips.

17.5.7.2.3 Pass a generous flow of water through the bucket containing the marble chips.

17.5.7.2.4 The samples are added to the bucket at the same time that the water is flowing allowing the samples to drain through the chips and become neutralized.

17.5.8 The Waste Disposal Logbook is located in close proximity to each drum. The following information is added to the logbook:

AES WORK ORDER Number
Client Sample I.D. Number
Employee(s) Name(s)
Nature of Disposal

17.5.9 The Health and Safety Officer maintains a separate waste disposal record file. These files contain the master list of samples that have been disposed, TCLP analytical results, raw data, and disposal manifest receipts.

17.6 Inorganic Waste Disposal (See also AES SOP HS-03005)

The procedure for the collection and disposal of expired inorganic chemicals and solutions is outlined in the subsequent sections.

17.6.1 AES is considered as a Conditionally Exempt, Small Quantity Generator under 40 CFR Part 261.5 (a generator who generates no more than 100 kilograms of hazardous waste or 1 kilogram of acute hazardous waste in a calendar month and accumulates no greater than 1000 kilograms of hazardous waste). Hazardous waste storage is limited to quantity and/or accumulation and must comply with RCRA regulations as specified in 40 CFR. These wastes should be packaged and separated according to compatible groups (e.g., solvents, acids, etc.). Waste water containing toxic waste from the laboratory that does not exceed 1% of total waste water flow can be disposed of into the sanitary sewer system as specified in 40 CFR part 261.3E.

17.6.2 The pH of the discharged waste MUST be between 5 and 10. If the pH of the discharged waste is out of this range, it is diluted with water or treated with the appropriate acid or base.

17.6.3 Apparatus and Equipment

17.6.3.1 Large polyethylene tank (250 gallon)

17.6.3.2 Latex gloves

17.6.3.3 Stirring rod (glass or wood)

17.6.4 Reagents and Chemicals

17.6.4.1 Soda Ash, sodium carbonate ($NaCO_3$)

17.6.5 Procedure

Prior to the disposal of any waste, the Health & Safety Officer provides a sample disposal list to the laboratory employee performing the task. Included in this list is the method of disposal and location of disposal for each sample. The Health and Safety Officer obtains this information from the AES LIMS system and categorizes the samples as hazardous or non-hazardous.

17.6.5.1 All inorganic aqueous waste is poured into a 250 gallon tank in the disposal room by disposal personnel. When the tank is approximately half full, the solution can be neutralized.

17.6.5.2 Soda Ash is slowly added to the waste solution while it is stirred. The solution will effervesce as the Soda Ash neutralizes the acid in the solution.

17.6.5.3 When the pH of the liquid has been sufficiently neutralized, the waste is drained slowly.

The tank is flushed with copious amounts of water.

17.6.5.4 Samples with observed concentrations of measured analyte above the calibration level of the various instruments are treated as hazardous waste. This includes the sample waste generated from the flame AA or ICP instrument. This waste is collected in a storage bottle and is disposed of as an acidic waste when the bottle is filled.

17.6.5.5 High-level inorganic wastes in organic solvents are treated in the following manner:

17.6.5.5.1 The high-level waste is placed into a clearly labeled container. When the container is full, the container is placed into the waste storage room.

17.6.5.5.2 Containers used for the storage of high-level wastes are not reused.

17.6.6 The Waste Disposal Logbook is located in close proximity to each drum. The following information is added to the logbook:

AES WORK ORDER Number
Client Sample I.D. Number
Employee(s) Name(s)
Nature of Disposal

17.6.7 The Health and Safety Officer maintains a separate waste disposal record file. These files contain the master list of samples that have been disposed, TCLP analytical results, raw data, and disposal manifest receipts.

APPENDIX I

WASTE DISPOSAL PROCEDURES

Waste Type	Associated Analytical and Sample Prep Methods	Storage Procedures	Disposal Procedures
Halogenated Solvents Methylene Chloride	Pesticides, Herbicides, BNA, GPC, etc.	Store in glass bottles, then in drums.**	Reclaimed by HW contractor.
Freon	Oil & Grease, Petroleum Hydrocarbons	Store in glass bottles.	Reclaimed by laboratory.
Mixed Solvents (Flammable & nonhalogenated)	VOC Standards, Herbicides, Pesticides	Store in glass bottles, then in drums.	Disposal by HW contractor.
All neat standards	All analyses	Store in original bottles of glass/plastic bottles, then lab pack.	Disposal by HW contractor (Packed by also)
Heavy Metals Solutions	Metals, COD, Chloride	Store in glass bottles, then in drums.	Disposal by HW contractor.
Acid Solutions	Metals, General Inorganics, Extractions	Store in glass bottles or add to neutralizing chambers.	Neutralize; sanitary sewer.
Alkaline Solutions	General Inorganics, Extractions	Store in glass bottles.	Neutralize; sanitary sewer.
All samples containing Organics or Inorganics exceeding hazardous waste standards*	All analytical groups	Store in original bottles or jars in sample custody storage area.	Return to client or disposal by HW contractor.

* Hazardous Waste Characteristics (D001-D017) (40 CFR Part 261), HCN>250 mg/kg, TCLP Toxicity Characteristics (Federal Register, 55FR 11798), March 29, 1990, or contains greater than 50 ppm PCBs.

** Bottles are kept in each laboratory and are periodically moved to the hazardous waste storage area.

APPENDIX II

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

	Service Interval							
EQUIPMENT ITEM	D	W	M	Q	SA	A	AN	SERVICE LEVEL
ICP-AES and ICP-MS								
Pump Tubing				X				Change
Nebulizer			X					Clean
Filters			X				X	Inspect - clean or replace.
Spray Chamber			X					Clean
Quartz Torch					X			Clean and realign.
D-Shaped Mirrors			X				X	Inspect - clean or replace
MERCURY ANALYZER AND AUTOSAMPLER								
Pump Tubing	X						X	Inspect – replace
Standard Cups	X						X	Inspect – replace
Drying Tube	X							Repack
Mixing Coil		X						Inspect - clean or replace
Sample Probe			X					Inspect - clean or replace
Mercury Lamp							X	Clean or replace
CONDUCTIVITY METER								
Battery							X	Check or replace
Probe Contacts							X	Clean or replace
pH METER								
Probe(s)	X							Check fluid levels and fill
Connectors	X							Check for corrosion and clean if necessary
AUTOANALYZER (TRAACS/LACHAT)								
Pump Platen							X	Replace
Pump Tubes				X				Replace
Flow Cell				X				Inspect and clean.
Autosampler	X							Check alignment
Cobalt Column							X	Inspect for channeling and repack
BLOCK DIGESTER								
Heating Elements							X	Replace as needed
Thermostat					X			Check against calibrated thermometer for accuracy
UV/VIS SPECTROPHOTOMETER								
Light Source							X	Replace
Belt	X							Check for wear, replace if frayed
Cuvettes	X						X	Check for scratches and buildup - replace
ION SELECTIVE ELECTRODE								
fluid filled probe	X						X	Check fluid level - empty and replace if crystals form
solid probe	X							Check for salt build-up on tip, clean if necessary
BOMB CALORIMETER								
Thermometer						X		Calibrate Thermometer
Seals	X							Check for breaks in seals and replace if needed
GAS CHROMATOGRAPH – SEMIVOLATILES								
Autosampler System							X	Syringe and tubing cleaned – Needles/ tubing replaced
Septa		X						Replace
Column/Injector							X	Chance sleeve and cut front of guard column.
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
GAS CHROMATOGRAPH - MASS SPEC SEMIVOLATILES								

APPENDIX II

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

	Service Interval							
EQUIPMENT ITEM	D	W	M	Q	SA	A	AN	SERVICE LEVEL
Column/Injector		X						Chance sleeve and cut front of column.
Septum		X						Replace
Splitless Disc					X			Replace
Autosampler	X					X		Syringe and tubing cleaned Needles and tubing replaced
Rough Pump						X		Oil change by HP service
Mass Spectrometer							X	Clean
Gas Cylinder	X							Inspect - Change when pressure reads <500 psi.
Hard Drive		X						Archive
ATOMIC ABSORPTION								
Pump	X							check for leaks and corrosion
Lamps							X	If intensity drops, replace
Nebulizer		X						Clean, sonicate
Tubing	X							If leaking or weak, replace
Burner Head		X						Clean, sonicate
Bottled Gases	X							Replace if pressure reaches 500 psi.
Spray Chamber			X					Clean, sonicate
GAS CHROMATOGRAPH – VOLATILES								
Column							X	Replace
Septum			X					Replace
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap						X		Replace
GAS CHROMATOGRAPH - MASS SPEC VOLATILES								
Column							X	Replace
Rough Pump						X		Oil change by HP service
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
Septum			X					Replace
Transfer Line							X	Check for leaks
GAS CHROMATOGRAPH – ECD								
Autosampler	X					X		Syringe cleaned Needles and tubing replaced
Column							X	Replace
Septa							X	Replace
Glass Insert							X	Replace
Gold Disk							X	Replace
Gas Cylinder	X							Inspect - change when pressure reads <500 psi.
EC Detector(s)						X		Send off for replacement of radioactive nickel foil.
GAS CHROMATOGRAPH – FID								
Autosampler	X						X	Syringe and tubing cleaned Needles and tubing replaced
Column							X	Replace
Septa							X	Replace
Gas Cylinder								Inspect daily, change when pressure reads <500 psi.
Glow Plug								Determine if glow is enough to ignite Hydrogen

APPENDIX II

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

	Service Interval							
EQUIPMENT ITEM	D	W	M	Q	SA	A	AN	SERVICE LEVEL
Housing and chimney								Check for rust and corrosion that will cause a short, and clean if necessary.
Glass Insert							X	Replace
Column							X	Replace
PURGE AND TRAP								
Sorbent Trap					X			Change
Heater Pockets	X							Check, replace if defective
Transfer Lines							X	Inspect and replace if needed
Purge Flow					X			Inspect, adjust as needed
TCLP EQUIPMENT								
Volatile Rotator	X							Check rotation (± 30 rpms)
Semi-volatiles/Metals Rotator	X							Check rotation (± 30 rpms)
BALANCES								
Balances	X							Calibrate, service annually
Auto-Pipettors				X				Calibrate
BALANCE WEIGHTS – for daily balance checks								
Set “B” – 10 weights								Verified every 5 years by a body that can prove traceability to NIST
THERMOMETER (CERTIFIED) – for in-house thermometer calibrations								
HB #28199 (CMI #32478) –1 to 200°C							X	Certified every 5 years by a body that can prove traceability to NIST
DISSOLVED OXYGEN METER								
Batteries	X							Check for strength, if < 13.20 replace
Membrane				X				Replace. Sooner if signal will not stabilize
Spill housing and stirrer	X							Clean

The service intervals listed in Appendix II are as follows: D = daily; W = weekly; M = monthly; Q = quarterly; SA = semi-annually; and AN = as needed.

APPENDIX III
LAB EQUIPMENT LIST

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1000	MS-4	Auto Sampler	Varian	Archon	13405	1999
1001	MS-4	Sample Concentrator	OI Analytical	4560	J448460426	1999
1002	MS-4	GC	HP	6890	430021BJ4	1999
1003	MS-4	MS	HP	5973	US82311468	1999
1004	MS-5	Auto Sampler	Varian	Archon	12110	2001
1005	MS-5	Sample Concentrator	OI Analytical	4560	H413460123	2001
1695	MS-5	Sample Concentrator	OI Analytical	4660	D63646651P	2006
1006	MS-5	GC	Agilent	6850	US00001050	2001
1007	MS-5	MS	Agilent	5973	US94240080	2001
1008	MS-7	Auto Sampler	Varian	Archon	12999	1999
1009	MS-7	Sample Concentrator	OI Analytical	4560	D310211	1999
1838	MS-7	Sample Concentrator	OI Analytical	4660	D807466325P	2008
1010	MS-7	GC	Agilent	6850	US00001051	2001
1011	MS-7	MS	Agilent	5973	US94240092	2001
1012	MS-8	Auto Sampler	Varian	Archon	13322	2001
1013	MS-8	Sample Concentrator	Tekmar	3000	98259003	2000
1623	MS-8	Purge & Trap	OI Corporation	Eclipse 4660	D524466126P	2005
1014	MS-8	GC	Agilent	6850	US00001100	2001
1015	MS-8	MS	Agilent	5973	US94240107	2001
1020	GC-2	GC	HP	5890SII	3336A5502	1994
1021	GC-2	Auto Sampler	HP	18596M	3209A27907	1994
1022	GC-2	Tower	HP	18593B	3202A29321	1994
1023	GC-3	GC	HP	5890SII	3140A38355	1995
1024	GC-3	Auto Sampler	HP	18596M	3433A36260	1995
1025	GC-3	Tower	HP	18593B	3341A36564	1995
1026	GC-4	GC	HP	5890SII	302218A29420	1997
1027	GC-4	Autosampler	HP	18596B	3320A32113	1997
1028	GC-4	Tower	HP	18593B	3013A22544	1997
1029	GC-5	GC	HP	5890SII	3140A39201	1998
1030	GC-5	Auto Sampler	HP	18596B	3050A23709	1998
1031	GC-5	Tower	HP	G1513A	US81205611	1998
1643	GC-6	GC	HP	5890SII	3235A46102	1995
1644	GC-6	A Sampler Controller	HP	7673 / 18594B	3318A32045	1995
1645	GC-6	Tower	HP	7673 / 18593B	3442A40453	1995
1537	GC-7	Computer	Agilent	MXZ3460BJW	MXZ3460BJW	2004
1538	GC-7	GC (ECD)	Agilent	6890N	CN10427041	2004
1539	GC-7	Tower	Agilent	7683	CN42437159	2004
1032	MS-6	GC	HP	6890	US00021363	1999
1033	MS-6	MS	HP	5973	US80310957	1999
1034	MS-6	Auto Sampler	Agilent	G2614A	US00807551	1999
1035	MS-6	Tower	Agilent	G2613A	US00811878	1999
1036	MS-3	GC	HP	5890SII	336A55978	1995
1037	MS-3	MS	HP	5972A	3501A02369	1995
1038	MS-3	Auto Sampler	HP	18596B	3342A33508	1995
1039	MS-3	Tower	HP	18593B	3013A22290	1995
1040	HPLC-1	Degasser	HP	G1322A	JP73017078	1999
1041	HPLC-1	Quatpump	HP	G1311A	DE91606476	1999
1042	HPLC-1	ALS	HP	G1313A	DE91608580	1999

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1043	HPLC-1	Colcom	HP	G1316A	DE91609970	1999
1044	HPLC-1	UV Detector	HP	G1314A	JP92108737	1999
1045	HPLC-1	Fluorescence Detector	Jasco	FP-920	D398 1892	1999
1046	HPLC-1	Interface	HP	35900E	CNDDQ1250	1999
1047	TOC-1	TOC Analyzer	Shimadzu	TOC5050A	36201577A	1999
1048	TOC-1	Auto Sampler	Shimadzu	ASI5000A	36N02328A	1999
1089	Balance 5	Top Loader	Denver Inst	AL500	B039416	2002
1099	MIDI Distillation	Distillation	Lachat	1700	2000-419	2002
1129		Concentrator	Zymark	TurboVap II	TV9909N8714	
1153	Meter	Conductivity Meter	Orion	150	19462	2001
1153	Meter	Conductivity Meter	Orion	150	19462	2001
1177		Velometer	Alnor	Jr.	N/A	
1182	Balance 4	Analytical	Mettler	AE100-240	L39952	
1888		Concentrator	Zymark	TurboVap II	TV0116N10262	
1187	MS-9	GC	Agilent	6890N	US10133113	2000
1188	MS-9	MS	Agilent	5973	US10441238	2000
1189	MS-9	Auto Sampler	Agilent	G2614A	US12419350	2000
1210	MS-10	GC/MS	Agilent	5973	US82311282	1998
1211	MS-10	GC/MS	Agilent	6890	US00024777	1998
1212	MS-10	Autosampler	Agilent	7683	US84302879	2001
1217	TOC-2	TOC	Rosemount	DC-190	L9408399	2002
1218	TOC-2	Auto Sampler	Rosemount	183	9401165	2002
1224	MS-11	Auto Sampler	Varian	Archon	12536	1999
1225	Autosampler	Auto Sampler	Varian	Archon	12535	
1226	MS-11	Sampler Concentrator	OI Corporation	4560	3515A10291	1999
1227	MS-11	GC	Agilent	5890	3336A56613	1994
1228	MS-11	MS	Agilent	5973	3435A01886	1994
1229	Concentrator	Concentrator	OI Corporation	4560	94284012	
1265	Microscope	M2 LabScope	LW Scientific	LW 200	301473	
1502	Microscope	M2 LabScope	LW Scientific	LW 200	30H584	1998
1503	MS-12	5973	HP	5973	US81221559	2003
1504	MS-12	6890/GC	HP	6890	DE00020822	2003
1505	MS-12	Sample Concentrator	OI Corporation	4660	A350466159	2003
1620	MS-13	GC	Agilent	6850N	US10506012	2005
1621	MS-13	MS	Agilent	5973N	US52047399	2005
1622	MS-13	Autosampler	Varian	Archon	14371	2005
1602	MS-13	Purge Press/4660	OI Analytical	4660	B421466132P	2004
1513	Block Digestor	BD-46 Block Digester	Lachat	BD-46	1 800 703	2002
1519	Lachat-2	YXZ	Lachat	ASX-500 Series	A81010-774	2003
1520	Lachat-2	Autoanalyzer	Lachat	QuickChem FIA+ 800	A8300-2107	2003
1521	Lachat-2	Reagent Pump	Lachat	RP-100Series		2003
1522	Autosampler	YXZ	Lachat	ASX-500 Series	A81010-774	
1523	Autosampler	Autosampler	Varian	SPS 5	EL00043932	
1609	IC2	ICS 1000 Ion Chrom. Sys	Dionex	ICS-1000	5010499	2005
1610	IC2	AS 40 Auto Sampler	Dionex		4100492	2005
1657	Digital Reactor Block	Digital Reactor Block 200	Hach	LTG082.99.42001	1147550	
1674	GC-8	GC-8	Agilent	6890N	CN 10609020	2006
1675	GC-8	Injector (Tower)	Agilent	7683B	CN603330862	2006
1676	GC-8	ALS Sampling Tray	Agilent	G2614A	CN60638448	2006

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
1700	Balance 12	Analytical	Mettler	AL104	1227330378	2006
1707	MS-14	MS	Inert	5975B	US62714424	2006
1708	MS-14	GC	Inert	6890 N	CN10631084	2006
1709	MS-14	Autosampler	Inert	7683B	CN63835818	2006
1714	Microscope	Vision Microscope	Lab Essentials, Inc.	Vision	505007	2006
1715	Microscope	Vision Microscope	Lab Essentials, Inc.	Vision	505019	2006
1716	Microscope	Vision Microscope	Lab Essentials, Inc.	Vision	505029	2006
1717	Balance 13	Analytical	Mettler	AL104	1227300041	2007
1722	Stage Micrometer		Microscope Service, Inc.	L & W		2005
1728	MS-15	GC	Agilent	6850A	US10710001	2007
1729	MS-15	MS	Agilent	5973 Inert	US44610842	2007
1730	MS-15	Purge & Trap	OI Corporation	Eclipse 4660	D713466088P	2007
1731	MS-15	Autosampler	Varian	Archon	15099	2007
1732	MS-15	Computer	HP Compaq	ESO	USV3400DTH	2007
1837	Microscope	Meiji PLM Asbestos	MilesCo Scientific	ML6130	600091	2008
1841	Balance 14	Analytical	Ohaus	AP3105	M52542	2003
1857	COD Reactor	30 position; 120V; 200Wt	Bioscience	100 003	COD-B0203	2008
1900	Turbovap II	Concentrator	Caliper Life Sci	103187	TV0953N15641	2010
1910	DO Meter	BOD Meter	YSI	500-115V	07H101424	2010
1921	MS-16	Autosampler	OI Corporation	4552	MS1003W023	2010
1922	Conductivity Probe	Conductivity Meter Probe	Orion	11510	Lot OX7-10019	2010
1924	MS-16	Sampler Concentrator	OI Corporation	4660	E008466762P	2010
1925	IC3	Ion Chromatograph	Dionex	ICS1500	1598656	2010
1930	MS-16	GC	Agilent	7820A	CN10202030	2010
1931	MS-16	MS	Agilent	5975	US10200403	2010
1936	Injector	Injector (Tower)	HP	18593B	3531A43472	2010
1955	MS-8	Autosampler	EST Centurion	Cents221031111	416080003183	2011
1974	pH Meter	pH Meter	Fisher Scientific	925	20400058	2002
1986	GC-3	Tower	HP	18593B	Motor # PJ5001W-17	1995
1987	ORP Probe	REDOX Potential	Accumet	Cat. 13-620-115	SN2362021P	2013
1988	ICP/MS-Agilent	ICPMS	Agilent - 7700X Series	(G3281A)	JP11391304	2013
1989	ICP/MS Autosampler	Auto Sampler	Agilent - ASX-500 Series	(G3286A)	US10167A520	2013
1990	ICP/MS Chiller	Recirculating Chiller	Agilent - QC3292-80000	(G3292A)	3K10B1258	2013
1991	ICP/MS Vac Pump	ICPMS	Edwards- G1833-81003	/ A36324904	119496740	2013
1995	DI Water System	DI Water	ELGA	Centra-R200	CN200RL220228	2013
2003	Balance	Analytical	Mettler Toledo	AB104-S	1121311765	2003
2004	Balance	Toploader	Mettler Toledo	PM4800	M86379	2004
2005	Balance	Toploader	Mettler Toledo	S12000S	2644872	2005
2006	COD Reactor	Block	HACH	Part #45600-00	9.512E+11	2002
2017	COD Reactor	Hot Block	HACH	45600-00	1030021841	2000
2027	Walk-in Cooler #2	Cooler	Trenton	CS18K6ETF5256/T EHA030E6HT3BB	13GCE793M/130311991T	2013
2036	Volatiles Cooler	Walk-in	Refrigeration	4G3	5605266	2000
2057	INCUBATOR 2	Oven	Fisher Scientific	655G	N/A	2002
2060	Electron Microscope	TEM	Philips	EM-420	943206007001	1985
2061	Water Chiller	for TEM lab	Haskris	R075	HA0058	1990
2064	pH Probe	pH Meter Probe	Orion-Thermo Scientific	Cat. 9102BNWP	Lot #SX1	2014
2065	Balance	Analytical	Fisher	Item # ALF64	N0588330030008P	2010
2067	Balance	Analytical	Mettler	AE160	0578	2002

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2068	Chiller	Neslab	Thermo Scientific	ThermoFlex2500	0110975101140313	2014
2069	Lachat-3	Quick Chem QC8500	Lachat	Series 2	140600001703	2014
2085	Sonicator	EDP No. 100-132-1640R	Fisher	500	BCK08014450A	2008
2086	Hach Incutrol	115v, 60Hz		2150	1752	2014
2087	Incubator	Kenmore		253.2274241	WB43851388	2014
2091	Sonicator	Output 550watt	Fisher	F500	F1657	2008
2092	MS-17	GC	Agilent	7890B	CN14403051	2014
2093	MS-17	MS	Agilent	5977A	US1441M401	2014
2100	Turbidity Meter	Turbidimeter	Lovibond	Lot# 7374	3078	2014
2101	MS-17	Cleaning Module	Entech	3100D	1687	2014
2102	MS-17	Oven	Entech	09-0V6L-12	0135	2014
2103	MS-17	Diluter	Entech	4700	0026	2014
2104	MS-17	Concentrator	Entech	7200	1217	2014
2105	MS-17	Autosampler	Entech	7650	0025	2014
2106	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # SS1-16273	2014
2107	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # SS1-16288	2014
2108	GC-9	GC	Agilent	7890B (G3440B)	CN14483265	2015
2109	GC-9	Auto Sampler Tray	Agilent	7693 (G4514A)	CN14380119	2015
2110	GC-9	Tower	Agilent	7693 (G4513A)	CN14490172	2015
2111	GC-9	ECD (Front)	Agilent	G2397A	U26039	2015
2112	GC-9	ECD (Back)	Agilent	G2397A	U26040	2015
2114	IC Autosampler	Automated Sampler	Dionex	AS40-1	96040432	1999
2120	MS-13	Autosampler	Centurion		CentW502100614	2014
2130	Hydrogen Generator	Whatman	Parker Balston	75-32		2013
2131	GC-9	ECD Cell	Agilent	G2397-60610	U25762	2015
2132	Chiller	Chiller	Polyscienece	N0772026	106500740	2015
2141	Incutrol 2 Regulator	BOD Incubator	HACH	2597A	961000010041	2015
2143	Zero Air Generator	FID	Whatman	76-803	76-803	2013
2145	Incutrol 2 Regulator	BOD Incubator	HACH	2597-00	9.304E+11	2015
2146	Zero Air Generator	FID	Whatman	76-830	E1523	2013
2148	ICP-OES	ICP-OES	Agilent	5100	MY15120005	2015
2149	Auto Sampler	CETAC	CETAC	ASX-520	011552A520	2015
2150	Chiller	Recirculating	Agilent	G8481-80001	1A1531347	2015
2156	Auto Sampler	Sample Prep System	Varian	SPS 5	EL 02056309	2010
2172	BOD Analyzer	BOD Auto EZ	Thermo Scientific	BODAUTOEZ	A0128	2015
2173	GC-10	6890 GC System	HP	G1530A	US00006903	2015
2174	GC-10	Auto-Sampler Controller	HP	G1512A	US70300684	2015
2175	GC-10	6890 ALS Tray	HP	18596C	4570100464	2015
2176	GC-10	7673 GC/SFC Injector	HP	18593B	3250A33325	2015
2177	GC-10	6890 Injector	HP	G15130	USZ0300Z10	2015
2178	GC-10	6890 Injector	HP	18593B	3042A23879	2015
2191	TKN Block Digestor	Block	Environmental Express	TKN100	2015TKNBC105	2015
2192	Carbon Coater	Vacuum Evaporator	SPI	Vacu-Prep II	None	1992
2193	Carbon Coater	Vacuum Evaporator	Akashi	VEF	2007	1973
2195	Incubator	Refrigerator like	Thermo Scientific	815	300033500	2015
2196	Zero Air Generator	for FID Makeup gas	Peak Scientific	Precision 3500cc	ZA15-09-457	2015
2208	Balance	Toploader	Sartorius	U6100	36040268	2015
2217	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # TO1-16409	2015

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2218	pH Probe	pH Meter Probe	Thermo Scientific	Cat. 10010-778	Lot # TO1-16402	2015
2233	Spectrophotometer		Hach	DR3900	1669679	2016
2237	pH Meter	Benchtop	Thermo Electron	Orion 3 Star	S/N 008172	2007
2238	pH Meter	Benchtop	Thermo Electron	Orion 3 Star	S/N B38810	2011
2240	pH Meter	Benchtop	Orion	520A	S/N 005618	1992
2242	pH Meter	Benchtop	Orion	520A	S/N 038734	1998
2243	pH Meter	Benchtop	Orion	520A	S/N 008368	1993
2244	Zero Air Generator	for FID Makeup gas	VWR / Whatman	26000-020/ 76-803	S/N ZA10000190	2013
2246	Auto Sampler	for Lachat	Cetac Technologies	ASX-520	070570A520	2011
2247	Dilutor	for Lachat	Lachat	PDS 200	50700000344	2011
2248	Balance	BasBal	Mettler	BB1200	L96139	2005
2249	Balance	Precision Advanced	OHAUS	GT 4100	8709	2007
2250	Balance	Research	Sartorius	R200D	60095	2000
2254	Sonicator	Water Bath	Bransonic	5510E-MT	ENA070028318F	2007
2255	Sonicator	Dismembrator	Fisher Scientific	F550	F1808	2008
2257	Spectrophotometer	SPEC-5	Shimadzu	UV-1601	A10753782917	2016
2261	MS-7	Autosampler	Centurion	M/S	462071416	2016
2265	Vacuum Pump	Oil-Less Centrifical	GAST	5KH36KNA510X	E16750339	2016
2282	Turbidimeter	Tungsten Lamp	Lovibond	194200	3463	2016
2285	GC-11	7890B GC System	Agilent	G3440B	CN16473170	2016
2286	GC-11	7890B ALS Tray	Agilent	G4567A	CN15030021	2016
2287	pH Probe	Orion-4 (for Alkalinity)	Thermo Scientific	Orion 9102BNWP	9102SC	2017
2288	pH Probe	Glass	Thermo Scientific	Orion 910	QR1-12852	2002
2291	TOC Analyzer	TOC-3	Shimadzu	TOC-L CPN	H54315432055 CS	2017
2292	TOC Autosampler	40 mL	Shimadzu	ASI-L	H57415401560 SA	2017
2293	Mercury Analyzer	Soil Combustion	Nippon	MS-3000	15740318	2017
2295	Liquid Sampler	Autosampler	Nippon	SC-3	13410578	2017
2296	Hg Analyzer	CVAA	Nippon	RA-4500	15780180	2017
2297	Hygrometer	Digital	Fisher	11-661-12	170254699	2017
2298	MS-18	GC	Agilent	7890B GC	CN15173094	2017
2299	MS-18	MS	Agilent	5977B MSD	US1715M029	2017
2300	MS-18	Autosampler	Agilent	ALS	CN15250014	2017
2301	MS-18	vacuum pump	Pfeiffer	DUO2.5	22032890	2017
2306	Thermoanemometer	Velometer	Extech	AN300	Z350828	2017
2307	Vulcan Digestor	Automated Hot Block	Questron Technologies	V84-P	VU17-1027-V1.1.1	2017
2309	FAA	240 AA	Agilent	G8431A	MY17220002	2017
2310	FAA Autosampler	SPS 4	Agilent	G8410A	AU17112735	2017
2311	Soil TOC Analyzer	Soil Analyzer	Shimadzu	SSM-5000A	H52735400079 NK	2017
2320	MS-4	Purge & Trap	EST Analytical	Evolution	EV806012517	2017
2321	MS-11	Purge & Trap	EST Analytical	Evolution	EV850061517	2017
2322	MS-15	Autosampler	EST Analytical	Centurion	CENTW597072017	2017
2332	Balance	Analytical	U.S. Solid	USS-DBS5	USS-DBS1709029	2017
2333	pH Probe	Glass	Thermo Scientific	Orion 9104BNWP	UT1-17346	2017
2339	Zero Air Generator	3500cc	Peak Scientific	Zero Air 3500cc	770004350	2017
2340	Nitrogen Generator	600cc	Peak Scientific	N2 Trace 600cc	770004363	2017
2341	C'prssd Air Generator	Compressed	Peak Scientific	Precision Air	770004231	2017
2345	Hydrogen Generator	Precision	Peak Scientific	H2 Trace 500 cc	000000000770005503	2017
2346	Pipettor	Adjustable, 1-10 mL	Oxford	Benchmate II	A86010041	2017

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2350	MS-19	GC	Agilent	7820A	CN1723204	2017
2351	MS-19	MS	Agilent	5977B MSD	US1741R002	2017
2358	pH Probe	Glass	Thermo Scientific	9157BN		2017
2359	ICP/MS	7900	Agilent	G8403A	JP17281926	2017
2360	ICP/MS Autosampler	SPS 4	Agilent	G8410A	AU17092619	2017
2362	Hotblock	Digital Reactor Block	Hach	DRB 200	17120C0305	2017
2367	Microwave Extractor	Ethox X	Milestone	49380	17122726	2018
2368	Discrete Analyzer	rAPID-T	Astoria-Pacific	4600	4660-1046	2018
2373	pH Meter	probe	Fisher Scientific	accumet AE150	ae95002608	2018
2375	Oxygen Probe	BOD Probe	YSI	5010		2018
2380	Discrete Analyzer	rAPID-T	Astoria-Pacific	4600	4660-1053	2018
2381	Balance	Analytical	U.S. Solid	USS-DBS5	USS-DBS1803053	2018
2382	Balance	Analytical	U.S. Solid	USS-DBS5	USS-DBS1803045	2018
2395	Vulcan Metals Digestor	Automated Hot Block	Questron Technologies	V42P	VU18-1005-V1.1.1	2018
2397	Hg Digest Analyzer	CVAA	Nippon	RA-4500	17780287	2018
2398	Flashpoint	Pensky Marten	Stanhope-Seta	35000-0 U	1053813	2018
2400	ICP-OES	ICP-OES	Agilent	5100	MY15500001	2018
2401	Auto Sampler	CETAC	CETAC	ASX-520	101525A520	2018
2402	Chiller	Recirculating	Agilent	G8481A	1805-01431	2018
2407	pH Probe	Glass	Thermo Scientific	9102BNWP	WV1-16437	2018
2408	pH Probe	Glass	Thermo Scientific	9102BNWP	WV1-16423	2018
2421	MS-17	Concentrator	Entech	7200CTS	1595	2018
2434	HPLC-1	ALS	HP	G1313A	DE65102508	2018
2439	Auto Titrator		Thermo Scientific	T910	T10147	2018
2440	ATC Probe		Thermo Scientific	927007MD		2018
2441	Ultra pH Electrode	ROSS	Thermo Scientific	8102BNUWP		2018
2442	Sonicator	Dismembrator	Fisher Scientific	F550	F1768	2018
2444	pH Meter	Digital Unit	Thermo Scientific	VSTAR10	V13409	2018
2445	pH Meter Module		Thermo Scientific	VSTAR-PH	VA18803	2018
2446	pH Electrode	Glass	Thermo Scientific	8302BNUMD	WR3	2018
2450	Waterbath	KD Concentration	Fisher Scientific	FSGPD20	300207609	2018
2452	ICP/MS	7900	Agilent	7900	SG1804244	2018
2454	Autosampler		OI Analytical	4100 Processor	D833410620	2018
2455	Purge/Trap Conc.		OI Analytical	4760 Eclipse	A832447935	2018
2458	Microscope	PLM Stereomicroscope	LW Scientific	Z4 Zoom	Z4H-BSF7-77SE	2018
2459	GC-12	6850A GC System	Agilent	6850A	US10540009	2018
2460	GC-12	6850A ALS Tray	Agilent	G2880A	CN53821085	2018
2462	Spectrophotometer		Thermo Scientific	Genesys 30	9A1W264118	2018
2463	Ultra pH Probe	ROSS	Orion	8102NUWP		2018
2464	Turbovap II		Zymark		04373	2018
2469	GC-14	6850A GC System	Agilent	6850A	US10406012	2018
2470	GC-14	6850 Autosampler	Agilent	6850 (G2880A)	CN14520114	2018
2471	pH Probe	Glass	Thermo Scientific Orion	8104BNUWP	XZ3-15334	2018
2485	Balance	Top Loader	RADWAG	WTC 2000	485747	2010
2491	Spectrophotometer	SPEC-7	Shlmadzu	Biospec-1601	A1075	2019
2493	N Generator		Peak Scientific	Precision 600cc	77005589	2019
2494	Discrete Analyzer-3		rAPID-T	4600	4660-1061	2019
2495	Discrete Analyzer-4		rAPID-T	4600	4660-1062	2019

ID No.	Instrument	Type	Manufacturer	Model	Serial Number	Age
2496	Discrete Analyzer-5		rAPID-T	4600	4660-1063	2019
2504	Chiller	for ICP-MS	Agilent	G3292-80200	180704660	2018
2507	Chiller	for ICP-MS	Agilent	G3292-80200	7U1760448	2018
2508	Chiller	for OES-2	Agilent	G8481A	1811-01643	2019
2512	Discrete Analyzer-6		rAPID-T	4600	4660-1067	2019
2514	Balance	Top Loader	RADWAG	WTC 2000	607423	2019
2515	Balance	Top Loader	RADWAG	WTC 2000	607428	2019
2516	Balance	Top Loader	RADWAG	WTC 2000	607458	2019
2522	Balance	Analytical	Mettler Toledo	ML204	B110120209	2019
2526	Balance	Analytical	Mettler Toledo	AE240	G50492	2019
2527	Meter	Conductivity/pH Meter	Oakton	pH/Con 10 Series	101196	2019
2528	Meter	Conductivity/pH Meter	Oakton	pH/Con 10 Series	76106	2017
2531	Balance	Top Loader	Radwag	WTC2000	607498	2017
2535	GC-15	GC Unit	Agilent	6850A	US10305001	2019
2536	Autosampler	For GC-15	Agilent	G2880A	CN31220462	2019
2537	pH Probe		Orion	8302BNUMD	XY3-15146	2019
2538	Autosampler	Autosampler	EST Analytical	Centurion	CENTW687040219	2019
2539	Autosampler	Autosampler	EST Analytical	Centurion	CENTS625040219	2019
2543	Titrator	Autotitrator	Thermo Fisher Orion	Orion T910	T10233	2019
2544	Probe	pH Electrode	Thermo Fisher	Ross Ultra	8102BNUWP	2019
2545	Autosampler	Autosampler	Dionex	AS-40	n/a	2019
2546	Dilutor	LaChat Dilutor		DRD	A89000-1192	2019
2549	Auto Soxlet Extractor	Soxtherm	Gerhardt	SOX 416	1/8465 19 0009	2019
2555	TEM Digital Camera	Digital	SIA	SIA-L3C	ML0081508	2016
2556	Conductivity Probe	Conductivity	Thermo Fisher Orion	013610MD 248930	G180035	2019
2557	Conductivity Probe	Conductivity	Thermo Fisher Orion	013005MD	248910-A01	2019

APPENDIX IV - Chain of Custody

AES | ANALYTICAL ENVIRONMENTAL SERVICES, INC.

Analytical Environmental Services, Inc.
3080 Presidential Drive, Atlanta, GA 30340-3704

CHAIN OF CUSTODY

Work Order: _____
Page ___ of ___

COMPANY:	ADDRESS:
PHONE:	EMAIL:
SAMPLED BY:	SIGNATURE:

#	SAMPLE ID	SAMPLED: DATE	SAMPLED: TIME	GRAB	COMPOSITE	MATRIX (see codes)	ANALYSIS REQUESTED / PRESERVATION (see codes)	REMARKS	Number of Containers
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									

Visit our website www.aesatlanta.com for downloadable COCs and to log in to your AESAccess account.

RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:
1.		1.	
2.		2.	
3.		3.	

SPECIAL INSTRUCTIONS/COMMENTS:

SHIPMENT METHOD

OUT: / / VIA:

IN: / / VIA:

Client FedEx UPS US mail courier

other: _____

PROJECT INFORMATION

PROJECT NAME:

PROJECT #:

SITE ADDRESS:

SEND REPORT TO:

INVOICE TO (IF DIFFERENT FROM ABOVE):

QUOTE #:_____ PO#:_____

RECEIPT

Total # of Containers

Turnaround Time (TAT) Request

- ☐ Standard
- ☐ 2 Business Day Rush
- ☐ Next Business Day Rush
- ☐ Same-Day Rush **(auth req.)**
- ☐ Other _____

STATE PROGRAM (if any): _____

E-mail? ☐ Fax? ☐

DATA PACKAGE: I ○ II ○ III ○ IV ○

Submission of samples to the laboratory constitutes acceptance of AES's Terms & Conditions. Client assumes sole responsibility for damage or loss of samples before we accept them. Samples received after 3PM or on Saturday are considered as received the following business day. If no TAT is marked on COC, AES will proceed with standard TAT. Samples are disposed of 30 days after completion of report unless other arrangements are made.

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water ST=Stormwater WW = Waste Water W = Water (Blanks) DW = Drinking Water (Blanks) O = Other (specify)

Preservative Codes: H+I = Hydrochloric acid + ice I = Ice only N = Nitric acid S+I = Sulfuric acid + ice S/M+I = Sodium Bisulfate/Methanol + ice O = Other (specify) NA = None

7.15.19_COC

White Copy - Original; Yellow Copy - Client

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
3080 Presidential Drive, Atlanta, GA 30340-3704
Tel.: (770) 457-8177 (800) 972-4889
www.aesatlanta.com

CHAIN OF CUSTODY FORM FOR AIR SAMPLE ANALYSIS

Client Name: _____ Contact: _____ Project Name/# : _____
Address: _____ Phone: _____ Samplers Name: _____
_____ Fax: _____ Sampling Date: _____

SAMPLE ID	SAMPLE DESCRIPTION (e.g. Locations, Name, etc)	PUMP NUMBER	TIME		FLOW RATE (L/min)			VOLUME (L)	ANALYSIS REQUESTED/REMARKS
			START	END	INITIAL	FINAL	AVG		

Turnaround Time: Normal (5 days): ☐ 3 Days Rush: ☐ 2 Days Rush: ☐ Next Day Rush: ☐

Comments: _____

Relinquished By:		Date/Time	
Received By:		Date/Time	
Relinquished By:		Date/Time	
Received By:		Date/Time	

Delivered Direct to Lab: ☐ Shipped: ☐
Method of Shipment: _____
Lab Recipient: _____
Date: _____

SAMPLES RECEIVED AFTER 3PM OR SATURDAY ARE CONSIDERED AS RECEIVED ON THE FOLLOWING BUSINESS DAY; IF NO TAT IS MARKED ON COC AES WILL PROCEED AS STANDARD TAT.

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
3080 Presidential Drive Atlanta, GA 30340-3704
Phone: (770) 457-8177 / Toll-Free: (800) 972-4889 / Fax: (770) 457-8188

Work Order: _____

Page ___ of ___

CHAIN OF CUSTODY
BULK ASBESTOS ANALYSIS

Client Name: _____ Phone: ( ) _____

Address: _____ Email: _____

City, State, Zip: _____ Project Name: _____

Contact: _____ Project Number: _____

Sampler's Name: _____ Sampling Date: _____

Report To: _____ Invoice To: _____

	Sample ID	Sample Location/Description	Analysis Requested	Turnaround Time (TAT)	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Relinquished by: _____ Date/Time: _____

Received by: _____ Date/Time: _____

Relinquished by: _____ Date/Time: _____

Received by: _____ Date/Time: _____

Submission of samples to the laboratory constitutes acceptance of AES's Terms & Conditions. Samples received after 3PM or on Saturday are considered as received the following business day. If no TAT is marked on COC, AES will proceed with standard TAT.

FOR LAB USE ONLY

Lab Recipient: _____ Date/Time: _____ Method of Shipment: _____

ANALYTICAL ENVIRONMENTAL SERVICES, INC
3080 Presidential Drive, Atlanta GA 30340-3704
TEL.: (770) 457-8177 / TOLL-FREE (800) 972-4889 / FAX: (770) 457-8188

VAPOR/AIR CHAIN OF CUSTODY

Work Order #: _____

Page ___ of ___

Company:	Address:	Bottle Order #:	Turnaround Time (Circle One): Standard 3 Day Rush 2 Day Rush Other
Phone:	Fax:		
Sampled by:	Signature:		

#	Sample ID	Sample Start Date	Sample Start Time (24hr)	Sample Finish Date	Sample Finish Time (24 hr)	Sample Matrix*	Canister Serial #	Flow Controller ID	Canister Pressure In Field ("Hg) Start	Canister Pressure In Field ("Hg) Stop	ANALYSIS REQUESTED TO-15							Remarks
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

SPECIAL INSTRUCTIONS/COMMENTS:	RELINQUISHED BY: DATE/TIME:	RECEIVED BY: DATE/TIME:	PROJECT INFORMATION
If specialized list is required, list analytes here:	1:	1:	PROJECT NAME:
	2:	2:	PROJECT #:
	3:	3:	SITE ADDRESS:
	SHIPMENT METHOD OUT / / VIA: IN / / VIA: CLIENT FedEx UPS MAIL COURIER GREYHOUND OTHER_____		SEND REPORT TO: INVOICE TO: (IF DIFFERENT FROM ABOVE) PO#: STATE PROGRAM (if any): _____ E-mail? Y / N Fax? Y / N QUOTE #:_____ DATA PACKAGE: I II III IV

SAMPLES RECEIVED AFTER 3PM OR SATURDAY ARE CONSIDERED AS RECEIVED ON THE NEXT BUSINESS DAY; IF NO TAT IS MARKED ON COC, AES WILL PROCEED AS STANDARD TAT.
Visit our website www.aesatlanta.com to check on the status of your results, place bottle orders, etc.

*SAMPLE MATRIX: IA = Indoor Air AA = Ambient Air SS = Subslab SV = Soil Vapor O = Other (specify)

AES, Inc., assumes no liability with respect to the collection and shipment of these samples.

White Copy - Original; Blue Copy - Client

APPENDIX V

determine if the field or sample transporting procedures and environments have contaminated the sample.

GC—Gas chromatograph or gas chromatography.

Internal standard—A compound added to an extract or standard solution in a known amount and used as a reference for quantitation of the analytes of interest and surrogates. In this method the internal standards are stable isotopically labeled analogs of selected method analytes (Table 8). Also see Internal standard quantitation.

Internal standard quantitation—A means of determining the concentration of an analyte of interest (Tables 1–3) by reference to a compound not expected to be found in a sample.

DOC—Initial demonstration of capability (section 8.2); four aliquots of reagent water spiked with the analytes of interest and analyzed to establish the ability of the laboratory to generate acceptable precision and recovery. A DOC is performed prior to the first time this method is used and any time the method or instrumentation is modified.

Laboratory Control Sample (LCS; laboratory fortified blank; section 8.4)—An aliquot of reagent water spiked with known quantities of the analytes of interest and surrogates. The LCS is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the limits specified in this method for precision and recovery.

Laboratory fortified sample matrix—See Matrix spike.

Laboratory reagent blank—A blank run on laboratory reagents; *e.g.,* methylene chloride (section 11.1.5).

Matrix spike (MS) and matrix spike duplicate (MSD) (laboratory fortified sample matrix and duplicate)—Two aliquots of an environmental sample to which known quantities of the analytes of interest and surrogates are added in the laboratory. The MS/MSD are prepared and analyzed exactly like a field sample. Their purpose is to quantify any additional bias and imprecision caused by the sample matrix. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS/MSD corrected for background concentrations.

May—This action, activity, or procedural step is neither required nor prohibited.

May not—This action, activity, or procedural step is prohibited.

Method blank—See blank.

Method detection limit (MDL)—A detection limit determined by the procedure at 40 CFR part 136, appendix B. The MDLs determined by EPA in the original version of the method are listed in Tables 1, 2 and 3. As noted in section 1.5, use the MDLs in Tables 1, 2, and 3 in conjunction with current MDL data from the laboratory actually analyzing samples to assess the sensitivity of this procedure relative to project objectives and regulatory requirements (where applicable).

Minimum level (ML)—The term ''minimum level'' refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the MDL in a method, or the MDL determined by a laboratory, by a factor of 3. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: ''quantitation limit,'' ''reporting limit,'' and ''minimum level.''

MS—Mass spectrometer or mass spectrometry, or matrix spike (a QC sample type).

MSD—Matrix spike duplicate (a QC sample type).

Must—This action, activity, or procedural step is required.

m/z—The ratio of the mass of an ion (m) detected in the mass spectrometer to the charge (z) of that ion.

Preparation blank—See blank.

Quality control check sample (QCS)—See Laboratory Control Sample.

Reagent water—Water demonstrated to be free from the analytes of interest and potentially interfering substances at the MDLs for the analytes in this method.

Regulatory compliance limit (or regulatory concentration limit)—A limit on the concentration or amount of a pollutant or contaminant specified in a nationwide standard, in a permit, or otherwise established by a regulatory/control authority.

Relative retention time (RRT)—The ratio of the retention time of an analyte to the retention time of its associated internal standard. RRT compensates for small changes in the GC temperature program that can affect the absolute retention times of the analyte and internal standard. RRT is a unitless quantity.

Relative standard deviation (RSD)—The standard deviation times 100 divided by the mean. Also termed ''coefficient of variation.''

RF—Response factor. See section 7.2.2.

RSD—See relative standard deviation.

Safety Data Sheet (SDS)—Written information on a chemical's toxicity, health hazards, physical properties, fire, and reactivity, including storage, spill, and handling precautions that meet the requirements of OSHA, 29 CFR 1910.1200(g) and appendix D to § 1910.1200. United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS), third revised edition, United Nations, 2009.

Selected Ion Monitoring (SIM)—An MS technique in which a few m/z's are monitored. When used with gas chromatography, the m/z's monitored are usually changed periodically throughout the chromatographic run, to correlate with the characteristic m/z's of the analytes, surrogates, and internal standards as they elute from the chromatographic column. The technique is often used to increase sensitivity and minimize interferences.

Signal-to-noise ratio (S/N)—The height of the signal as measured from the mean (average) of the noise to the peak maximum divided by the width of the noise.

Should—This action, activity, or procedural step is suggested but not required.

SPE—Solid-phase extraction; an extraction technique in which an analyte is extracted from an aqueous solution by passage over or through a material capable of reversibly adsorbing the analyte. Also termed liquid-solid extraction.

Stock solution—A solution containing an analyte that is prepared using a reference material traceable to EPA, the National Institute of Science and Technology (NIST), or a source that will attest to the purity, authenticity, and concentration of the standard.

Surrogate—A compound unlikely to be found in a sample, and which is spiked into sample in a known amount before extraction or other processing, and is quantitated with the same procedures used to quantify other sample components. The purpose of the surrogate is to monitor method performance with each sample.

* * * * *

■ 9. Appendix B to part 136 is revised to read as follows:

Appendix B to Part 136—Definition and Procedure for the Determination of the Method Detection Limit—Revision 2

Definition

The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.

I. Scope and Application

(1) The MDL procedure is designed to be a straightforward technique for estimation of the detection limit for a broad variety of physical and chemical methods. The procedure requires a complete, specific, and well-defined analytical method. It is essential that all sample processing steps used by the laboratory be included in the determination of the method detection limit.

(2) The MDL procedure is *not* applicable to methods that do not produce results with a continuous distribution, such as, but not limited to, methods for whole effluent toxicity, presence/absence methods, and microbiological methods that involve counting colonies. The MDL procedure also is *not* applicable to measurements such as, but not limited to, biochemical oxygen demand, color, pH, specific conductance, many titration methods, and any method where low-level spiked samples cannot be prepared. Except as described in the addendum, for the purposes of this procedure, ''spiked samples'' are prepared from a clean reference matrix, such as reagent water, spiked with a known and consistent quantity of the analyte. MDL determinations using spiked samples may not be appropriate for all gravimetric methods (*e.g.,* residue or total suspended solids), but an MDL based on method blanks can be determined in such instances.

II. Procedure

(1) Estimate the initial MDL using one or more of the following:

(a) The mean determined concentration plus three times the standard deviation of a set of method blanks.

(b) The concentration value that corresponds to an instrument signal-to-noise ratio in the range of 3 to 5.

(c) The concentration equivalent to three times the standard deviation of replicate instrumental measurements of spiked blanks.

(d) That region of the calibration where there is a significant change in sensitivity, *i.e.,* a break in the slope of the calibration.

(e) Instrumental limitations.

(f) Previously determined MDL.

Note: It is recognized that the experience of the analyst is important to this process. However, the analyst should include some or all of the above considerations in the initial estimate of the MDL.

(2) Determine the initial MDL.

Note: The Initial MDL is used when the laboratory does not have adequate data to perform the Ongoing Annual Verification specified in Section (4), typically when a new method is implemented or if a method was rarely used in the last 24 months.

(a) Select a spiking level, typically 2—10 times the estimated MDL in Section 1. Spiking levels in excess of 10 times the estimated detection limit may be required for analytes with very poor recovery (*e.g.,* for an analyte with 10% recovery, spiked at 100 micrograms/L, with mean recovery of 10 micrograms/L; the calculated MDL may be around 3 micrograms/L. Therefore, in this example, the spiking level would be 33 times the MDL, but spiking lower may result in no recovery at all).

(b) Process a minimum of seven spiked samples and seven method blank samples through all steps of the method. The samples used for the MDL must be prepared in at least three batches on three separate calendar dates and analyzed on three separate calendar dates. (Preparation and analysis may be on the same day.) Existing data may be used, if compliant with the requirements for at least three batches, and generated within the last twenty four months. The most recent available data for method blanks and spiked samples must be used. Statistical outlier removal procedures should not be used to remove data for the initial MDL determination, since the total number of observations is small and the purpose of the MDL procedure is to capture routine method variability. However, documented instances of gross failures (*e.g.,* instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations, provided that at least seven spiked samples and seven method blanks are available. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.)

(i) If there are multiple instruments that will be assigned the same MDL, then the sample analyses must be distributed across all of the instruments.

(ii) A minimum of two spiked samples and two method blank samples prepared and analyzed on different calendar dates is required for each instrument. Each analytical batch may contain one spiked sample and one method blank sample run together. A spiked sample and a method blank sample may be analyzed in the same batch, but are not required to be.

(iii) The same prepared extract may be analyzed on multiple instruments so long as the minimum requirement of seven preparations in at least three separate batches is maintained.

(c) Evaluate the spiking level: If any result for any individual analyte from the spiked samples does not meet the method qualitative identification criteria or does not provide a numerical result greater than zero, then repeat the spiked samples at a higher concentration. (Qualitative identification criteria are a set of rules or guidelines for establishing the identification or presence of an analyte using a measurement system. Qualitative identification does not ensure that quantitative results for the analyte can be obtained.)

(d) Make all computations as specified in the analytical method and express the final results in the method-specified reporting units.

(i) Calculate the sample standard deviation (S) of the replicate spiked sample measurements and the sample standard deviation of the replicate method blank measurements from all instruments to which the MDL will be applied.

(ii) Compute the MDL_s (the MDL based on spiked samples) as follows:

$$MDL_S = t_{(n\ -\ 1,\ 1\ -\ \alpha\ =\ 0.99)} S_s$$

Where:

MDL_s = the method detection limit based on spiked samples

$t_{(n-1,\ 1\ -\ \alpha\ =\ 0.99)}$ = the Student's t-value appropriate for a single-tailed 99th percentile t statistic and a standard deviation estimate with n-1 degrees of freedom. See Addendum Table 1.

S_s = sample standard deviation of the replicate spiked sample analyses.

(iii) Compute the MDL_b (the MDL based on method blanks) as follows:

(A) If none of the method blanks give numerical results for an individual analyte, the MDL_b does not apply. A numerical result includes both positive and negative results, including results below the current MDL, but not results of ''ND'' (not detected) commonly observed when a peak is not present in chromatographic analysis.

(B) If some (but not all) of the method blanks for an individual analyte give numerical results, set the MDL_b equal to the highest method blank result. If more than 100 method blanks are available, set MDL_b to the level that is no less than the 99th percentile of the method blank results. For ''n'' method blanks where $n \geq 100$, sort the method blanks in rank order. The (n * 0.99) ranked method blank result (round to the nearest whole number) is the MDL_b. For example, to find MDL_b from a set of 164 method blanks where the highest ranked method blank results are . . . 1.5, 1.7, 1.9, 5.0, and 10, then $164 \times 0.99 = 162.36$ which rounds to the 162nd method blank result. Therefore, MDL_b is 1.9 for n = 164 (10 is the 164th result, 5.0 is the 163rd result, and 1.9 is the 162nd result). Alternatively, you may use spreadsheet algorithms to calculate the 99th percentile to interpolate between the ranks more precisely.

(C) If all of the method blanks for an individual analyte give numerical results, then calculate the MDL_b as:

$$MDL_b = \overline{X} + t_{n-1,1-\alpha\ =\ (0.99)} S_b$$

Where:

MDL_b = the MDL based on method blanks

$\overline{X}$ = mean of the method blank results (use zero in place of the mean if the mean is negative)

$t_{(n-1,\ 1\alpha\ =\ 0.99)}$ = the Student's t-value appropriate for the single-tailed 99th percentile t statistic and a standard deviation estimate with $n-1$ degrees of freedom. See Addendum Table 1.

S_b = sample standard deviation of the replicate method blank sample analyses.

Note: If 100 or more method blanks are available, as an option, MDL_b may be set to the concentration that is greater than or equal to the 99th percentile of the method blank results, as described in Section (2)(d)(iii)(B).

(e) Select the greater of MDL_s or MDL_b as the initial MDL.

(3) Ongoing Data Collection.

(a) During any quarter in which samples are being analyzed, prepare and analyze a minimum of two spiked samples on each instrument, in separate batches, using the same spiking concentration used in Section 2. If any analytes are repeatedly not detected in the quarterly spiked sample analyses, or do not meet the qualitative identification criteria of the method (see section 2(c) of this procedure), then this is an indication that the spiking level is not high enough and should be adjusted upward. Note that it is not necessary to analyze additional method blanks together with the spiked samples, the method blank population should include all of the routine method blanks analyzed with each batch during the course of sample analysis.

(b) Ensure that at least seven spiked samples and seven method blanks are completed for the annual verification. If only one instrument is in use, a minimum of seven spikes are still required, but they may be drawn from the last two years of data collection.

(c) At least once per year, re-evaluate the spiking level.

(i) If more than 5% of the spiked samples do not return positive numerical results that meet all method qualitative identification criteria, then the spiking level must be increased and the initial MDL re-determined following the procedure in section 2.

(ii) [Reserved]

(d) If the method is altered in a way that can be reasonably expected to change its sensitivity, then re-determine the initial MDL according to section 2, and the restart the ongoing data collection.

(e) If a new instrument is added to a group of instruments whose data are being pooled to create a single MDL, analyze a minimum of two spiked replicates and two method blank replicates on the new instrument. If both method blank results are below the existing MDL, then the existing MDL_b is validated. Combine the new spiked sample results to the existing spiked sample results and recalculate the MDL_s as in Section 4. If the recalculated MDL_s does not vary by more than the factor specified in section 4(f) of this

procedure, then the existing MDL_s is validated. If either of these two conditions is not met, then calculate a new MDL following the instructions in section 2.

(4) Ongoing Annual Verification.

(a) At least once every thirteen months, re-calculate MDL_s and MDL_b from the collected spiked samples and method blank results using the equations in section 2.

(b) Include data generated within the last twenty four months, but only data with the same spiking level. Only documented instances of gross failures (*e.g.,* instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.) If the laboratory believes the sensitivity of the method has changed significantly, then the most recent data available may be used, maintaining compliance with the requirement for at least seven replicates in three separate batches on three separate days (see section 2b).

(c) Include the initial MDL spiked samples, if the data were generated within twenty four months.

(d) Only use data associated with acceptable calibrations and batch QC. Include all routine data, with the exception of batches that are rejected and the associated samples reanalyzed. If the method has been altered in a way that can be reasonably expected to change its sensitivity, then use only data collected after the change.

(e) Ideally, use all method blank results from the last 24 months for the MDL_b calculation. The laboratory has the option to use only the last six months of method blank data or the fifty most recent method blanks, whichever criteria yields the greater number of method blanks.

(f) The verified MDL is the greater of the MDL_s or MDL_b. If the verified MDL is within 0.5 to 2.0 times the existing MDL, and fewer than 3% of the method blank results (for the individual analyte) have numerical results above the existing MDL, then the existing MDL may optionally be left unchanged. Otherwise, adjust the MDL to the new verification MDL. (The range of 0.5 to 2.0 approximates the 95th percentile confidence interval for the initial MDL determination with six degrees of freedom.)

Addendum to Section II: Determination of the MDL for a Specific Matrix

The MDL may be determined in a specific sample matrix as well as in reagent water.

(1) Analyze the sample matrix to determine the native (background) concentration of the analyte(s) of interest.

(2) If the response for the native concentration is at a signal-to-noise ratio of approximately 5–20, determine the matrix-specific MDL according to Section 2 but without spiking additional analyte.

(3) Calculate MDL_b using the method blanks, not the sample matrix.

(4) If the signal-to-noise ratio is less than 5, then the analyte(s) should be spiked into the sample matrix to obtain a concentration that will give results with a signal-to-noise ratio of approximately 10–20.

(5) If the analytes(s) of interest have signal-to-noise ratio(s) greater than approximately 20, then the resulting MDL is likely to be biased high.

TABLE 1—SINGLE-TAILED 99th PERCENTILE t STATISTIC

Number of replicates	Degrees of freedom (n − 1)	$t_{(n-1,\ 0.99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
32	31	2.453
48	47	2.408
50	49	2.405
61	60	2.390
64	63	2.387
80	79	2.374
96	95	2.366
100	99	2.365

III. Documentation

The analytical method used must be specifically identified by number or title and the MDL for each analyte expressed in the appropriate method reporting units. Data and calculations used to establish the MDL must be able to be reconstructed upon request. The sample matrix used to determine the MDL must also be identified with MDL value. Document the mean spiked and recovered analyte levels with the MDL. The rationale for removal of outlier results, if any, must be documented and maintained on file with the results of the MDL determination.

[FR Doc. 2017–17271 Filed 8–25–17; 8:45 am]

BILLING CODE 6560–50–P

APPENDIX VI
QUALITY ASSURANCE MANUAL TRAINING SUMMARY (FORM 1)

Quality Assurance Manual Date and Revision Number:
Revision 25; February 3, 2020

Initial each section as reviewed. Please complete and return this form to Technical Director for placement in Employee's Training File:

_____ Section 3.0, Statement of Policy
_____ Section 4.0, Organization
_____ Section 5.0, Quality Assurance Program
_____ Section 6.0, Sample Bottle Preparation
_____ Section 7.0, Custody of Samples, Equipment and Supplies
_____ Section 8.0, Analytical Procedures
_____ Section 9.0, Calibration Procedures and Frequency
_____ Section 10.0, Preventative Maintenance
_____ Section 11.0, Quality Control Checks & Routines to Assess Precision, Accuracy & MDLs
_____ Section 12.0, Data Reduction, Review and Reporting
_____ Section 13.0, Corrective Action and Nonconformances
_____ Section 14.0, Performance and System Audits
_____ Section 15.0, Quality Assurance Reports to Management
_____ Section 16.0, Reagent Storage and Documentation
_____ Section 17.0, Waste Disposal
_____ Appendix I, Waste Disposal Procedures
_____ Appendix II, Lab Equipment Preventive Maintenance Schedule
_____ Appendix III, Lab Equipment List
_____ Appendix V, 40 CFR Part 136, Method Detection Limit
_____ Appendix VII, Corrective Action Form
_____ Appendix IX, List of all methods under which lab is Accredited
_____ Appendix XI (Outside Reference Documents)

Comments:_____
_____
_____

Print Name: _____ Date:_____

Signature: _____ Date:_____

Supervisor:_____ Date:_____

Technical Director:_____ Date:_____

Quality Assurance Manager:_____ Date:_____

APPENDIX VI
QUALITY ASSURANCE MANUAL TRAINING SUMMARY NON-TECHNICAL (FORM 2)

Quality Assurance Manual Date and Revision Number:
Revision 25; February 3, 2020

Initial each section as reviewed. Please complete and return this form to Technical Director for placement in Employee's Training File:

_____ Section 3.0, Statement of Policy
_____ Section 4.0, Organization
_____ Section 5.0, Quality Assurance Program
_____ Section 6.0, Sample Bottle Preparation
_____ Section 7.0, Custody of Samples, Equipment and Supplies
_____ Section 13.0, Corrective Action and Nonconformances
_____ Section 14.0, Performance and System Audits
_____ Section 16.0, Reagent Storage and Documentation
_____ Section 17.0, Waste Disposal
_____ Appendix I, Waste Disposal Procedures
_____ Appendix VII, Corrective Action Form
_____ Appendix IX, List of all methods under which lab is Accredited

Comments:_____
_____
_____
_____

Print Name: _____ Date:_____

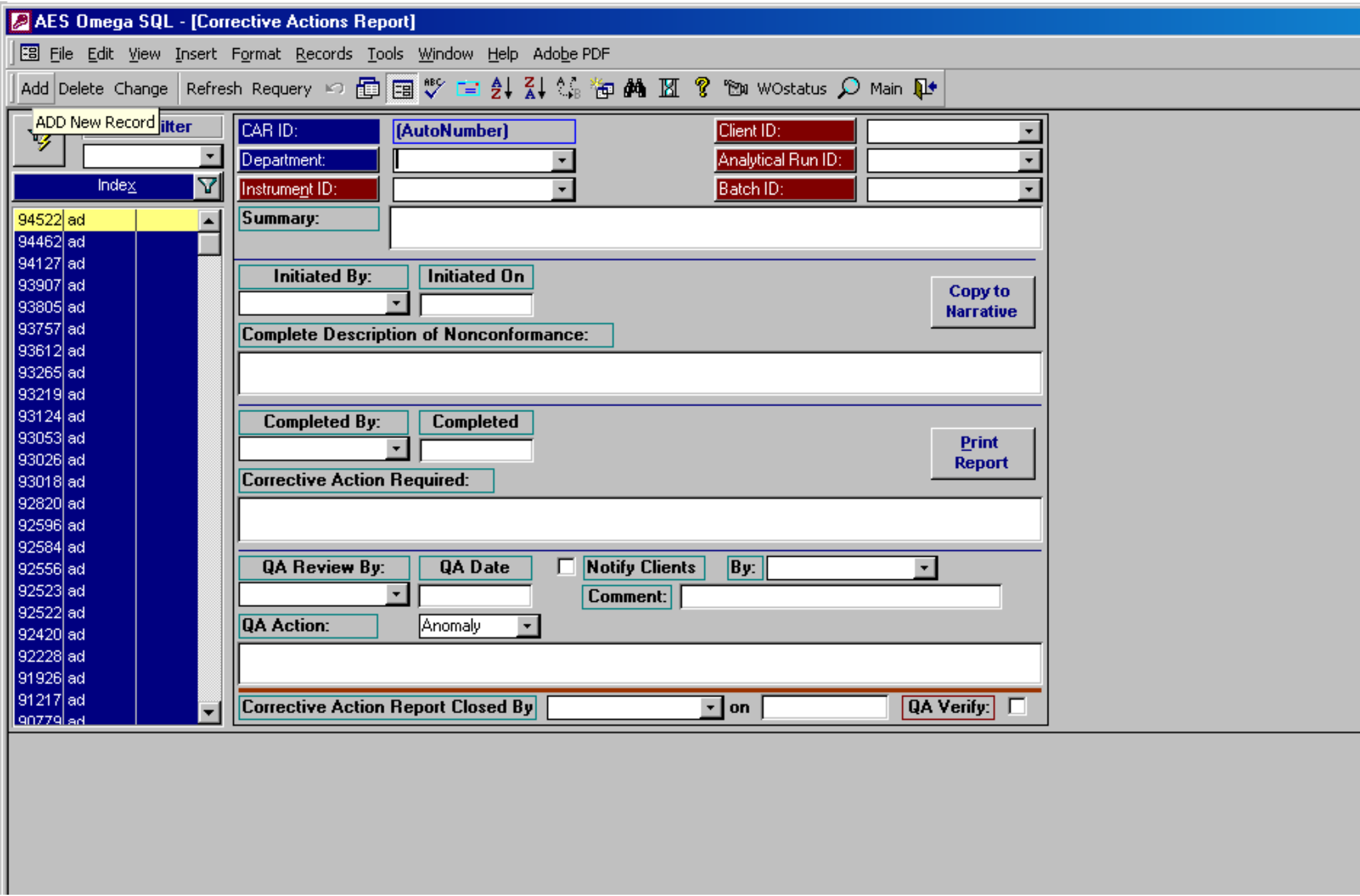
Signature: _____ Date:_____

Supervisor:_____ Date:_____

Technical Director:_____ Date:_____

Quality Assurance Manager:_____ Date:_____

APPENDIX VII - CORRECTIVE ACTION FORM


AES Omega SQL - [Corrective Actions Report]
File Edit View Insert Format Records Tools Window Help Adobe PDF
Add Delete Change Refresh Requery WOstatus Main
ADD New Record
Index
94522 ad
94462 ad
94127 ad
93907 ad
93805 ad
93757 ad
93612 ad
93265 ad
93219 ad
93124 ad
93053 ad
93026 ad
93018 ad
92820 ad
92596 ad
92584 ad
92556 ad
92523 ad
92522 ad
92420 ad
92228 ad
91926 ad
91217 ad
CAR ID:
(AutoNumber)
Client ID:
Department:
Analytical Run ID:
Instrument ID:
Batch ID:
Summary:
Initiated By:
Initiated On
Copy to Narrative
Complete Description of Nonconformance:
Completed By:
Completed
Print Report
Corrective Action Required:
QA Review By:
QA Date
Notify Clients
By:
Comment:
QA Action:
Anomaly
Corrective Action Report Closed By
on
QA Verify:

APPENDIX VIII - SAMPLE RECEIPT CHECKLIST

Clear Save as

ANALYTICAL ENVIRONMENTAL SERVICES, INC.

SAMPLE/COOLER RECEIPT CHECKLIST

1. Client Name: _____ AES Work Order Number: **1802**

2. Carrier: FedEx ☐ UPS ☐ USPS ☐ Client ☐ Courier ☐ Other _____

		Yes	No	N/A	Details	Comments
3.	Shipping container/cooler received in good condition?	○	○	○	damaged ☐ leaking ☐ other ☐	
4.	Custody seals present on shipping container?	○	○	○		
5.	Custody seals intact on shipping container?	○	○	○		
6.	Temperature blanks present?	○	○	○		
7.	Cooler temperature(s) within limits of 0-6°C? [See item 13 and 14 for temperature recordings.]	○	○	○	Cooling initiated for recently collected samples / ice present ☐	
8.	Chain of Custody (COC) present?	○	○	○		
9.	Chain of Custody signed, dated, and timed when relinquished and received?	○	○	○		
10.	Sampler name and/or signature on COC?	○	○	○		
11.	Were all samples received within holding time?	○	○	○		
12.	TAT marked on the COC?	○	○	○	If no TAT indicated, proceeded with standard TAT per Terms & Conditions. ☐	

13. Cooler 1 Temperature _____ °C Cooler 2 Temperature _____ °C Cooler 3 Temperature _____ °C Cooler 4 Temperature _____ °C

14. Cooler 5 Temperature _____ °C Cooler 6 Temperature _____ °C Cooler 7 Temperature _____ °C Cooler 8 Temperature _____ °C

15. Comments: _____

I certify that I have completed sections 1-15 (dated initials). _____

		Yes	No	N/A	Details	Comments
16.	Were sample containers intact upon receipt?	○	○	○		
17.	Custody seals present on sample containers?	○	○	○		
18.	Custody seals intact on sample containers?	○	○	○		
19.	Do sample container labels match the COC?	○	○	○	incomplete info ☐ illegible ☐ no label ☐ other ☐	
20.	Are analyses requested indicated on the COC?	○	○	○		
21.	Were all of the samples listed on the COC received?	○	○	○	samples received but not listed on COC ☐ samples listed on COC not received ☐	
22.	Was the sample collection date/time noted?	○	○	○		
23.	Did we receive sufficient sample volume for indicated analyses?	○	○	○		
24.	Were samples received in appropriate containers?	○	○	○		
25.	Were VOA samples received without headspace (< 1/4" bubble)?	○	○	○		
26.	Were trip blanks submitted?	○	○	○	listed on COC ☐ not listed on COC ☐	

27. Comments: _____

I certify that I have completed sections 16-27 (dated initials). _____

This section only applies to samples where pH can be checked at Sample Receipt.

		Yes	No	N/A	Details	Comments
28.	Have containers needing chemical preservation been checked? *	○	○	○		
29.	Containers meet preservation guidelines?	○	○	○		
30.	Was pH adjusted at Sample Receipt?	○	○	○		

* Note: Certain analyses require chemical preservation but must be checked in the laboratory and not upon Sample Receipt such as Coliforms, VOCs and Oil & Grease/TPH.

I certify that I have completed sections 28-30 (dated initials). _____

Lock Checklist

APPENDIX IX - List of all methods for which lab is Accredited

Potable or Drinking Water (Safe Drinking Water Act - SDWA)			
Matrix	Category	Method	Description
PW	Microbiology	SM9223B	Total Coliforms
PW	Microbiology	SM9221D	E. coli
PW	Microbiology	SM9221D	Fecal Coliforms
PW	Metals	EPA 200.8	Metals

Non-Potable Water (Clean Water Act - CWA)			
Matrix	Category	Method	Description
NPW	Microbiology	SM9222B	Total Coliforms
NPW	Microbiology	SM9222D	Fecal Coliforms
NPW	Microbiology	SM9223B	E. coli
NPW	Gen Chem	EPA 1010	Ignitability
NPW	Gen Chem	EPA 120.1 and EPA 9050	Conductivity
NPW	Gen Chem	EPA 160.4	Residue-volatile
NPW	Gen Chem	EPA 1664B and EPA 9070	Oil & Grease
NPW	Gen Chem	EPA 180.1	Turbidity
NPW	Gen Chem	EPA 300.0	Ion Scan
NPW	Gen Chem	EPA 350.1	Ammonia as N
NPW	Gen Chem	EPA 351.2	Kjeldahl nitrogen - total
NPW	Gen Chem	EPA 353.2	Nitrate as N and Nitrate-nitrite
NPW	Gen Chem	EPA 353.2 and SM4500NO2 B	Nitrite as N
NPW	Gen Chem	EPA 365.1	Orthophosphate as P
NPW	Gen Chem	EPA 365.1	Phosphorus total
NPW	Gen Chem	EPA 365.3	Orthophosphate as P
NPW	Gen Chem	EPA 410.4	Chemical oxygen demand
NPW	Gen Chem	EPA 420.1 and EPA 420.2	Total phenolics
NPW	Gen Chem	EPA 7196 and SM3500Cr B	Chromium VI
NPW	Gen Chem	EPA 9010/9014	Total cyanide
NPW	Gen Chem	EPA 9030/9034	Sulfide
NPW	Gen Chem	EPA 9040 and SM4500H$^+$B	pH
NPW	Gen Chem	EPA 9056	Ion Scan
NPW	Gen Chem	EPA 9060	Total organic carbon
NPW	Gen Chem	EPA 9065	Total phenolics
NPW	Gen Chem	SM2310B Acidity	Acidity as CaCO3
NPW	Gen Chem	SM10200H	Chlorophylls
NPW	Gen Chem	SM2120B Color	Color
NPW	Gen Chem	SM2120E	Color ADMI
NPW	Gen Chem	SM2320B Alkalinity	Alkalinity as CaCO3
NPW	Gen Chem	SM2340B	Hardness
NPW	Gen Chem	SM2540B TS	Residue-total
NPW	Gen Chem	SM2540C TDS	Residue-filterable (TDS)
NPW	Gen Chem	SM2540D TSS	Residue-nonfilterable (TSS)
NPW	Gen Chem	SM2540G	Total fixed and volatile residue
NPW	Gen Chem	SM2540F Settleable Solids	Residue-settleable
NPW	Gen Chem	SM3500-Fe B	Ferrous Iron
NPW	Gen Chem	SM5210B BOD	Biochemical oxygen demand
NPW	Gen Chem	SM4500ClG Residual Chlorine	Residual free chlorine
NPW	Gen Chem	SM4500CN E Total Cyanide	Cyanide

Non-Potable Water (Clean Water Act - CWA)			
Matrix	Category	Method	Description
NPW	Gen Chem	SM4500CN G Amenable Cyanide	Amenable cyanide
NPW	Gen Chem	SM4500O G Dissolved Oxygen	Dissolved Oxygen
NPW	Gen Chem	SM4500S2 F Sulfide	Sulfide
NPW	Gen Chem	SM4500SO3 B Sulfite	Sulfite-SO3
NPW	Gen Chem	SM5210B	Carbonaceous BOD (CBOD)
NPW	Gen Chem	SM5310B TOC	Total organic carbon
NPW	Gen Chem	SM5540C MBAS Surfactants	Surfactants - MBAS
NPW	Gen Chem	TKN - AMMONIA	Organic nitrogen
NPW	Metals	EPA 200.7 and EPA 6010	Metals
NPW	Metals	EPA 200.7	Total Phosphorus
NPW	Metals	EPA 6010	Total Phosphorus
NPW	Metals	EPA 200.8 and EPA 6020	Metals
NPW	Metals	EPA 245.1 and EPA 7470	Mercury
NPW	Ext Organics	EPA 8015	Diesel range organics (DRO)
NPW	Ext Organics	FL-PRO	Total Petroleum Hydrocarbons (TPH)
NPW	Ext Organics	EPA 610 and EPA 8310	Polynuclear Aromatic Hydrocarbons (PAHs)
NPW	Ext Organics	EPA 8315	Formaldehyde and Acetaldehyde
NPW	Ext Organics	EPA 625.1 and EPA 8270	Semi-Volatile (Base-Neutral-Acid) Organics
NPW	Ext Organics	RSK-175	GC Analysis of Gaseous Samples
NPW	Pest-Herb-PCB	EPA 8081	Pesticides
NPW	Pest-Herb-PCB	EPA 8082	Polychlorinated Biphenyls
NPW	Pest-Herb-PCB	EPA 615 and EPA 8151	Herbicides
NPW	Vol Organics	EPA 8011	EDB & DBCP
NPW	Vol Organics	EPA 8015	Gasoline range organics (GRO)
NPW	Vol Organics	EPA 8015	Various Nonhalogenated Volatile Compounds
NPW	Vol Organics	EPA 624.1 and EPA 8260	Volatile Organics

Solids & Hazardous Materials (Resource Conservation & Recovery Act - RCRA)			
Matrix	Category	Method	Description
Solids	Gen Chem	EPA 350.1 in Soil	Ammonia
Solids	Gen Chem	EPA 351.2 in Soil	Kjeldahl nitrogen - total
Solids	Gen Chem	EPA 365.1 in Soil	Total Phosphorus
Solids	Gen Chem	EPA 1010	Ignitability
Solids	Gen Chem	EPA 1030	Ignitability of Solids
Solids	Gen Chem	EPA 1311	TCLP
Solids	Gen Chem	EPA 1312	SPLP
Solids	Gen Chem	EPA 7196	Chromium VI
Solids	Gen Chem	EPA 9010/9014	Total cyanide
Solids	Gen Chem	EPA 9030/9034	Sulfide
Solids	Gen Chem	EPA 9040	pH
Solids	Gen Chem	EPA 9045	pH
Solids	Gen Chem	EPA 9050	Conductivity
Solids	Gen Chem	EPA 9056	Ion Scan
Solids	Gen Chem	EPA 9060	Total organic carbon
Solids	Gen Chem	EPA 9065	Total phenolics
Solids	Gen Chem	EPA 9071	Oil & Grease
Solids	Gen Chem	EPA 9081	Cation exchange capacity
Solids	Gen Chem	EPA 9095	Paint Filter Liquids Test

Solids & Hazardous Materials (Resource Conservation & Recovery Act - RCRA)			
Matrix	Category	Method	Description
Solids	Gen Chem	Sec. 7.3 SW-846	Reactive cyanide
Solids	Gen Chem	Sec. 7.3 SW-846	Reactive sulfide
Solids	Metals	EPA 6010	Metals
Solids	Metals	EPA 6020	Metals
Solids	Metals	EPA 7471	Mercury
Solids	Metals	EPA 7473	Mercury
Solids	Ext Organics	EPA 8015	Diesel range organics (DRO)
Solids	Ext Organics	FL-PRO	Total Petroleum Hydrocarbons (TPH)
Solids	Ext Organics	EPA 8310	Polynuclear Aromatic Hydrocarbons (PAHs)
Solids	Ext Organics	EPA 8315	Formaldehyde
Solids	Ext Organics	EPA 8270	Semi-Volatile (Base-Neutral-Acid) Organics
Solids	Pest-Herb-PCB	EPA 8081	Pesticides
Solids	Pest-Herb-PCB	EPA 8082	Polychlorinated Biphenyls
Solids	Pest-Herb-PCB	EPA 8151	Herbicides
Solids	Vol Organics	EPA 8015	Gasoline range organics (GRO)
Solids	Vol Organics	EPA 8015	Various Nonhalogenated Volatile Compounds
Solids	Vol Organics	EPA 8260	Volatile Organics

Matrix	Category	Method	Description
Air & Emissions			
Air	Vol Organics	EPA TO-14A	Volatile Organics
Air	Vol Organics	EPA TO-15	Volatile Organics

AIHA-LAP, LLC Methods			
Matrix	Category	Method	Description
Air	Metals	NIOSH 7300M/7303	Elements by ICP
Solids	Metals	NIOSH 7082	Lead in Paint
Solids	Metals	SW3050B/7000B	Total Lead in Solids
Air	Metals	NIOSH 7082	Lead on Wipes
Air	Asbestos	NIOSH 7400	PCM
Air	Microbiology	Fungal Air Direct Exam	MB - 15019, MB - 15022, MB - 15028
Air	Microbiology	Fungal Bulk Direct Exam	MB - 15020
Air	Microbiology	Fungal Surface Direct Exam	MB - 15020

Attachment 5

Quality Assurance Manual Acceptance Agreement

The information in this Quality Assurance Manual including its tables, appendices, figures, and / or attachments may be legally privileged and is confidential information intended for the use of reviewing Analytical Environmental Services Quality System policies and procedures. You are hereby notified that any dissemination, distribution, or copy of this manual or information therein including tables, appendices, figures, and / or attachments is strictly prohibited without written permission from a representative of Analytical Environmental Services Customer Service Department. If you have received this manual in error, please notify Analytical Environmental Services Customer Service by telephone at (770) 457-8177 for instructions on returning the document. If an electronic copy has been received in error by email, contact info@aesatlanta.com and delete the message. Thank you.

SOP No. QA-01000

Date Revised	Revision No.
February 3, 2020	25

I have read, understood and agree to comply with the above statement.

_____ _____
Signature Date

_____
Printed Name

_____
Company

_____
Phone Number with extension

APPENDIX X - Training Form 1

New Employee Initial Quality Assurance Manual Training

TRAINING: Initial Training on AES SOP No. QA-01000,
"SOP for the Quality Assurance Manual"

My signature confirms that I attended the initial training of the company's Quality Assurance Manual, which includes a discussion of the various sections contained within as well as responsibilities I have while performing my daily duties. I will be reading various sections of that document according to my job function. Upon completion I will sign-off on form 'Appendix VI – Quality Assurance Manual Training Summary'.

Supervisor: _____

Section/area: _____

Print Name: _____

Employee Signature:
_____

Date: _____

APPENDIX X - Training Form 2

Employee SOP / QA Manual Training & Retraining Form

SOP and/or Training Description: _____
_____
_____
_____
_____

My signature confirms that I was explained the reasons for this training/retraining and I have read/reviewed sections of the SOP, where applicable, along with other appropriate information including Interim Change Notices (ICNs), spreadsheets, logbook pages, sections in LIMS, calculations, and other forms as they apply. Further, I understand my responsibilities to follow the items presented in this training/retraining as they pertain to my job.

Supervisor: _____

Section/area: _____

Print Name: _____

Employee Signature:
_____

Date: _____

APPENDIX XI

QUALITY ASSURANCE MANUAL
STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT

Name (Printed): _____

SOP Title: Quality Assurance Manual

SOP Number: QA-01000 Rev. No. 25

The laboratory analyst signature on this approved SOP signifies the following: The analyst has read the SOP in its entirety and has read the analytical methods referenced in the SOP.

The analyst understands that the SOP is to be followed explicitly. Any deviation from the SOP must be noted in writing. Furthermore, the deviation from the SOP must be approved in writing by the laboratory supervisor and the QA staff prior to the analyst's adoption of the deviation from the SOP.

The controlled electronic of this SOP is located on the portal server at: Documents: Quality Assurance: QA Manuals: QA Manual: 2020_QA_Manual_Rev_25.pdf. If a hard copy is desired, you may request one from the Supervisor.

Do not make a copy or print out the QA Manual yourself. Printed copies are uncontrolled documents.

Print Name: _____ Date: _____

Analyst's Signature: _____ Date: _____

Department Manager Signature: _____ Date: _____

Technical Director's Signature: _____ Date: _____

APPENDIX XII
Outside Reference Documents

1. 2003 NELAC Standards, National Environmental Laboratory Accreditation Conference (NELAC), EPA 600/R-041-003, June 5, 2003, www.nelac-institute.org.

2. 2009 NELAC Standards, National Environmental Laboratory Accreditation Conference (NELAC), EL-V1 through V4-2011, www.nelac-institute.org.

3. *AIHA-LAP, LLC Policy Modules for AIHA Laboratory Accreditation Programs*, current revisions posted to web, www.aiha.org.

4. American National Standard, *General Requirements for the Competence of Testing and Calibration Laboratories*, ANSI/ISO/IEC 17025:2005.

5. North Carolina Administrative Code, Title 15: Department of Environment, Health and Natural Resources; Chapter 2, Environmental Management Division; Subchapter 2H; Procedures for Permits, Approvals; Section .0800; Laboratory Certification, August 1, 2002, Environmental Management Commission, Raleigh, North Carolina, http://deq.nc.gov/about/divisions/water-resources/water-resources-rules/nc-administrative-code-statutes.

6. North Carolina Administrative Code, Title 15: Department of Environment, Health and Natural Resources; Chapter 2, Environmental Management Division; Subchapter 2L; Groundwater Classification and Standards, Environmental Management Commission, Raleigh, North Carolina, http://deq.nc.gov/about/divisions/water-resources/water-resources-rules/nc-administrative-code-statutes.

7. *Analytical Methodology for Groundwater and Soil Assessment Guidelines*, SCDHEC UST Program Guidance document, July 14, 2014, http://www.scdhec.gov/Environment/Guidance/.

8. Quality Assurance Program Plan for the Underground Storage Tank Management Division, Revision 3.1, SCDHEC, February 2016, http://www.scdhec.gov/Environment/LW/UST/ReleaseAssessmentClean-up/QualityAssurance/.

9. Solutions to Analytical Chemistry Problems with Clean Water Act Methods, EPA 821-R-07-002 (revision to the "Pumpkin Document", EPA 821-B-93-001), March 2007, www.epa.gov.

10. *Code of Federal Regulations, Title 40, Part 136*, U. S. Government Printing Office: Washington DC, current revision posted on the web, www.epa.gov.

11. Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition, EPA 815-R-05-004, January 2005, www.epa.gov/safewater/methods/laboratorycertification.html.

12. Supplement 1 to the Fifth Edition of the Manual for the Certification of Laboratories Analyzing Drinking Water, EPA 815-F-08-006, June 2008, www.epa.gov/safewater/methods/laboratorycertification.html.

13. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.

14. Methods for the Determination of Metals in Environmental Samples, Supplement I, EPA 600/R-94/111, May 1994.

15. Methods for the Determination of Inorganic Substances in Environmental Samples, EPA 600/R-93/100, August 1993.

16. HACH Procedures Manual, Seventh Edition, *Chemical Oxygen Demand, Method 8000*, HACH Chemical Company: Loveland, CO, 1999.

17. Standard Methods for the Examination of Water and Wastewater, Twentieth Edition, American Public Health Association, Washington, DC, 1998.

18. Standard Methods for the Examination of Water and Wastewater, Twenty First Edition, American Public Health Association, Washington, DC, 2005.

19. Standard Methods for the Examination of Water and Wastewater, Twenty Second Edition, American Public Health Association, Washington, DC, 2012.

20. Methods and Guidance for Analysis of Water, *The Determination of Chlorinated Herbicides in Municipal and Industrial Wastewater, Method 615*, EPA 821-C-99-004, June 1999.

21. EASY DIST Manual of Environmental Methods, Rev. 9/5/1996.

22. Method 1664, Revision B: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-Polar Material) by Extraction and Gravimetry, EPA-821-R-10-001, February 2010, www.epa.gov.

23. *Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID*, State of Tennessee Department of Environment and Conservation, Division of Underground Storage Tanks, current revision posted to web, http://www.tennessee.gov/environment/topic/ust-suspected-or-confirmed-release.

24. *Method for Determination of Petroleum Range Organics, Method # FL-PRO*, Florida Department of Environmental Protection, Revision 1, November 1, 1995, www.dep.state.fl.us/.

25. Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (including Updates I, II, IIA, IIB, III, IIIA, IIIB, IV, and V), US EPA Office of Solid Waste and Emergency Response: Washington, DC, April 1998, www.epa.gov.

26. Methods of Soil Analysis, No. 5, Part 2, *Section 10-2 Saturation Extract and Other Aqueous Extracts, Chemical and Microbiological Properties, Second Edition*, American Society of Agronomy, Inc., 1982.

27. ASTM Standards, latest editions, www.astm.org.

28. NIOSH Manual of Analytical Methods, Fourth Edition (August 1994) and Fifth Edition (August 2016), US Department of Health and Human Services, Cincinnati, Ohio, www.cdc.gov/niosh/.

29. *Code of Federal Regulations, Title 40, Part 60 Appendix A, Test Method 18, VOC by GC*, U. S. Government Printing Office: Washington DC, current revision posted on the web, www.epa.gov.

30. Laboratory Guide to Common Aspergillus Species and Their Telemorphs, Klich, Maren, and John Pitt, CISRO Food Research Laboratory, 1988.

31. Identifying Filamentous Fungi, A Clinical Laboratory Handbook, St-Germain, Guy, and Richard Summerbell, 1996.

32. Environmental Monitoring Services Recommendations for Identification and Quantification of Airborne Fungal Spores, Hyphae, Skin Fragments, Pollen, Fibrous particulaes, and Arthropod (insect) Fragments, Revision 110402.

33. McCrone Research Institute of Chicago, IL, Recommendations for Identification and Quantification of Airborne Fungal Spores, Hyphae, and Pollen as instructed in Course 1630: Indoor air Quality: Fungal Spore Identification.

34. Environmental Monitoring Services Micro5 Analysis Standard Operating Procedure for Examining 100% of Total Trace, Revision 11/4/02.

35. Standards of Practice for the Assessment of Indoor Environmental Quality, Indoor Environmental Standards Organization, Volume 1, First Edition, April 2002.

36. The Alaska Methods: AK101-GRO (4/8/2002), AK102-DRO (4/8/2002), and AK103-RRO (4/8/2002), Alaska Contaminated Sites Approval, Division of Environmental Health, Environmental Health Laboratory, http://dec.alaska.gov/eh/lab/CS/CSapproval.htm.

37. EPA's *Volunteer Monitor's Guide to Quality Assurance Project Plans*, EPA 841-B-96-003, September 1996.

APPENDIX XIII

Environmental Microbiology Laboratory Accreditation Program (EMLAP) Specific Requirements

1.0 INTRODUCTION

Analytical Environmental Services, Inc. is dedicated to providing quality analytical services. Analytical Environmental Services, Inc. (AES) specializes in the analysis of microorganisms commonly detected in air (e.g., spore trapping), surface (e.g., tape lifts, swabs, wipes), and bulk (e.g., wallboard, carpet, building materials) samples collected from schools, hospitals, offices, industrial, agricultural, and other work environments. AES has implemented a quality assurance and quality control (QA/QC) program to establish quality control standards necessary for compliance to guidelines by The American Industrial Hygiene Association's Laboratory Accreditation Program (AIHA-LAP, LLC) Environmental Microbiology Laboratory Accreditation Program (EMLAP). In order to consistently maintain high standards of precision and accuracy in analytical testing, AES participates in AIHA-LAP, LLC's Proficiency Analytical Testing (PAT) program.

This quality assurance plan will establish the procedures that will be followed to ensure accuracy, precision, completeness, and representation of data obtained from the analysis of environmental microbiology samples.

2.0 PURPOSE

AES has implemented a quality assurance, quality control program for the purpose of providing a baseline of standards which will allow for a continuous surveillance quality performance for the benefit of AIHA-LAP, LLC EMLAP compliance, client satisfaction, and minimization of liability.

3.0 SCOPE

This QA/QC program provides the necessary guidelines to secure and maintain:

- High level of quality work
- Comprehensive accountability of all activities relevant to laboratory services.
- Continuous compliance with ISO/IEC 17025 and AIHA-LAP, LLC's EMLAP quality requirements.

This QA/QC program includes the following information:

- Comprehensive system of daily, weekly, monthly, and annual record keeping.
- Definition of routine monitoring activities.
- Sampling techniques for air, surface, and bulk collection.
- Sampling Equipment
- Calibration of Sampling Equipment
- Analysis of Air, Surface, and Bulk samples.
- Analytical Equipment
- Calibration of Analytical Equipment
- In-House training of analysts.
- QA/QC activities within lab.

4.0 FACILITIES

The laboratory has adequate facilities for the scope of services and meets the requirements for the most current and relative biosafety guidelines set forth by CDC, WHO, and AIHA-LAP, LLC. The lab has a documented routine

monitoring program for the verification of adequate contamination control. The laboratory has the proper facilities for biological and chemical storage and disposal of refuse.

5.0 EQUIPMENT

Microscope/Magnification System

- Microscope/Magnification System consisting of Compound optical microscope with a high magnification (100x) oil immersion objective having a numerical aperture (n.a.) of at least 1.25.
- Alignment of each microscope shall be documented with each day of use.
- Each microscope shall have an ocular micrometer that shall be checked annually with a NIST traceable stage micrometer.
- Field of View Diameter for each objective on the microscope shall be checked annually.

Class II Biological Safety Cabinet

- Performance certified annually according to NSF Standard 49.

Steam Sterilizer/Autoclave

- An autoclave with functioning temperature and pressure gauges for the disposal of potentially viable waste.
- Routine use of indicators to document successful sterilization with each use.
- Routine use of biological indicators to document the sterilization process.

Incubators and Refrigerators

- Temperature settings appropriate for the scope of testing.
- Temperatures recorded twice daily.

6.0 PERSONNEL

The laboratory conforms to the personnel requirements of the AIHA-LAP, LLC EMLAP guidelines. In all cases training records for degreed laboratory staff shall include a copy of transcript or diploma from an accredited college/university.

Technical Manager

- The laboratory shall be under the overall direction of an onsite, qualified person, who for the purposes of this document, is designated as the Technical Manager, and has the responsibility for the function, administration, and day-to-day operation of the laboratory. The Technical Manager or designee shall serve as the approved signatory.
- The Technical Manager shall have an earned microbiology or life science degree, minimally at the baccalaureate level, with the required combination of semester hours in microbiology and/or non-academic work experience as listed below. All non-academic work experience and coursework must be documented in the employee's training and personnel files.
    - **(a)** Microbiology degree and a minimum of two (2) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).
    - **(b)** Life Science degree and:
        - **i.** Twenty (20) semester hours in Microbiology and a minimum two (2) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).

ii. Sixteen (16) semester hours in Microbiology and a minimum three (3) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).

iii. Twelve (12) semester hours in Microbiology and a minimum four (4) years of full time equivalent documented environmental microbiological work experience (bacteriology and/or mycology).

iv. Eight (8) semester hours in microbiology and a minimum of five (5) years of full time equivalent documented environmental microbiological experience (bacteriology and/or mycology).

(c) Experience must reflect the scope of work of the laboratory.

- The Technical Manager shall be experienced in the selection and the use of bioaerosol, surface, fluid, and raw material sampling methods and in sample processing for the quantification and identification appropriate to the FoTs of mesophilic and thermophilic bacteria, and mesophilic, xerophilic, thermo tolerant fungi (molds and yeasts), and fungi identified by spore trap collection methods.

- Training records for the Technical Manager shall include documentation of ability to identify genus/group of fungi from spore trap analysis and genus/species of fungi that are reported.

Laboratory Analytical Staff
The environmental microbiological program distinguishes two titles for those conducting analytical procedures within the laboratory. An analyst is one who has a bachelor's degree and a technician is one who does not have a degree.

Laboratory Technicians

- These staff members shall have a high school diploma or General Education Development (GED) During this required training period, the trainee shall perform work (and have work reviewed prior to release) under the direct supervision of a qualified technician, analyst and/or the Technical Manager.

- Technicians may function in the same manner as analysts for Air – Direct Examination (spore trap) analysis after completion of six (6) months documented on the job training and demonstrated proficiency. For all other analyses, technicians may function in the same manner as analysts after one (1) year documented on the job training and demonstrated proficiency.

Laboratory Analysts

- These staff members shall have a bachelor's degree in a physical or biological science. Analysts shall have three (3) months of documented training for Air - Direct Examination (spore trap) and six (6) months of documented on-the-job training functioning for all other analyses as an analyst trainee. During the required analyst training period, the trainee shall be under the direct supervision of another qualified analyst and/or the Technical Manager. During this period, the trainee shall have all work reviewed prior to release by another qualified analyst and/or the Technical Manager. Training records for technicians and analysts shall include documentation of ability to identify genus/species of fungi and genus/group of fungi that are reported. Bacterial identification training records shall document training of relevant diagnostic procedures (e.g., gram stain, oxidase, biochemical reactions).

- All analysts and technicians shall have demonstrated ability to produce reliable results through accurate analysis of certified reference materials (CRMs), proficiency testing samples or in-house quality control samples. This demonstration shall be performed and documented at a minimum of every six (6) months.

Laboratory Quality Assurance Coordinator

- This Quality Assurance Coordinator (QAC) of the laboratory shall possess a bachelor's degree in an applicable basic or applied science and have six (6) months of non-academic relevant and documented microbiological laboratory analysis experience. In lieu of bachelor's degree, four years of non-academic analytical experience is acceptable.

- The QAC shall have documented training in statistics. Additional training may consist of quality control procedures.

7.0 ANALYTICAL METHODS: See SOP's

8.0 QUALITY ASSURANCE/QUALITY CONTROL

- Routine QA/QC procedures shall be an integral part of the laboratory procedures and functions. The laboratory is in compliance with APHA-AWWA-WPCF guidelines in *Standard Methods for the Examination of Water and Wastewater*, 21st Edition, APHA, 2005 for microbiology laboratories.

- Five (5) percent intra-analyst analysis shall be completed by each analyst to assess the precision of the analyst.

- Five (5) percent inter-analyst analysis shall be completed to assess the accuracy of the analysis performed within the laboratory.

- The laboratory shall use control charts or databases to compare intra- and inter-analyst analysis performance to established control charts.

- The laboratory shall ensure the quality control of culture media and analytical reagents per lot number for appropriate sterility, microbial growth, and/or analytical reactions. Records will be maintained and acceptance criteria will be documented.

- Acceptance Criteria on 5% replicate and duplicate analysis, daily reference slide analysis (spore traps) and monthly reference culture analysis will be documented and shall include the following:
  (a) Taxon identification acceptability
  (b) Taxon abundance ranking acceptability
  (c) Count of concentration acceptability determined statistically with use of control charts or databases (Spore Traps only).

- Laboratory will maintain routine records of temperature documentation for refrigerators and incubators. Acceptance criteria will be documented.

- The laboratory maintains a microbial culture collection of common organisms relevant to the methods performed. Cultures will be from recognized sources including EMPAT rounds. The culture collection will include the source and date of acquisition.

- The culture collection will be used monthly to prepare blind cultures to be used as part of the routine QC program to monitor accuracy in culture identification.

- The laboratory has a reference slide collection with various count levels and genera/groups of spores which is maintained and used as part of total spore analysis quality control.

- Each day of analysis, at least one slide from the collection shall be reviewed by each analyst. Slides are viewed on a rotational schedule so a different slide is viewed each day until the entire slide collection is examined. The analysis of these slides is incorporated into the daily QC plan. Acceptance criteria will be documented.

- Statistically derived control charts with control limits are used to assess performance.

- The laboratory participates and has documentation of a round robin slide exchange of real samples consistent with AIHA-LAP, LLC Policy 6A.3.2 *Requirements for Round Robin Programs*.

- Round robins include the participation of three (3) laboratories. Round robin program will consist of at least two (2) rounds per year, with each round completed within a 6-month timeframe.

- Each round will consist of four (4) samples at varying concentrations.

- Each analyst within the laboratory will analyze the samples independently and each of the analyst's results will be reported.

- The round robin analytical data will include raw counts and final concentrations for each fungal structure observed.

- Round Robin acceptance criteria shall include the organism identification, ranking, and quantification.

- A designated laboratory shall be responsible for data collection and distribution. The participating laboratories shall rotate this designation.

- A routine air monitoring program is used to verify adequate contamination control.

(a) Two (2) spore trap samples are collected each month. One (1) inside sample and One (1) outside sample are collected and compared. Acceptance criteria will be documented.

SAFETY, HEALTH, ENVIRONMENTAL AND TRANSPORTATION REGULATIONS

Analytical Environmental Services, Inc. adheres to all applicable federal, state, and local regulations regarding safety, health, environment or transportation. Potentially viable microbial waste shall be collected in properly designated biohazard containers and disposed of properly through autoclaving.

Attachment 6

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
ANNUAL MANAGEMENT REVIEW

REQUIRED PARTICIPANTS:

President	VP Operations
QA Manager	Technical Director
PCM Manager	Metals Lab Manager
Sample Rec. Manager	Semi-Volatile Lab Manager
Micro Bio Lab Manager	Customer Service Manager
HR Manager	Volatiles Lab Manager
IC Manager	Wet Chem Lab Manager
TEM Manager	PLM Manager
IT Manager	

The review will be conducted by the President or Vice President of Operations with the assistance of the Quality Assurance Manager.

AGENDA

1. Follow Up-Actions from previous Management Review meetings.
    a. Changes in Policy and Procedures (QA)
    b. Facility Improvements (President/VP)

2. Quality Assurance Report:
    a. Accreditation Requirements (QA)
    b. Changes in Management Structure (President/VP)
    c. Changes/Expansion of laboratory Services (President/VP)
    d. New/Updates of Procedures/SOP's/Reference Materials (QA)
    e. Outcomes to the Assurance of the Validity of Results from
        i. Internal QC Samples; Certified or Second source Reference Materials
        ii. Proficiency Tests
        iii. Replicate Testing
        iv. Correlation of Results for different sample tests (e.g. COD / BOD ratio)
    f. Results of Risk Identification

3. Review of Performance in Quality Areas
    a. Handling of failed QC Data: Each Department Supervisor provide an overall statement of finding these errors and how they are being handled in their department as they relate to the items listed. How the lab control listed affected Quality Control Performance if relative (e.g. Pipettor AES 1234 was received in April. Quarterly checks were noticeably tighter than the +/-2% acceptance criteria listed on the sheet.)
        i. General Quality Assurance (indicate ability of the equipment to meet verification frequency requirements)
            1. Balance Performance:
            2. Pipettor Performance:
            3. Hotblock Temperature Checks:

4. Thermometer Verifications:
5. Incubator Temperature Checks:
6. Annual QC Acceptance Limits Update:
7. Annual Reporting Limit Verification:
8. Annual MDL Studies (where applicable):
9. Other:

ii. Metals:

1. Balance Performance:
2. Pipettor Performance:
3. Annual QC Acceptance Limits Update:
4. Annual Reporting Limit Verification:
5. Annual MDL Studies (where applicable):
6. Linear Calibration Range Studies:
7. Quarterly Pb Contamination Checks:
8. New Personnel:
9. Other (Annual vs. Quarterly IDL Check):

iii. Metals Prep:

1. Balance Performance:
2. Pipettor Performance:
3. Hotblock Temperature Checks:
4. Annual Reporting Limit Verification:
5. Annual MDL Studies (where applicable):
6. New Personnel:
7. Other:

iv. Wet Chemistry:

1. Equipment Performance
2. Hotblock Temperature Checks:
3. Pipettor Performance:
4. Balance Performance:
5. Annual QC Acceptance Limits Update:
6. Annual Reporting Limit Verification:
7. Annual MDL Studies (where applicable):
8. Linear Calibration Range Studies (EPA 180.1):
9. New Personnel:
10. Other (e.g. Automated vs. Annual BOD check):

v. IC:

1. Equipment Performance
2. Linear Range Calibration Study:
3. Hotblock Temperature Checks:
4. Pipettor Performance:
5. Balance Performance:
6. Annual QC Acceptance Limits Update (e.g. 365.1_S):

7. Annual Reporting Limit Verification:
8. Annual MDL Studies (where applicable):
9. Linear Calibration Range Studies:
10. New Personnel:
11. Other:

vi. Semi-Volatiles/Semi-Prep:

1. Equipment Performance
2. Balance Performance:
3. Annual QC Acceptance Limits Update:
4. Annual Reporting Limit Verification:
5. Annual MDL Studies (where applicable):
6. New Personnel:
7. Other:

vii. Volatiles:

1. Equipment Performance
2. Balance Performance:
3. Annual QC Acceptance Limits Update:
4. Annual Reporting Limit Verification:
5. Annual MDL Studies (where applicable):
6. New Personnel:
7. Other (e.g. Quarterly GRO check):

viii. Asbestos:

1. Microscope Performance
2. Balance Performance:
3. Microscope Alignment Calibration:
4. Monthly Air Contamination Checks:
5. New Personnel:
6. Other:

ix. Microbiology:

1. Microscope Performance
2. Balance Performance:
3. Microscope Alignment Calibration:
4. Monthly Air Contamination Checks:
5. New Personnel:
6. Other:

b. Major PT Failure issues (QA)
c. Repeat and total number of deficiencies per department (Each Dept. Supervisor provide info. on repeat and total number of deficiencies related to a specific analysts or your dept. and how it is being handled, technical reprimands, etc.)
   Wet Chemistry:
   IC:
   Metals:

Metals Prep:
Volatiles:
Semi-Volatiles:
Semi-Prep:
Sample Receiving:
Asbestos:
Microbiology

4. Managerial Reports
    a. Equipment Needs (Each Dept. Supervisor to provide info. on current equip./staff needs)
    Wet Chemistry:
    IC:
    Metals:
    Metals Prep:
    Volatiles:
    Semi-Volatiles:
    Semi-Prep:
    Sample Receiving:
    Asbestos:
    Microbiology:
    b. Equipment Maintenance
        i. Calibration Information (VP)
        ii. Repair and maintenance data (VP)
        iii. Equipment downtime logs/review (Each Dept. Supervisor)
        Wet Chemistry:
        Metals:
        Metals Prep:
        Volatiles:
        Semi-Volatiles:
        Semi-Prep:
        Sample Receiving:
        Asbestos:
        Microbiology:

        iv. Resources
            1. Staffing Needs (Each Dept. Supervisor/VP)
            2. Department Training Needs (Technical Director)
            3. Facility and Equipment Needs (President/VP)

5. Internal Auditing
    a. Audit Results (QA)
    b. Audit Schedule (QA)
    c. Nonconformance by Department (HR)

d. Results of Inter-Laboratory comparisons or proficiency (QA)

6. Corrective Actions
    a. Type and source of issues (Each dept. Supervisor)
    Wet Chemistry:
    IC:
    Metals:
    Metals Prep:
    Volatiles:
    Semi-Volatiles:
    Semi-Prep:
    Sample Receiving:
    Asbestos:
    Microbiology:

    b. Areas most commonly having problems (QA)
    c. Trends of root causes (QA)
    d. Reoccurring problems (QA)
    e. Summary and review of corrective action log (QA)
7. External Audit
    a. Performance Evaluation for Quality System and Technical Aspects (VP)
    b. Evaluation common weak areas from each auditing agency (QA)
8. Quality Planning
    a. Upcoming projects (Customer Service Manager)
    b. Status of ongoing projects (Customer Service Manager)
    c. Significant changes including staff/equipment/required accreditations (VP)
9. Customer Feedback (Customer Service Manager)
    a. Customer complaints
        i. Review of Customer Complaint Corrective Action Logs
            1. Repeated complaints
            2. Related/Unrelated issues
            3. Cause of issues identified and corrective measures followed
            4. Weekly meeting review
    b. Client satisfaction survey
10. Improvements (President/VP)
    a. Review of Quality Policy/Objectives
    b. Review of Quality Systems effectiveness and improvement of system and services

Detail and assign responsible party time line for implementation of task.

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
_____ ANNUAL MANAGEMENT REVIEW

My signature confirms that I participated in the Annual Management Review:

Name	Position	Date

Attachment 7 - Subcontract Laboratories

Analysis to Subcontract	Method Required	Holding Time/ Container/ Preservative	Certification Information (i.e. state specific)	Subcontract Lab Name/Location	Subcontract Lab Phone Number	Subcontract Lab Contact	Price	TAT	Quote Expiration Date	Quote Posted to Portal/CS/ Subcontract Lab
2,3,7,8-TCDD	8280		Most	Pace Minneapolis			300	15		
2,3,7,8-TCDD	8290		Most	Pace Minneapolis			350	15		
2,3,7,8-TCDD	1613 DW		Most	Pace Minneapolis			188	5		
2,3,7,8-TCDD	1613 DW		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	450			
2,3,7,8-TCDD	8290/1631 non DW		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	500			
2,3,7,8-TCDD	8290	amber unp, ice	most	SGS Wilmington	(910) 350-1903	Michael Page	375	21 days		TE 6/29/15
2,3,7,8-TCDD	8290	amber unp, ice	Most	SGS Wilmington	(910) 350-1903	Amber Kornegay	656	10 days TAT		
2,3,7,8-TCDD in Potable Water	EPA 1613B		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	203	standrad is 10 business days	12/31/2018	yes
2,3,7,8-TCDD (not-potable water/soil)	EPA 1613B or SW-846 8290A		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	276	standrad is 10 business days	12/31/2018	yes
Acrylamide	8316		most	TA Various locations	912-944-7847	Debbie Harbuck	215+25 (samp filt)		4/12/2015	
ASTM Leaching Procedure	D3987-85		most	TA Various locations	912-944-7850	Debbie Harbuck	60		4/15/2015	
Carbamates	8318		most	TA Various locations	912-944-7848	Debbie Harbuck	270		4/13/2015	
Compound Specific Isotope analysis	NA	They need 7-8 VOA HCL vials. Holding time not more than 6 months	NA	Pace/Microseeps	412-826-4483	Robin	varies based on isotopes requested-see quote posted under Pace/Microseeps for details	30-50 days	3/1/2015	yes
17 Dioxins/Furans	EPA 1613B or SW-846 8290A		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	428	standrad is 10 business days	12/31/2018	yes
17 Dioxins/Furans w/Nontoxic Totals	EPA 1613B or SW-846 8290A		NELAP, ISO 17025, DoD, most states	Eurofins Lancaster	(717) 945-4521	Jenifer Lewis	513	standrad is 10 business days	12/31/2018	yes
Dioxins 17 isomers	8290	2 1L unpreserved ambers	most	TA Various locations	912-944-7837	Debbie Harbuck	1,080		4/2/2015	
Dioxins 17 isomers	8280	2 1L unpreserved ambers	most	TA Various locations	912-944-7840	Debbie Harbuck	600		4/5/2015	
Dioxins/Furans TCL	1631/8290 A9		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	800			
Dioxins/Furans TCL	1631/8290 Full List		Most	TA Knoxville	(865) 291-3065	Terry Wasmund	950			
Dioxins/Furans TCL 17 isomers	8280 (low resolution)		Most	Pace Minneapolis			375	15		
Dioxins/Furans TCL 17 isomers	8290		Most	Pace Minneapolis			525	15		
EMSL	AHERA TEM			EMSL/Smyrna	770-956-9150		See Portal pricing			deB 8/18/15
EMSL	TEM			EMSL/Smyrna	770-956-9150		See Portal pricing			
EOX	9023		most	TA Various locations	912-944-7849	Debbie Harbuck	100		4/14/2015	
Free CN	OIA-1677-09	NaOH	NELAP	Eurofins Lancaster	717-556-7263	Marrissa Williams	45	15		9/6/2019
Free CN	A4500	NaOH	NELAP	ALS Env	616-399-6070	Tom Beamish	40		DOES receive on Sat	
Grainsize Distribution	ASTM Method D422-63									
Grainsize Distribution	ASTM Method D1140-92									
Grainsize particle	ASTM Method D1140			United Consulting	770-582-2843	Mahvand Saleki	115			
Grainsize with hydrometer	ASTM D6913			Timeley Eng	770-938-8233	Lev Buchko	100			
Grainsize with hydrometer	ASTM D6913			United Consulting	770-582-2843	Mahvand Saleki	75			
Grainsize without hydrometer	ASTM D422			Timeley Eng	772-938-8233	Lev Buchko	125			
Grainsize without hydrometer	ASTM D422			United Consulting	770-582-2843	Mahvand Saleki	140			
Herbicides	8321	2 1L unpreserved ambers	most	TA Various locations	912-944-7838	Debbie Harbuck	240		4/3/2015	JF 1/7/16
Hex Chrome	7199		most	TA Various locations	912-944-7843	Debbie Harbuck	100		4/8/2015	JF 1/7/21
Hex Cr in Air	N7600			MAS Labs (Suwanee, GA)	770-866-3200		90			

APPENDIX F

EPA Region 4 SOPs

Region 4 **U.S. Environmental Protection Agency** **Laboratory Services and Applied Science Division** **Athens, Georgia**	
Operating Procedure	
Title: Field Equipment Cleaning and Decontamination	ID: LSASDPROC-205-R4
Issuing Authority: LSASD Field Branch Chief	
Effective Date: June 22, 2020	Review Due Date: June 22, 2023

Purpose

This procedure is to be used by Region 4 Laboratory Services and Applied Science Division staff . This document describes general and specific procedures, methods and considerations to be used and observed when cleaning and decontaminating sampling equipment during the course of field investigations. This procedure is to be used by all Region 4 Laboratory Services and Applied Science Division (LSASD) staff.

Scope/Application

The procedures contained in this document are to be followed when field cleaning sampling equipment, for both re-use in the field, as well as used equipment being returned to the Field Equipment Center (FEC). On the occasion that LSASD field investigators determine that any of the procedures described in this section are either inappropriate, inadequate or impractical and that other procedures must be used to clean or decontaminate sampling equipment at a particular site, the variant procedure will be documented in the field logbook, along with a description of the circumstances requiring its use. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

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1 General Information

1.1 Documentation/Verification

This procedure was prepared by persons deemed technically competent by LSASD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the LSASD Local Area Network (LAN). The Document Control Coordinator (DCC) is responsible for ensuring the most recent version of the procedure is placed on LAN and for maintaining records of review conducted prior to its issuance.

1.2 Definitions

- Decontamination: The process of cleaning dirty sampling equipment to the degree to which it can be re-used, with appropriate QA/QC, in the field.

- Deionized water: Tap water that has been treated by passing through a standard deionizing resin column. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard inductively coupled Argon Plasma Spectrophotometer (ICP) (or equivalent) scan. Deionized water obtained by other methods is acceptable, as long as it meets the above analytical criteria. Organic-free water may be substituted for deionized water.

- Detergent shall be a standard brand of phosphate-free laboratory detergent such as Liquinox® or Luminox®. Liquinox® is a traditional anionic laboratory detergent and is used for general cleaning and where there is concern for the stability of the cleaned items in harsher cleaners. Luminox® is a specialized detergent with the capability of removing oils and organic contamination. It is used in lieu of a solvent rinse step in cleaning of equipment for trace contaminant sampling. Where not specified in these procedures, either detergent is acceptable.

- Drilling Equipment: All power equipment used to collect surface and sub-surface soil samples or install wells. For purposes of this procedure, direct push is also included in this definition.

- Field Cleaning: The process of cleaning dirty sampling equipment such that it can be returned to the FEC in a condition that will minimize the risk of transfer of contaminants from a site.

- Organic-free water: Tap water that has been treated with activated carbon and deionizing units. At a minimum, the finished water must meet the analytical criteria of deionized water and it should contain no detectable pesticides, herbicides, or extractable organic compounds, and no volatile organic compounds above minimum detectable levels as determined by the Region 4 laboratory for a given set of analyses. Organic-free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.

- Tap water: Water from any potable water supply. Deionized water or organic-free water may be substituted for tap water.

1.3 General Precautions

1.3.1 Safety

Proper safety precautions must be observed when field cleaning or decontaminating dirty sampling equipment. Refer to the LSASD Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate. At a minimum, the following precautions should be taken in the field during these cleaning operations:

- When conducting field cleaning or decontamination using laboratory detergent, safety glasses with splash shields or goggles, and latex gloves will be worn.

- No eating, smoking, drinking, chewing, or any hand to mouth contact should be permitted during cleaning operations.

1.3.2 Procedural Precaution

Prior to mobilization to a site, the expected types of contamination should be evaluated to determine if the field cleaning and decontamination activities will generate rinses and other waste waters that might be considered RCRA hazardous waste or may require special handling.

2 Introduction to Field Equipment Cleaning and Decontamination

2.1 General

The procedures outlined in this document are intended for use by field investigators for cleaning and decontaminating sampling and other equipment in the field. These procedures should be followed in order that equipment is returned to the FEC in a condition that will minimize the risk of transfer of contaminants from a site.

Sampling and field equipment cleaned in accordance with these procedures must meet the minimum requirements for the Data Quality Objectives (DQOs) of the study or investigation. If deviations from these procedures need to be made during the course of the field investigation, they will be documented in the field logbook along with a description of the circumstances requiring the use of the variant procedure.

Cleaning procedures for use at the Field Equipment Center (FEC) are found in LSASD Operating Procedure for Equipment Cleaning and Decontamination at the FEC (LSASDPROC-206).

2.2 Handling Practices and Containers for Cleaning Solutions

Improperly handled cleaning solutions may easily become contaminated. Storage and application containers must be constructed of the proper materials to ensure their integrity. Following are acceptable materials used for containing the specified cleaning solutions:

- Detergent must be kept in clean plastic, metal, or glass containers until used. It should be poured directly from the container during use.

- Tap water may be kept in tanks, hand pressure sprayers, squeeze bottles, or applied directly from a hose.

- Deionized water must be stored in clean, glass or plastic containers that can be closed for transport. It can be applied from plastic squeeze bottles.

- Organic-free water must be stored in clean glass or Teflon® containers prior to use. It may be applied using Teflon® squeeze bottles, or with the portable system.

2.3 Disposal of Cleaning Solutions

Procedures for the safe handling and disposition of investigation derived waste (IDW); including used wash water and rinse water are in LSASD Operating Procedure for Management of Investigation Derived Waste (LSASDPROC-202).

2.4 Sample Collection Equipment Contaminated with Concentrated Materials

Equipment used to collect samples of concentrated materials from investigation sites must be field cleaned before returning from the study. At a minimum, this should consist of washing with detergent and rinsing with tap water. When the above procedure cannot be followed, the following options are acceptable:

- Leave with facility for proper disposal;

- If possible, containerize, seal, and secure the equipment and leave on-site for later disposal;

- Containerize, bag, or seal the equipment so that no odor is detected and return to the Field Equipment Center.

It is the project leader's responsibility to evaluate the nature of the sampled material and determine the most appropriate cleaning procedures for the equipment used to sample that material.

2.5 Sample Collection Equipment Contaminated with Environmental Media

Equipment used to collect samples of environmental media from investigation sites should be field cleaned before returning from the study. Based on the condition of the sampling equipment, one or more of the following options must be used for field cleaning:

- Wipe the equipment clean;

- Water-rinse the equipment;

- Wash the equipment in detergent and water followed by a tap water rinse.

- For grossly contaminated equipment, the procedures set forth in Section 2.4 must be followed.

Under extenuating circumstances such as facility limitations, regulatory limitations, or during residential sampling investigations where field cleaning operations are not feasible, equipment can be containerized, bagged or sealed so that no odor is detected and returned to the FEC without being field cleaned. If possible, FEC personnel should be notified that equipment will be returned without being field cleaned. It is the project leader's responsibility to evaluate the nature of the sampled material and determine the most appropriate cleaning procedures for the equipment used to sample that material.

2.6 Handling of Decontaminated Equipment

After decontamination, equipment should be handled only by personnel wearing clean gloves to prevent re-contamination. In addition, the equipment should be moved away (preferably upwind) from the decontamination area to prevent re-contamination. If the equipment is not to be immediately re-used, it should be covered with plastic sheeting or wrapped in aluminum foil to prevent re-contamination. The area where the equipment is kept prior to re-use must be free of contaminants.

3 Field Equipment Decontamination Procedures

3.1 General

Sufficient equipment should be transported to the field so that an entire study can be conducted without the need for decontamination. When equipment must be decontaminated in the field, the following procedures are to be utilized.

Note: Equipment utilized for PFAS sampling will not cleaned in the field.

3.2 Specifications for Decontamination Pads

Decontamination pads constructed for field cleaning of sampling and drilling equipment should meet the following minimum specifications:

- The pad should be constructed in an area known or believed to be free of surface contamination.
- The pad should not leak.
- If possible, the pad should be constructed on a level, paved surface and should facilitate the removal of wastewater. This may be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit should also be lined.
- Sawhorses or racks constructed to hold equipment while being cleaned should be high enough above ground to prevent equipment from being splashed.
- Water should be removed from the decontamination pad frequently.
- A temporary pad should be lined with a water impermeable material with no seams within the pad. This material should be either easily replaced (disposable) or repairable.

At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material designated by the site project leader, but only after all waste/rinse water has been pumped into containers for disposal. See LSASD Operating Procedure for Management of Investigation Derived Waste (LSASDPROC-202) for proper handling and disposal of these materials. If the decontamination pad has leaked excessively, soil sampling may be required.

3.3 "Classical Parameter" Sampling Equipment

"Classical Parameters" are analyses such as oxygen demand, nutrients, certain inorganic compounds, sulfide, flow measurements, etc. For routine operations involving classical parameter analyses, water quality sampling equipment such as Kemmerers, buckets, dissolved oxygen dunkers, dredges, etc., may be cleaned with the sample water or tap water between sampling locations as appropriate.

Flow measuring equipment such as weirs, staff gages, velocity meters, and other stream gauging equipment may be cleaned with tap water between measuring locations, if necessary.

Note: The procedures described in Section 3.3 are not to be used for cleaning field equipment to be used for the collection of samples undergoing trace organic or inorganic constituent analyses.

3.4 Sampling Equipment used for the Collection of Trace Organic and Inorganic Compounds

For samples undergoing trace organic or inorganic constituent analyses, the following procedures are to be used for all sampling equipment or components of equipment that come in contact with the sample:

3.4.1 Standard LSASD Method

- An optional Liquinox® detergent wash step may be useful to remove gross dirt and soil.
- Clean with tap water and Luminox® detergent using a brush, if necessary, to remove particulate matter and surface films.
- Rinse thoroughly with tap water.
- Rinse thoroughly with organic-free water and place on a clean foil-wrapped surface to **a**ir-dry.
- Wrap the dry equipment with aluminum foil or bag in clean plastic. If the equipment is to be stored overnight before it is wrapped in foil, it should be covered and secured with clean, unused plastic sheeting.

3.4.2 Alternative Solvent Rinse Method

The historical solvent rinse method of cleaning equipment for trace contaminant sampling remains an acceptable method.

- Clean with tap water and Liquinox® detergent using a brush, if necessary, to remove particulate matter and surface films. Equipment may be steam cleaned (Liquinox® detergent and high-pressure hot water) as an alternative to brushing. Sampling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. PVC or plastic items should not be steam cleaned.

- Rinse thoroughly with tap water.

- Rinse thoroughly with deionized water.
- Rinse with an appropriate solvent (generally isopropanol).
- Rinse with organic-free water and place on a clean foil-wrapped surface to **a**ir-dry.
- Wrap the dry equipment with aluminum foil or plastic. If the equipment is to be stored overnight before it is wrapped, it should be covered and secured with clean, unused plastic sheeting.

3.5 Well Sounders or Tapes

The following procedures are recommended for decontaminating well sounders (water level indicators) and tapes. Unless conditions warrant, it is only necessary to decontaminate the wetted portion of the sounder or tape.

- Wash with Liquinox® detergent and tap water.
- Rinse with tap water.
- Rinse with deionized water.

3.6 Redi-Flo2® Pump

CAUTION – Do not wet the controller. Always disconnect power from the pump when handling the pump body.

The Redi-Flo2® pump and any associated connected hardware (e.g., check valve) should be decontaminated between each monitoring well. The following procedures are required, depending on whether the pump is used solely for purging or used for purging and sampling.

3.6.1 Purge Only (Pump and Wetted Portion of Tubing or Hose)

- Disconnect power and wash exterior of pump and wetted portion of the power lead and tubing or hose with Liquinox® detergent and water solution.
- Rinse with tap water.
- Final rinse with deionized water.
- Place pump and reel in a clean plastic bag and keep tubing or hose contained in clean plastic or galvanized tub between uses.

3.6.2 Purge And Sample

Grundfos Redi-Flo2® pumps are extensively decontaminated and tested at the FEC to prevent contamination from being transmitted between sites. The relevant sections of LSASDPROC-206, *Field Equipment Cleaning and Decontamination at the FEC,* should be implemented in the field where a high risk of cross-contamination exists, such as where NAPL or high-concentration contaminants occur. In most cases, the abbreviated cleaning procedure described below will suffice, provided that sampling proceeds from least to most contaminated areas.

- Disconnect and discard the previously used sample tubing from the pump. Remove the check valve and tubing adapters and clean separately (See Section 3.6.3 for check valve). Wash the pump exterior with detergent and water.

- Prepare and fill three containers with decontamination solutions, consisting of Container #1, a tap water/detergent washing solution. Luminox® is commonly used. An additional pre-wash container of Liquinox® may be used; Container #2, a tap water rinsing solution; and Container #3, a deionized or organic-free water final rinsing solution. Choice of detergent and final rinsing solution for all steps in this procedure is dependent upon project objectives (analytes and compounds of interest). The containers should be large enough to hold the pump and one to two liters of solution. An array of 2' long 2" PVC pipes with bottom caps is a common arrangement. The solutions should be changed at least daily.

- Place the pump in Container #1. Turn the pump on and circulate the detergent and water solution through the pump and then turn the pump off.

- Place the pump in Container #2. Turn the pump on and circulate the tap water through the pump and then turn the pump off.

- Place the pump in Container #3. Turn the pump on and circulate deionized or organic-free water through the pump and then turn the pump off.

- Disconnect power and remove pump from Container #3. Rinse exterior and interior of pump with fresh deionized or organic-free water.

- Decontaminate the power lead by washing with detergent and water, followed by tap water and deionized water rinses. This step may be performed before washing the pump if desired.

- Reassemble check valve and tubing adapters to pump. ALWAYS use Teflon® tape to prevent galling of threads. Firm hand-tightening of fittings or light wrench torque is generally adequate.

- Place the pump and reel in a clean plastic bag.

3.6.3 Redi-Flo2® Ball Check Valve

- Remove the ball check valve from the pump head. Check for wear and/or corrosion, and replace as needed. During decontamination check for free-flow in forward direction and blocking of flow in reverse direction.

- Using a brush, scrub all components with detergent and tap water.

- Rinse with deionized water.

- Rethread the ball check valve to the Redi-Flo2® pump head.

3.7 Mega-Monsoon® and GeoSub® Electric Submersible Pump

As these pumps have lower velocities in the turbine section and are easier to disassemble in the field than Grundfos pumps, the outer pump housing should be removed to expose the impeller for cleaning prior to use and between each use when used as a sampling pump for trace contaminant sampling.

- Remove check valves and adapter fittings and clean separately.
- Remove the outer motor housing by holding the top of the pump head and unscrewing the outer housing from its O-ring sealed seat.
- Clean all pump components per the provisions of section 3.4. Use a small bottle brush for the pump head passages
- Wet the O-ring(s) on the pump head with organic-free water. Reassemble the outer pump housing to the pump head.
- Clean cable and reel per Section 3.4.
- Conduct final rinse of pump with organic-free water over pump and through pump turbine.

3.8 Bladder Pumps

Bladder pumps are presumed to be intended for use as low flow purge-and-sample pumps. The Geotech® bladder pump and Geoprobe Systems® mechanical bladder pump can be cleaned similarly.

- Discard any tubing returned with the pump.

- Completely disassemble the pump, being careful to note the initial position of and retain any springs and loose ball checks.

- Discard pump bladder.

- Clean all parts as per the standard cleaning procedure in Section 3.4.

- Install a new Teflon® bladder and reassemble pump.

3.9 Downhole Drilling Equipment

While LSASD does not currently operate drilling equipment, LSASD personnel do oversee and specify drilling operations. The following procedures are to be used for drilling activities involving the collection of soil samples for trace organic and inorganic constituent analyses and for the construction of monitoring wells to be used for the collection of groundwater samples for trace organic and inorganic constituent analyses.

3.9.1 Introduction

Cleaning and decontamination of all equipment should occur at a designated area (decontamination pad) on the site. The decontamination pad should meet the specifications of Section 3.2 of this procedure.

Tap water brought on the site for drilling and cleaning purposes should be contained in a pre-cleaned tank.

A steam cleaner and/or high pressure hot water washer capable of generating a pressure of at least 2500 PSI and producing hot water and/or steam, with a detergent compartment, should be obtained.

3.9.2 Preliminary Cleaning and Inspection

Drilling equipment should be clean of any contaminants that may have been transported from off-site to minimize the potential for cross-contamination. The drilling equipment should not serve as a source of contaminants. Associated drilling and decontamination equipment, well construction materials, and equipment handling procedures should meet these minimum specified criteria:

- All downhole augering, drilling, and sampling equipment should be sandblasted before use if painted, and/or there is a buildup of rust, hard or caked matter, etc., that cannot be removed by steam cleaning (detergent and high pressure hot water), or wire brushing. Sandblasting should be performed prior to arrival on site, or well away from the decontamination pad and areas to be sampled.

- Any portion of the drilling equipment that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (detergent and high pressure hot water) and wire brushed (as needed) to remove all rust, soil, and other material which may have come from other sites before being brought on site.

- Printing and/or writing on well casing, tremie tubing, etc., should be removed before use. Emery cloth or sand paper can be used to remove the printing and/or writing. Most well material suppliers can provide materials without the printing and/or writing if specified when ordered. Items that cannot be cleaned are not acceptable and should be discarded.

- Equipment associated with the drilling and sampling activities should be inspected to insure that all oils, greases, hydraulic fluids, etc., have been removed, and all seals and gaskets are intact with no fluid leaks.

3.9.3 Drill Rig Field Cleaning Procedure

Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (detergent and high pressure hot water) between boreholes.

3.9.4 Field Decontamination Procedure for Drilling Equipment

The following is the standard procedure for field cleaning augers, drill stems, rods, tools, and associated equipment. This procedure does not apply to well casings, well screens, or split-spoon samplers used to obtain samples for chemical analyses, which should be decontaminated as outlined in Section 3.4 of this procedure.

- Wash with tap water and detergent, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high pressure hot water with detergent) may be necessary to remove matter that is difficult to remove with the brush. Drilling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. Hollow-stem augers, drill rods, etc., that are hollow or have holes that transmit water or drilling fluids, should be cleaned on the inside with vigorous brushing.

- Rinse thoroughly with tap water.

- Remove from the decontamination pad and cover with clean, unused plastic if not used immediately. If stored overnight, the plastic should be secured to ensure that it stays in place.

3.9.5 Field Decontamination Procedure for Direct Push Technology (DPT) Equipment

- Certain specific procedures for the decontamination of DPT tools are described in the various sampling procedures, but the following general guidelines apply:

- Prior to return to the Field Equipment Center, all threaded tool joints should be broken apart and the equipment cleaned per the provisions of *Section 2.5, Sample Collection Equipment Contaminated with Environmental Media* of this procedure.

- Equipment that contacts the sample media and is cleaned in the field for reuse should be cleaned per the provisions of *Section 3.4, Sampling Equipment used for the Collection of Trace Organic and Inorganic Compounds* of this procedure. This would include piston sampler points and shoes, screen point sampler screens and sheaths, and the drive rods when used for groundwater sampling.

- Equipment that does not directly contact the sample media and is cleaned in the field for reuse can generally be cleaned per the provisions of Section *3.7.4, Field Decontamination Procedure for Drilling Equipment* of this procedure.

- Stainless steel SP15/16 well screens require special care as the narrow slots are difficult to clean under even controlled circumstances and galvanic corrosion can release chrome from the screen surface. As soon as possible after retrieval, the screen slots should be sprayed from the outside to break loose as much material as possible before it can dry in place. To prevent galvanic corrosion, the screens must be segregated from the sampler sheaths, drive rods, and other carbon steel during return transport from the field.

3.10 Rental Pumps

Completing a groundwater sampling project may require the use of rental pumps. Rental pumps are acceptable where they are of suitable stainless steel and Teflon® construction. These pumps should be cleaned prior to use using the procedures specified herein and a rinse-blank collected prior to use.

4 References

LSASD Operating Procedure for Management of Investigation Derived Waste, LSASDPROC-202, Most Recent Version

LSASD Operating Procedure for Equipment Cleaning and Decontamination at the FEC, LSASDPROC-206, Most Recent Version

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 LSASD, Athens, GA, Most Recent Version

Revision History

The top row of this table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the LSASD Document Control Coordinator on the LSASD local area network (LAN).

History	Effective Date
LSASDPROC-205-R4, *Field Equipment Cleaning and Decontamination,* replaces SESDPROC-205-R3 **General:** Updated format, Division and Branch names and naming conventions post agency re-alignment. Section 3.1: Added note that PFAS sampling equipment will not be cleaned in the field. Clarified in Section 3.9 that LSASD does not performing drilling activities.	June 22, 2020
SESDPROC-205-R3, *Field Equipment Cleaning and Decontamination*, replaces SESDPROC-205-R2. **Cover Page:** The author was changed to Brian Striggow. LSASD's reorganization was reflected in the authorization section by making John Deatrick the Chief of the Field Services Branch. The FQM was changed from Bobby Lewis to Hunter Johnson. **Revision History:** Changes were made to reflect the current practice of only including the most recent changes in the revision history. **General:** Corrected any typographical, grammatical and/or editorial errors. **Section 1.4:** Differentiate between Liquinox® and Luminox® detergents. **Section 3.4:** Restore solvent rinse as alternative cleaning method. **Section 3.7:** Added section on cleaning of 12 Volt electric submersible pumps. **Section 3.8:** Added section on cleaning of bladder pumps. **Section 3.9:** Added language on cleaning and transport of SP15/16 screens **Section 3.10:** Added section on cleaning of rental pumps	December 18, 2015
SESDPROC-205-R2, *Field Equipment Cleaning and Decontamination*, replaces SESDPROC-205-R1.	December 20, 2011
SESDPROC-205-R1, *Field Equipment Cleaning and Decontamination*, replaces SESDPROC-205-R0.	November 1, 2007

SESDPROC-205-R0, *Field Equipment Cleaning and Decontamination*, Original Issue	February 05, 2007

Region 4 **U.S. Environmental Protection Agency** **Laboratory Services and Applied Science Division** **Athens, Georgia**	
Operating Procedure	
Title: Management of Investigation Derived Waste	ID: LSASDPROC-202-R4
Issuing Authority: LSASD Field Branch Chief	
Effective Date: May 8, 2020	Review Date: May 8, 2024

Purpose

This document describes general and specific procedures and considerations to be used and observed when managing investigation derived waste (IDW) generated during the course of hazardous waste site investigations.

Scope/Application

The procedures and management options for the different categories of IDW described in this document are to be used by LSASD field personnel to manage IDW generated during site investigations. On the occasion that LSASD field personnel determine that any of the procedures described in this section are inappropriate, inadequate or impractical and that another procedure must be used to manage IDW generated at a particular site, the variant procedure will be documented in the field logbook, along with a description of the circumstances requiring its use. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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TABLES

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This procedure was prepared by persons deemed technically competent by LSASD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the LSASD Local Area Network (LAN). The Document Control Coordinator (DCC) is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

1.2 General Precautions

1.2.1 Safety

Proper safety precautions must be observed when managing IDW. Refer to the LSASD Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASP) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.2.2 Procedural Precautions

The following precautions should be considered when managing IDW:

- Due to time limitations and restrictions posed by RCRA regulations on storage of hazardous waste, accumulation start dates should be identified on all drums, buckets or other containers used to hold IDW so that it can be managed in a timely manner.
- During generation of both non-hazardous and hazardous IDW, keep hazardous IDW segregated from non-hazardous IDW to minimize the volume of hazardous IDW that must be properly managed.

2 Types of Investigation Derived Waste

Materials which may become IDW include, but are not limited to:

- Personal protective equipment (PPE) - This includes disposable coveralls, gloves, booties, respirator canisters, splash suits, etc.

- Disposable equipment and items - This includes plastic ground and equipment covers, aluminum foil, conduit pipe, composite liquid waste samplers (COLIWASAs), Teflon® tubing, broken or unused sample containers, sample container boxes, tape, etc.

- Soil cuttings from drilling or hand augering.

- Drilling mud or water used for mud or water rotary drilling.

- Groundwater obtained through well development or well purging.

- Cleaning fluids such as spent solvents and wash water.

- Packing and shipping materials.

Table 1, found at the end of this procedure, lists the types of IDW commonly generated during field investigations and the current disposal practices for these materials.

For the purpose of determining the ultimate disposition of IDW, it is typically distinguished as being either hazardous or non-hazardous. This determination is based on either clear regulatory guidance or by subsequent analysis. This determination and subsequent management is the responsibility of the program site manager.

3 Management of Non-Hazardous IDW

Disposal of non-hazardous IDW should be addressed in the Sampling and Analysis Plan (SAP) or QAPP for the investigation. To reduce the volume of any IDW transported back to the Field Equipment Center (FEC), it may be necessary to compact the waste into a reusable container, such as a 55-gallon drum.

If the waste is from an active facility, permission should be sought from the operator of the facility to place the non-hazardous PPE, disposable equipment, and/or paper/cardboard into the facility's dumpsters. If necessary, these materials may be placed into municipal dumpsters, with the permission of the owner. These materials may also be taken to a nearby permitted landfill. On larger studies, waste hauling services may be obtained and a dumpster located at the study site.

Disposal of non-hazardous IDW such as drill cuttings, drilling mud, purge or development water, decontamination wash water, etc., should be specified in the approved SAP or QAPP. It is recommended that these materials be placed into a unit with an environmental permit, such as a landfill or sanitary sewer. These materials must not be placed into dumpsters. If the facility at which the study is being conducted is active, permission should be sought to place these types of IDW into the facility's treatment system. It may be feasible to spread drill cuttings around the borehole, or, if the well is temporary, to place

the cuttings back into the borehole. Non-hazardous monitoring well purge or development water may also be poured onto the ground down gradient of the monitoring well when site conditions permit. Purge water from private potable wells which are in service may be discharged directly onto the ground surface.

The minimum requirements for this subsection are:

- Non-hazardous liquid and soil/sediment IDW may be placed on the ground or returned to the source if doing so does not endanger human health or the environment or violate federal or state regulations. Under no circumstances, however, should monitoring well purge water be placed back into the well from which it came.
- Soap and water decontamination fluids and rinses of such cannot be placed in any water bodies and must be collected and returned to the FEC for disposition.
- The collection, handling and proposed disposal method must be specified in the approved SAP or QAPP.

4 Management of Hazardous IDW

Disposal of hazardous or suspected hazardous IDW must be specified in the approved SAP or QAPP for the study or investigation. Hazardous IDW must be disposed as specified in USEPA regulations. If appropriate, these wastes may be placed back in an active facility waste treatment system. These wastes may also be disposed in the source area from which they originated if doing so does not endanger human health or the environment.

If on-site disposal is not feasible, and if the wastes are suspected to be hazardous, appropriate tests must be conducted to make that determination. If they are determined to be hazardous wastes, they must be properly contained and labeled. They may be stored on the site for a maximum of 90 days before they must be manifested and shipped to a permitted treatment or disposal facility. Generation of hazardous IDW must be anticipated, if possible, to allow arrangements for proper containerization, labeling, transportation and disposal/treatment in accordance with USEPA regulations.

The generation of hazardous IDW should be minimized to conserve Division resources. Most routine studies should not produce any hazardous IDW, with the possible exception of spent solvents and, possibly, purged groundwater. The use of solvents during field cleaning of equipment should be minimized by using solvent-free cleaning procedures for routine cleaning and decontamination (see SESD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205). If solvents are needed, the volume should be minimized by using only the amount necessary and by capturing the residual solvent separately from the aqueous decontamination fluids (detergent/wash water mixes and water rinses).

At a minimum, the requirements of the management of hazardous IDW are as follows:

- Spent solvents must be left on-site with the permission of site operator and proper disposal arranged.
- All hazardous IDW must be containerized. Proper handling and disposal should be arranged prior to commencement of field activities.

5 References

LSASD Operating Procedure for Field Equipment Cleaning and Decontamination, LSASDPROC-205, Most Recent Version

United States Environmental Protection Agency (US EPA). 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD), Athens, GA

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version

6 Revision History

The top row of this table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the SESD Document Control Coordinator on the SESD local area network (LAN).

History	Effective Date
LSASDPROC-202-R4, *Management of Investigation Derived Waste*, replaces SESDPROC-202-R3 **General:** Corrected typographical, grammatical and/or editorial errors. Updated format and naming convention, updated references from SESD to LSASD and FSB to LSB.	May 8, 2020
SESDPROC-202-R3, *Management of Investigation Derived Waste*, replaces SESDPROC-202-R2. **General:** Corrected typographical, grammatical and/or editorial errors. **Cover Page:** The Enforcement and Investigations Branch Chief was changed from Archie Lee to Acting Chief John Deatrick. The Ecological Assessment Branch Chief was changed from Bill Cosgrove to Acting Chief Mike Bowden. The FQM was changed from Liza Montalvo to Bobby Lewis. **Revision History:** Changes were made to reflect the current practice of only including the most recent changes in the revision history.	July 3, 2014
SESDPROC-202-R2, *Management of Investigation Derived Waste*, replaces SESDPROC-202-R1.	October 15, 2010
SESDPROC-202-R1, *Management of Investigation Derived Waste*, replaces SESDPROC-202-R0.	November 1, 2007
SESDPROC-202-R0, Management of Investigation Derived Waste, Original Issue	February 05, 2007

Table 1: Disposal of IDW

TYPE	HAZARDOUS	NON - HAZARDOUS
PPE-Disposable	Containerize in plastic 5-gallon bucket with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise return to FEC for proper disposal.	Place waste in trash bag. Place in dumpster with permission of site operator, otherwise return to FEC for disposal in dumpster.
PPE-Reusable	Decontaminate as per SESD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, if possible. If the equipment cannot be decontaminated, containerize in plastic 5-gallon bucket with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise return to FEC for proper disposal.	Decontaminate as per SESDPROC-205, and return to FEC.
Spent Solvents	Containerize in original containers. Clearly identify contents. Leave on-site with permission of site operator and arrange for proper disposal.	N/A
Soil Cuttings	Containerize in DOT-approved container with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal.	Containerize in a 55-gallon steel drum with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal. **
Groundwater	Containerize in DOT-approved container with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal.	Containerize in an appropriate container with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal. **
Decontamination Water	Containerize in DOT-approved container with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal.	Containerize in an appropriate container with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal. Decontamination water may also be disposed in a sanitary sewer system, with permission from the wastewater treatment plant representative, and if doing so does not endanger human health or the environment, or violate federal or state regulations.
Disposable Equipment	Containerize in DOT-approved container or 5-gallon plastic bucket with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal.	Containerize in an appropriate container with tight-fitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal. If unfeasible, return to FEC for disposal in dumpster.
Trash	N/A	Place waste in trash bag. Place in dumpster with permission of site operator, otherwise return to FEC for disposal in dumpster.

**** These materials may be placed on the ground if doing so does not endanger human health or the environment or violate federal or state regulations.**

Region 4 **U.S. Environmental Protection Agency** **Laboratory Services and Applied Science Division** **Athens, Georgia**	
Operating Procedure	
Title: Packing, Marking, Labeling and Shipping of Environmental and Waste Samples	ID: LSASDPROC-209-R4
Issuing Authority: LSASD Field Branch Chief	
Effective Date: February 23, 2020	Review Due Date: February 23, 2024

Purpose

Regulations for packing, marking, labeling, and shipping of dangerous goods by air transport are promulgated by Department of Transportation under 49 CFR, Subchapter C, Hazardous Materials Regulations, and the International Air Transport Authority (IATA), which is equivalent to United Nations International Civil Aviation Organization (UN/ICAO). Transportation of hazardous materials (dangerous goods) by EPA personnel is covered by EPA Order 1000. This document describes general and specific procedures, methods and considerations to be used and observed by LSASD field investigators when packing, marking, labeling and shipping environmental and waste samples to ensure that all shipments are in compliance with the above regulations and guidance.

Scope/Application

The procedures contained in this document are to be used by field personnel when packing, marking, labeling, and shipping environmental samples and dangerous goods by air transport. Samples collected during field investigations or in response to a hazardous materials incident must be classified prior to shipment, as either environmental or hazardous materials (dangerous goods) samples.

In general, environmental samples include drinking water, most groundwater and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, biological specimens, or any samples not expected to be contaminated with high levels of hazardous materials. Samples collected from process wastewater streams, drums, bulk storage tanks, soil, sediment, or water samples from areas suspected of being highly contaminated may require shipment as dangerous goods.

Government employees transporting samples or hazardous materials (i.e., preservatives or waste samples) in government vehicles are not subject to the requirements of this section in accordance with 49 CFR 171.1(d)(5). EPA contractors, however, are not covered by this exemption and may not transport these materials without full compliance with 49 CFR. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

TABLE OF CONTENTS

1 General Information

1.1 Documentation/Verification

This procedure was prepared by persons deemed technically competent by LSASD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the LSASD local area network (LAN). The Document Control Coordinator (DCC) is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

1.2 General Precautions

1.2.1 Safety

Proper safety precautions must be observed when packing, marking, labeling, and shipping environmental or waste samples. Refer to the LSASD Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional.

2 Shipment of Dangerous Goods

2.1 The project leader is responsible for determining if samples collected during a specific field investigation meet the definitions for dangerous goods. If a sample is collected of a material that is listed in the Dangerous Goods List, Section 4.2, IATA, then that sample must be identified, packaged, marked, labeled, and shipped according to the instructions given for that material. If the composition of the collected sample(s) is unknown, and the project leader knows or suspects that it is a regulated material (dangerous goods), the sample may not be offered for air transport. If the composition and properties of the waste sample or highly contaminated soil, sediment, or water sample are unknown, or only partially known, the sample may not be offered for air transport.

In addition, the shipment of pre-preserved sample containers or bottles of preservatives (e.g., NaOH pellets, HCL, etc.) which are designated as dangerous goods by IATA is regulated. Shipment of nitric acid is strictly regulated. Consult the IATA Dangerous Goods Regulations for guidance. ***Dangerous goods must not be offered for air transport by any personnel except LSASD's dangerous goods shipment designee or other personnel trained and certified by IATA in dangerous goods shipment.***

3 Shipment of Environmental Samples

3.1 Guidance for the shipment of environmental laboratory samples by personnel is provided in a memorandum dated March 6, 1981, subject "Final National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Laboratory Samples". By this memorandum, the shipment of the following unpreserved samples is not regulated:

3.1.1 Drinking water
3.1.2 Treated effluent
3.1.3 Biological specimens
3.1.4 Sediment
3.1.5 Water treatment plant sludge
3.1.6 POTW sludge

3.2 In addition, the shipment of the following preserved samples is not regulated, provided the amount of preservative used does not exceed the amounts found in 40 CFR 136.3 or the USEPA Region 4 Analytical Support Branch Laboratory Operations and Quality Assurance Manual (ASBLOQAM), Most Recent Version. This provision is also discussed in correspondence between DOT and EPA (Department of Transportation, Letter from Edward T. Mazzullo, Director, Office of Hazardous Materials Standards, to Henry L. Longest II, Acting Assistant Administrator, USEPA, Ref No.: 02-0093, February 13, 2003). It is the shippers' (individual signing the air waybill) responsibility to ensure that proper amounts of preservative are used:

3.2.1 Drinking water
3.2.2 Ambient water
3.2.3 Treated effluent
3.2.4 Biological specimens
3.2.5 Sediment
3.2.6 Wastewater treatment plant sludge
3.2.7 Water treatment plant sludge

3.3 Samples determined by the project leader to be in these categories are to be shipped using the following protocol, developed jointly between USEPA, OSHA, and DOT. This procedure is documented in the "Final National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Environmental Laboratory Samples."

3.4 Untreated wastewater and sludge from Publicly Owned Treatment Works (POTWs) are considered to be "diagnostic specimens" (not environmental laboratory samples). However, because they are not considered to be etiologic agents (infectious) they are not restricted and may be shipped using the procedures outlined below.

3.5 Environmental samples should be packed prior to shipment by air using the following procedures:

3.5.1 Allow sufficient headspace (ullage) in all bottles (except VOA containers with a septum seal) to compensate for any pressure and temperature changes (approximately 10 percent of the volume of the container).

3.5.2 Ensure that the lids on all bottles are tight (will not leak).

3.5.3 Place bottles in separate and appropriately sized polyethylene bags and seal the bags. If available, the use of Whirl-Pak bags is preferable, if unavailable seal regular bags with tape (plastic electrical tape).

3.5.4 Select a sturdy cooler in good repair. Secure and tape the drain plug with fiber or duct tape inside and outside. Line the cooler with a large heavy duty plastic bag.

3.5.5 Place cushioning/absorbent material in the bottom of the cooler and then place the containers in the cooler with sufficient space to allow for the addition of cushioning between the containers.

3.5.6 .If required by the method for preservation, put "blue ice" (or ice that has been "double bagged" in heavy duty polyethylene bags and properly sealed) on top of and/or between the containers. Fill all remaining space between the containers with absorbent material.

3.5.7. If the samples are preserved with ice, include a temperature blank for the laboratory to verify that the samples are received at the appropriate temperature.

3.5.8 Securely fasten the top of the large garbage bag with tape (preferably plastic electrical tape).

3.5.9 Place the Chain-of-Custody Record or the CLP Traffic Report Form (if applicable) into a plastic bag and tape the bag to the inner side of the cooler lid.

3.5.10 Close the cooler and securely tape (preferably with fiber tape) the top of the cooler shut. Chain-of-custody seals should be affixed to the top and sides of the cooler within the securing tape so that the cooler cannot be opened without breaking the seal.

4 References

International Air Transport Authority (IATA). Dangerous Goods Regulations, Most Recent Version.

Title 40 Code of Federal Regulations (CFR), Pt. 136.3, Identification of Test Procedures, July 1, 2001. See Table II, Footnote 3.

Title 49 CFR, Pt. 171.1(d)(5), Applicability of Hazardous Materials Regulations (HMR) to Persons and Functions.

United States Department of Transportation (US DOT). 2003. Letter from Edward T. Mazzullo, Director, Office of Hazardous Materials Standards, to Henry L. Longest II, Acting Assistant Administrator, USEPA, Ref No. 02-0093, February 13, 2003.

US Environmental Protection Agency (US EPA) Order 1000.18, February 16, 1979.

US EPA. 1981. "Final Regulation Package for Compliance with DOT Regulations in the Shipment of Environmental Laboratory Samples," Memo from David Weitzman, Work Group Chairman, Office of Occupational Health and Safety (PM-273), April 13, 1981.

US EPA. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (LSASD), Athens, GA.

US EPA. Analytical Support Branch Laboratory Operations and Quality Assurance Manual. Region 4 LSASD, Athens, GA, Most Recent Version.

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 LSASD Athens, GA, Most Recent Version.

5 Revision History

This table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the LSASD Quality Assurance Coordinator on the LSASD local area network (LAN).

History	Effective Date
LSASDPROC-209-R4 *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples*, replaces LSASDPROC-209-R3 Reformatted document to Divisional Format	February 23, 2020
LSASDPROC-209-R3, *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples*, replaces LSASDPROC-209-R2.	February 4, 2015

Cover Page: Changes made to reflect reorganization of LSASD from two field branches to one: John Deatrick listed as the Chief, Field Services Branch. The FQM was changed from Liza Montalvo to Hunter Johnson. **Revision History:** Changes were made to reflect the current practice of only including the most recent changes in the revision history.	
LSASDPROC-209-R2, *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples*, replaces LSASDPROC-209-R1.	April 20, 2011
LSASDPROC-209-R1, *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples*, replaces LSASDPROC-209-R0.	November 1, 2007
LSASDPROC-209-R0, Packing, Marking, Labeling and Shipping of Environmental and Waste Samples, Original Issue	February 05, 2007

Region 4 **U.S. Environmental Protection Agency** **Laboratory Services and Applied Science Division** **Athens, Georgia**	
Operating Procedure	
Title: Soil Sampling	ID: LSASDPROC-300-R4
Issuing Authority: LSASD Field Branch Chief	
Effective Date: June 11, 2020	Review Due Date: June 11, 2024

Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when collecting soil samples for field screening or laboratory analysis.

Scope/Application

The procedures contained in this document are to be used by field personnel when collecting and handling soil samples in the field. On the occasion that LSASD field personnel determine that any of the procedures described in this section are inappropriate, inadequate or impractical and that another procedure must be used to obtain a soil sample, the variant procedure will be documented in the field logbook and subsequent investigation report, along with a description of the circumstances requiring its use. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

Table of Contents

1 General Information

1.1 Documentation/Verification

This procedure was prepared by persons deemed technically competent by LSASD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the LSASD local area network (LAN). The QAC is responsible for ensuring the most recent version of the procedure is placed on the LAN, and for maintaining records of review conducted prior to its issuance.

1.2 General Precautions

1.2.1 Safety

Proper safety precautions must be observed when collecting soil samples. Refer to the LSASD Safety and Occupational Health Manual and any pertinent site-specific Health and Safety Plans (HASP) and Job Hazard Assessments for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. The reader should address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.2.2 Procedural Precautions

The following precautions should be considered when collecting soil samples:

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody sealed during long-term storage or shipment.
- Collected samples are in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179), and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.
- Documentation of field sampling is done in a bound logbook.

- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- All shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader in the project files. (Air bills are generated online via UPS Campusship program and package tracking is done online). Receipts are not always received at time of shipping.
- Sampling in landscaped areas: Cuttings should be placed on plastic sheeting and returned to the borehole upon completion of the sample collection. Any 'turf plug' generated during the sampling process should be returned to the borehole.
- Sampling in non-landscaped areas: Return any unused sample material back to the auger, drill or push hole from which the sample was collected.

2 Special Sampling Considerations

2.1 Special Precautions for Trace Contaminant Soil Sampling

- A clean pair of new, non-powdered, disposable gloves will be worn each time a different sample is collected and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
- Sample containers with samples suspected of containing high concentrations of contaminants shall be handled and stored separately.
- All background samples shall be segregated from obvious high-concentration or waste samples. Sample collection activities shall proceed progressively from the least suspected contaminated area to the most suspected contaminated area. Samples of waste or highly-contaminated media must not be placed in the same ice chest as environmental (i.e., containing low contaminant levels) or background samples.
- If possible, one member of the field sampling team should take all the notes and photographs, fill out tags, etc., while the other member(s) collect the samples.
- Samplers must use new, verified/certified-clean disposable or non-disposable equipment cleaned according to procedures contained in the LSASD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205), for collection of samples for trace metals or organic compound analyses.

2.2 Sample Homogenization

1. If sub-sampling of the primary sample is to be performed in the laboratory, transfer the entire primary sample directly into an appropriate, labeled sample container(s). Proceed to step 4.

2. If sub-sampling the primary sample in the field or compositing multiple primary samples in the field, place the sample into a glass or stainless steel homogenization container and mix thoroughly. Each aliquot of a composite sample should be of the same approximate volume.

3. All soil samples must be thoroughly mixed to ensure that the sample is as representative as possible of the sample media. ***Samples for VOC analysis are not homogenized.*** The most common method of mixing is referred to as quartering. The quartering procedure should be performed as follows:

   - The material in the sample pan should be divided into quarters and each quarter should be mixed individually.
   - Two quarters should then be mixed to form halves.
   - The two halves should be mixed to form a homogenous matrix.

   This procedure should be repeated several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning the material over.

4. Place the sample into an appropriate, labeled container(s) by using the alternate shoveling method and secure the cap(s) tightly. The alternate shoveling method involves placing a spoonful of soil in each container in sequence and repeating until the containers are full or the sample volume has been exhausted. Threads on the container and lid should be cleaned to ensure a tight seal when closed.

2.3 Dressing Soil Surfaces

Any time a vertical or near vertical surface is sampled, such as achieved when shovels or similar devices are used for subsurface sampling, the surface should be dressed (scraped) to remove smeared soil. This is necessary to minimize the effects of contaminant migration interferences due to smearing of material from other levels.

2.4 Quality Control

If possible, a control sample should be collected from an area not affected by the possible contaminants of concern and submitted with the other samples. This control sample should be collected as close to the sampled area as possible and from the same soil type. Equipment blanks should be collected if equipment is field cleaned and re-used on-site or if necessary to document that low-level contaminants were not introduced by sampling tools. LSASD Operating Procedure for Field Sampling Quality Control (SESDPROC-011) contains other procedures that may be applicable to soil sampling investigations.

2.5 Records

Field notes, recorded in a bound field logbook, as well as chain-of-custody documentation will be generated as described in the LSASD Operating Procedure for Logbooks (SESDPROC-010) and the LSASD Operating Procedure for Sample and Evidence Management (SESDPROC-005).

3 Samples Collected for Volatile Organic Compounds (VOC) or for Per- and Polyfluoroalkyl Substances (PFAS) Analyses

3.1 Soil Samples Collected for Volatile Organic Compounds (VOC) Analysis

The procedures outlined here are summarized from *Test Methods for Evaluating SolidWaste, Physical/Chemical Methods SW-846, Method 5035.*If samples are to be analyzed for VOCs, they should be collected in a manner that minimizes disturbance of the sample. For example, when sampling with an auger bucket, the sample for VOC analysis should be collected directly from the auger bucket (preferred) or from minimally disturbed material immediately after an auger bucket is emptied into the pan. The sample shall be containerized by filling an En Core® Sampler or other Method 5035 compatible container. ***Samples for VOC analysis are not homogenized.*** Preservatives may be required for some samples with certain variations of Method 5035. Consult the method or the principal analytical chemist to determine if preservatives are necessary.

3.2 Soil Sampling for VOCs (Method 5035)

The following sampling protocol is recommended for site investigators assessing the extent of VOCs in soils at a project site. Because of the large number of options

available, careful coordination between field and laboratory personnel is needed. The specific sampling containers and sampling tools required will depend upon the detection levels and intended data use. Once this information has been established, selection of the appropriate sampling procedure and preservation method best applicable to the investigation can be made.

3.2.1 Equipment

Soil for VOC analyses may be retrieved using any of the LSASD soil sampling methods described in Sections 4 through 8 of this procedure. Once the soil has been obtained, the En Core® Sampler, syringes, stainless steel spatula, standard 2-oz. soil VOC container, or pre-prepared 40 mL vials may be used/required for sub-sampling. The specific sample containers and the sampling tools required will depend upon the data quality objectives established for the site or sampling investigation. The various sub-sampling methods are described below.

3.2.2 Sampling Methodology - Low Concentrations (<200 µg/kg)

When the total VOC concentration in the soil is expected to be less than 200 µg/kg, the samples may be collected directly with the En Core® Sampler or syringe. If using the syringes, the sample must be placed in the sample container (40 mL pre-prepared vial) immediately to reduce volatilization losses. The 40 mL vials should contain 10 mL of organic-free water for an un-preserved sample or approximately 10 mL of organic-free water and a preservative. It is recommended that the 40 mL vials be prepared and weighed by the laboratory (commercial sources are available which supply preserved and tared vials). When sampling directly with the En Core® Sampler, the vial must be immediately capped and locked.

A soil sample for VOC analysis may also be collected with conventional sampling equipment. A sample collected in this fashion must either be placed in the final sample container (En Core® Sampler or 40 mL pre-prepared vial) immediately or the sample may be immediately placed into an intermediate sample container with no head space. If an intermediate container (usually 2-oz. soil jar) is used, the sample must be transferred to the final sample container (En Core® Sampler or 40 mL pre-prepared vial) as soon as possible, not to exceed 30 minutes.

NOTE: After collection of the sample into either the En Core® Sampler or other container, the sample must immediately be stored in an ice chest and cooled.

Soil samples may be prepared for shipping and analysis as follows:

En Core® Sampler - the sample shall be capped, locked, and secured in the original foil bag. All foil bags containing En Core® samplers are then placed in a plastic bag and sealed with custody tape, if required.

Syringe - Add about 3.7 cc (approximately 5 grams) of sample material to 40-mL pre-prepared containers. Secure the containers in a plastic bag. Do not use a custody seal on the container; place the custody seal on the plastic bag. Note: When using the syringes, it is important that no air is allowed to become trapped behind the sample prior to extrusion, as this will adversely affect the sample.

Stainless Steel Laboratory Spatulas - Add between 4.5 and 5.5 grams (approximate) of sample material to 40 mL containers. Secure the containers in a plastic bag. Do not use a custody seal on the container; place the custody seal on the plastic bag.

3.2.3 Sampling Methodology - High Concentrations (>200 µg/kg)

Based upon the data quality objectives and the detection level requirements, this high-level method may also be used. Specifically, the sample may be packed into a single 2-oz. glass container with a screw cap and septum seal. The sample container must be filled quickly and completely to eliminate head space. Soils\sediments containing high total VOC concentrations may also be collected as described in Section 3.2.2, Sampling Methodology - Low Concentrations, and preserved using 10 mL methanol.

3.2.4 Special Techniques and Considerations for Method 5035

Effervescence

If low concentration samples effervesce (rapidly form bubbles) from contact with the acid preservative, then either a test for effervescence must be performed prior to sampling, or the investigators must be prepared to collect each sample both preserved or un-preserved, as needed, or all samples must be collected unpreserved.

To check for effervescence, collect a test sample and add to a pre-preserved vial. If preservation (acidification) of the sample results in effervescence then preservation by acidification is not acceptable, and the sample must be collected un-preserved.

If effervescence occurs and only pre-preserved sample vials are available, the preservative solution may be placed into an appropriate hazardous waste container and the vials triple rinsed with organic free water. An appropriate amount of organic free water, equal to the amount of preservative solution, should be placed

into the vial. The sample may then be collected as an un-preserved sample. Note: the amount of organic free water placed into the vials will have to be accurately measured.

Sample Size

While this method is an improvement over earlier ones, field investigators must be aware of an inherent limitation. Because of the extremely small sample size and the lack of sample mixing, sample representativeness for VOCs may be reduced compared to samples with larger volumes collected for other constituents. The sampling design and objectives of the investigation should take this into consideration.

Holding Times

Sample holding times are specified in the Laboratory Services Branch *Laboratory Operations and Quality Assurance Manual* (ASBLOQAM), Most Recent Version. Field investigators should note that the holding time for an un-preserved VOC soil/sediment sample on ice is 48 hours. Arrangements should be made to ship the soil/sediment VOC samples to the laboratory by overnight delivery the day they are collected so the laboratory may preserve and/or analyze the sample within 48 hours of collection.

Percent Solids

Samplers must ensure that the laboratory has sufficient material to determine percent solids in the VOC soil/sediment sample to correct the analytical results to dry weight. If other analyses requiring percent solids determination are being performed upon the sample, these results may be used. If not, a separate sample (minimum of 2 oz.) for percent solids determination will be required. The sample collected for percent solids may also be used by the laboratory to check for preservative compatibility.

Safety

Methanol is a toxic and flammable liquid. Therefore, methanol must be handled with all required safety precautions related to toxic and flammable liquids. Inhalation of methanol vapors must be avoided. Vials should be opened and closed quickly during the sample preservation procedure. Methanol must be handled in a ventilated area. Use protective gloves when handling the methanol vials. Store methanol away from sources of ignition such as extreme heat or open flames. The vials of methanol should be stored in a cooler with ice at all times.

Shipping

Methanol and sodium bisulfate are considered dangerous goods, therefore shipment of samples preserved with these materials by common carrier is regulated by the U.S. Department of Transportation and the International Air Transport Association (IATA). The rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179) and the current edition of the IATA Dangerous Goods Regulations must be followed when shipping methanol and sodium bisulfate. Consult the above documents or the carrier for additional information. Shipment of the quantities of methanol and sodium bisulfate used for sample preservation falls under the exemption for small quantities.

The summary table on the following page lists the options available for compliance with SW846 Method 5035. The advantages and disadvantages are noted for each option. LASSD's goal is to minimize the use of hazardous material (methanol and sodium bisulfate) and minimize the generation of hazardous waste during sample collection.

Table 1: Method 5035 Summary

OPTION	PROCEDURE	ADVANTAGES	DISADVANTAGES
1	Collect two 40 mL vials with ≈ 5 grams of sample, and one 2 oz. glass jar w/septum lid for screening, % moisture and preservative compatibility.	Screening conducted by lab.	Presently a 48-hour holding time for unpreserved samples. Sample containers must be tared.
2	Collect three En Core® samplers, and one 2 oz. glass jar w/septum lid for screening, % solids.	Lab conducts all preservation/preparation procedures.	Presently a 48- hour holding time for preparation of samples.
3	Collect two 40 mL vials with 5 grams of sample and preserve w/methanol or sodium bisulfate, and one 2-oz. glass jar w/septum lid for screening, % solids .	High level VOC samples may be composited. Longer holding time.	Hazardous materials used in the field. Sample containers must be tared.
4	Collect one 2-oz. glass jar w/septum lid for analysis, % solids (high level VOC only).	Lab conducts all preservation/preparation procedures.	May have significant VOC loss.

3.3 Soil Samples for Per- and Polyfluoroalkyl Substances (PFAS) Analysis

Sources of PFAS contamination in soils can include direct discharges, direct applications of some PFAS products such as aqueous film-forming foams (AFFF), air deposition from manufacturing stack emissions, landfill leachate, and land applications of biosolids or effluents. The distribution of PFAS in soils is multifaceted and will be dependent on site-specific conditions and soils as well as the individual properties of the PFAS such as chain length and functional group. Heavy PFAS contamination of subsurface soils can serve as long-term sources for both groundwater and surface water contamination. For more information about conducting site investigations for PFAS, please see the Interstate Technology and Regulatory Council's (ITRC's) April 2020 Fact Sheets: *Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)*, and *Environmental Fate and Transport for Per- and Polyfluoroalkyl Substances*.

3.3.1 Sampling Equipment

Guidance documents recommend sampling equipment be made of stainless-steel, high-density polyethylene (HDPE), polypropylene, and/or silicone. Standard soil sampling equipment such as stainless-steel spoons, hand augers, and direct push samplers with liners that are PFAS-free can be used to collect samples for PFAS analyses. Direct contact sampling equipment that will be used to collect samples for PFAS analyses should be decontaminated following the procedures in the *Field Equipment Cleaning and Decontamination at the FEC*, LSASDPROC-206.

3.3.2 PFAS Soil Sample Mixing and Homogenization Considerations

Because studies have shown the loss of PFAS due to adsorption to surfaces, samples should be minimally handled and directly placed into the sample container when possible. Sample preparation procedures should be specified in the Sampling and Analysis Plan (SAP). If compositing, mixing or homogenization of the sample is desired, it should preferably be done at the laboratory so that a representative subsample will be analyzed. In cases where the homogenization is conducted in the field, extra grab samples should accompany the mixed or composited samples to determine the variability and impacts on PFAS concentrations of the mixed samples.

3.3.3 Trace Level Sampling Technique for PFAS

To prevent PFAS contamination, **extreme care** is required when handling containers, samples and equipment that will be used to collect samples for PFAS analyses. **New gloves** need to be worn when decontaminating and handling sample containers and equipment. When worn gloves become compromised by potential PFAS containing materials, they need to be changed for new gloves. Nitrile gloves are recommended for PFAS sampling investigations. Also, sample containers should be kept covered in original packaging or in Whirl-Paks® until ready for use due to potential PFAS

contamination from air deposition of vapors, aerosols, and particulates.

This trace level sampling technique is used to minimize PFAS contamination of the samples. This process will require two field personnel for PFAS sample collection. When the field investigators are prepared to fill the sample container(s), a designated sampler will don new gloves while a second designee, also with new gloves, will assist by opening sample container packaging/Whirl-Pak®. The designated sampler removes the sample container(s) from the packaging but keeps them closed. Only after the second designee is ready to fill the sample container does the designated sampler remove the cap and hold it in their hand until the appropriate sample volume is obtained. After capping the sample container(s), return them to their Whirl-Pak®. The designated sampler who holds the sample container(s) should not touch anything else during the sample collection process. This is important because of the wide use of PFAS in commercial products such as clothing, field gear, personnel protective equipment, sunscreen, insect repellants, and personal hygiene products. Additionally, the designated sampler should avoid touching the sample media and the inside of the sample container. The second designee will operate sampling equipment and assist with sample container packaging and labeling. Sampling equipment known or suspected to contain PFAS should be avoided during sampling activities.

3.3.4 Quality Control Samples and Standard Operating Procedures

For soil samples undergoing PFAS analyses, it extremely important that quality control samples be collected as part of the investigation to account for the PFAS contribution of the sample containers, decontamination solutions, gloves, decontaminated equipment and plastic used to store equipment. Equipment rinse and material blanks are needed for PFAS sampling investigations to assess the direct contact sampling equipment impact on the sampling results. It is also helpful to take field quality control samples such as field blanks, duplicates, and trip blanks to evaluate the soil sampling and sample handling activities of the investigation. Laboratory sources of water used for equipment decontamination and blank sample collection should be produced as PFAS-free or assessed for background concentrations of PFAS.

Along with a good quality assurance program, standard operating procedures (SOPs) and detailed SAPs are required for PFAS investigations to provide consistency between samplers and investigations.

4 Manual Soil Sampling Methods

4.1 General

These methods are used primarily to collect surface and shallow subsurface soil samples. Surface soils are generally classified as soils between the ground surface and 6 to 12 inches below ground surface. The most common interval is 0 to 6 inches; however, the data quality objectives of the investigation may dictate another interval, such as 0 to 3 inches for risk assessment purposes. The shallow subsurface interval may be considered to extend from approximately 12 inches below ground surface to a site-specific depth at which sample collection using manual collection methods becomes impractical.

If a thick, matted root zone, gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials.

When compositing, make sure that each composite location (aliquot) consist of equal volumes, i.e., same number of equal spoonfuls.

4.2 Spoons

Stainless steel spoons may be used for surface soil sampling to depths of approximately 6 inches below ground surface where conditions are generally soft and non-indurated, and there is no problematic vegetative layer to penetrate.

4.2.1 Special Considerations When Using Spoons

When using stainless steel spoons, consideration must be given to the procedure used to collect the volatile organic compound sample. If the soil being sampled is cohesive and holds its in situ texture in the spoon, the En Core® Sampler or syringe used to collect the sub-sample for Method 5035 should be plugged directly from the spoon. If, however, the soil is not cohesive and crumbles when removed from the ground surface for sampling, consideration should be given to plugging the sample for Method 5035 directly from the ground surface at a depth appropriate for the investigation Data Quality Objectives.

4.3 Hand Augers

Hand augers may be used to advance boreholes and collect soil samples in the surface and shallow subsurface intervals. Typically, 3-inch stainless steel auger buckets with cutting

heads are used. The bucket is advanced by simultaneously pushing and turning using an attached handle with extensions (if needed).

4.3.1 Surface Soil Sampling

When conducting surface soil sampling with hand augers, the auger buckets may be used with a handle alone or with a handle and extensions. The bucket is advanced to the appropriate depth and the contents are transferred to the homogenization container for processing. Observe precautions for volatile organic compound and PFAS sample collection found in Section 3.

4.3.2 Subsurface Soil Sampling

Hand augers are the most common equipment used to collect shallow subsurface soil samples. Auger holes are advanced one bucket at a time until the sample depth is achieved. When the sample depth is reached, the bucket used to advance the hole is removed and a clean bucket is attached. The clean auger bucket is then placed in the hole and filled with soil to make up the sample and removed.

The practical depth of investigation using a hand auger depends upon the soil properties and depth of investigation. In sand, augering is usually easily performed, but the depth of collection is limited to the depth at which the sand begins to flow or collapse. Hand augers may also be of limited use in tight clays or cemented sands. In these soil types, the greater the depth attempted, the more difficult it is to recover a sample due to increased friction and torqueing of the hand auger extensions. At some point these problems become so severe that power equipment must be used.

4.3.3 Special Considerations for Soil Sampling with the Hand Auger

- Because of the tendency for the auger bucket to scrape material from the sides of the auger hole while being extracted, the top several inches of soil in the auger bucket should be discarded prior to placing the bucket contents in the homogenization container for processing.
- Observe precautions for volatile organic compound (VOC) and PFAS sample collection found in Section 3. Collect the VOC sample directly from the auger bucket, if possible.
- Power augers, such as the Little Beaver® and drill rigs may be used to advance boreholes to depths for subsurface soil sampling with the hand auger. They may not be used for sample collection. When power augers are used to advance a borehole to depth for sampling, care must be taken that exhaust fumes, gasoline and/or oil do not contaminate the borehole or area in the immediate vicinity of sampling.
- When moving to a new sampling location, the entire hand auger assembly must be replaced with a properly decontaminated hand auger assembly.

5 Direct Push Soil Sampling Methods

5.1 General

These methods are used primarily to collect shallow and deep subsurface soil samples. Three samplers are available for use within the Division's direct push tooling inventory. All of the sampling tools involve the collection and retrieval of the soil sample within a thin-walled liner. The following sections describe each of the specific sampling methods that can be accomplished using direct push techniques, along with details specific to each method. While LSASD currently uses the sample tooling described, tooling of similar design and materials is acceptable.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with these devices.

5.2 Large Bore® Soil Sampler

The Large Bore® (LB) sampler is a solid barrel direct push sampler equipped with a piston-rod point assembly used primarily for collection of depth-discrete subsurface soil samples. The sample barrel is approximately 30-inches (762 mm) long and has a 1.5-inch (38 mm) outside diameter. The LB® sampler is capable of recovering a discrete sample core 22 inches x 1.0 inch (559 mm x 25 mm) contained inside a removable liner. The resultant sample volume is a maximum of 283 mL.

After the LB® sample barrel is equipped with the cutting shoe and liner, the piston-rod point assembly is inserted, along with the drive head and piston stop assembly. The assembled sampler is driven to the desired sampling depth, at which time the piston stop pin is removed, freeing the push point. The LB® sampler is then pushed into the soil a distance equal to the length of the LB® sample barrel. The probe rod string, with the LB® sampler attached, is then removed from the subsurface. After retrieval, the LB® sampler is then removed from the probe rod string. The drive head is then removed to allow removal of the liner and soil sample.

5.3 Macro-Core® Soil Sampler

The Macro-Core® (MC) sampler is a solid barrel direct push sampler equipped with a piston-rod point assembly used primarily for collection of either continuous or depth-discrete subsurface soil samples. Although other lengths are available, the standard MC® sampler has an assembled length of approximately 52 inches (1321 mm) with an outside

diameter of 2.2 inches (56 mm). The MC® sampler is capable of recovering a discrete sample core 45 inches x 1.5 inches (1143 mm x 38 mm) contained inside a removable liner. The resultant sample volume is a maximum of 1300 mL. The MC® sampler may be used in either an open-tube or closed-point configuration. Although the MC® sampler can be used as an open-barrel sampler, in LSASD usage, the piston point is always used to prevent the collection of slough from the borehole sides.

5.4 Dual Tube Soil Sampling System

The Dual Tube 21 soil sampling system is a direct push system for collecting continuous core samples of unconsolidated materials from within a sealed outer casing of 2.125-inch (54 mm) OD probe rod. The samples are collected within a liner that is threaded onto the leading end of a string of 1.0-inch diameter probe rod. Collected samples have a volume of up to 800 mL in the form of a 1.125-inch x 48-inch (29 mm x 1219 mm) core. Use of this method allows for collection of continuous core inside a cased hole, minimizing or preventing cross-contamination between different intervals during sample collection. The outer casing is advanced, one core length at a time, with only the inner probe rod and core being removed and replaced between samples. If the sampling zone of interest begins at some depth below ground surface, a solid drive tip must be used to drive the dual tube assembly and core to its initial sample depth.

5.5 Special Considerations When Using Direct Push Sampling Methods

- *Liner Use and Material Selection* – Direct Push Soil Samples are collected within a liner to facilitate removal of sample material from the sample barrel. The liners may only be available in a limited number of materials for a given sample tool, although overall, liners are available in brass, stainless steel, cellulose acetate butyrate (CAB), polyethylene terepthalate glycol (PETG), polyvinyl chloride (PVC) and Teflon®. For most LSASD investigations, the standard polymer liner material for a sampling tool will be acceptable. When the study objectives require very low reporting levels or unusual contaminants of concern, the use of more inert liner materials such as Teflon® or stainless steel may be necessary.

- *Sample Orientation* – When the liners and associated sample are removed from the sample tubes, it is important to maintain the proper orientation of the sample. This is particularly important when multiple sample depths are collected from the same push. It is also important to maintain proper orientation to define precisely the depth at which an aliquot was collected. Maintaining proper orientation is typically accomplished using vinyl end caps. Convention is to place red caps on the top of the liner and black caps on the bottom to maintain proper sample orientation. Orientation can also be indicated by marking on the exterior of the liner with a permanent marker.

- *Core Catchers* – Occasionally the material being sampled lacks cohesiveness and is subject to crumbling and falling out of the sample liner. In cases such as these, the use of core catchers on the leading end of the sampler may help retain the sample until it is retrieved to the surface. Core catchers may only be available in specific materials and should be evaluated for suitability. However, given the limited sample contact that core-catchers have with the sample material, most standard core-catchers available for a tool system will be acceptable.

- *Decontamination* – The cutting shoe and piston rod point are to be decontaminated between each sample, using the procedures specified for the collection of trace organic and inorganic compounds found in Field Equipment and Decontamination – SESDPROC-205, most recent version. Within a borehole, the sample barrel, rods, and drive head may be subjected to an abbreviated cleaning to remove obvious and loose material, but must be cleaned between boreholes using the procedures specified for downhole drilling equipment in Field Equipment and Decontamination – SESDPROC-205, most recent version.

- *Decommissioning* – Boreholes must be decommissioned after the completion of sampling. Boreholes less than 10 feet deep that remain open and do not approach the water table may be decommissioned by pouring 30% solids bentonite grout from the surface or pouring bentonite pellets from the surface, hydrating the pellets in lifts. Boreholes deeper than 10 feet, or any borehole that intercepts groundwater, must be decommissioned by pressure grouting with 30% solids bentonite grout, either through a re-entry tool string or through tremie pipe introduced to within several feet of the borehole bottom.

- *VOC and PFAS Sample Collection* – Observe precautions for volatile organic compounds and Per- and Polyfluoroalkyl Substances sample collection found in Section 3 of this procedure.

6 Split Spoon/Drill Rig Methods

6.1 General

Split spoon sampling methods are used primarily to collect shallow and deep subsurface soil samples. All split spoon samplers, regardless of size, are basically split cylindrical barrels that are threaded on each end. The leading end is held together with a beveled threaded collar that functions as a cutting shoe. The other end is held together with a threaded collar that serves as the sub used to attach the spoon to the string of drill rod. Two basic methods are available for use, including the smaller diameter standard split spoon, driven with the drill rig safety hammer, and the larger diameter continuous split spoon,

advanced inside and slightly ahead of the lead auger during hollow stem auger drilling. The following sections describe each of the specific sampling methods, along with details specific to each method.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with these devices.

6.2 Standard Split Spoon

A drill rig is used to advance a borehole to the target depth. The drill string is then removed and a standard split spoon is attached to a string of drill rod. Split spoons used for soil sampling must be constructed of stainless steel and are typically 2.0-inches OD (1.5-inches ID) and 18-inches to 24-inches in length. Other diameters and lengths are common and may be used if constructed of the proper material. After the spoon is attached to the string of drill rod, it is lowered into the borehole. The safety hammer is then used to drive the split spoon into the soil at the bottom of the borehole. After the split spoon has been driven into the soil, filling the spoon, it is retrieved to the surface, where it is removed from the drill rod string and opened for sample acquisition.

6.3 Continuous Split Spoon

The continuous split spoon is a large diameter split spoon that is advanced into the soil column inside a hollow stem auger. Continuous split spoons are typically 3 to 5 inches in diameter and either 5 feet or 10 feet in length, although the 5-foot long samplers are most common. After the auger string has been advanced into the soil column a distance equal to the length of the sampler being used it is returned to the surface. The sampler is removed from inside the hollow stem auger and the threaded collars are removed. The split spoon is then opened for sampling.

6.4 Special Considerations When Using Split Spoon Sampling Methods

- Always discard the top several inches of material in the spoon before removing any portion for sampling. This material normally consists of borehole wall material that has sloughed off of the borehole wall after removal of the drill string prior to and during inserting the split spoon.
- Observe precautions for volatile organic compounds and Per- and Polyfluoroalkyl Substances sample collection found in Section 3.

7 Shelby Tube/Thin-Walled Sampling Methods

7.1 General

Shelby tubes, also referred to generically as thin-walled push tubes or Acker thin-walled samplers, are used to collect subsurface soil samples in cohesive soils and clays during drilling activities. In addition to samples for chemical analyses, Shelby tubes are also used to collect relatively undisturbed soil samples for geotechnical analyses, such as hydraulic conductivity and permeability, to support hydrogeologic characterizations at hazardous waste and other sites.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with this device.

7.2 Shelby Tube Sampling Method

A typical Shelby tube is 30 inches in length and has a 3.0-inch OD (2.875-inch ID) and may be constructed of steel, stainless steel, galvanized steel, or brass. They also typically are attached to push heads that are constructed with a ball-check to aid in holding the contained sample during retrieval. If used for collecting samples for chemical analyses, it must be constructed of stainless steel. If used for collecting samples for standard geotechnical parameters, any material is acceptable.

To collect a sample, the tube is attached to a string of drill rod and is lowered into the borehole, where the sampler is then pressed into the undisturbed material by hydraulic force. After retrieval to the surface, the tube containing the sample is then removed from the sampler head. If samples for chemical analyses are needed, the soil contained inside the tube is then removed for sample acquisition. If the sample is collected for geotechnical parameters, the tube is typically capped, maintaining the sample in its relatively undisturbed state, and shipped to the appropriate geotechnical laboratory.

7.3 Special Considerations When Using Split Spoon Sampling Methods

Observe precautions for volatile organic compounds and Per- and Polyfluoroalkyl Substances sample collection found in Section 3.

8 Backhoe Sampling Method

8.1 General

Backhoes may be used in the collection of surface and shallow subsurface soil samples. The trenches created by excavation with a backhoe offer the capability of collecting samples from very specific intervals and allow visual correlation with vertically and horizontally adjacent material. If possible, the sample should be collected without entering the trench. Samples may be obtained from the trench wall or they may be obtained directly from the bucket at the surface. The following sections describe various techniques for safely collecting representative soil samples with the aid of a backhoe.

The depth measurement for the sample begins at the top of the soil horizon.

8.2 Scoop-and-Bracket Method

If a sample interval is targeted from the surface, it can be sampled using a stainless steel scoop and bracket. First a scoop and bracket are affixed to a length of conduit and is lowered into the backhoe pit. The first step is to take the scoop and scrape away the soil comprising the surface of the excavated wall. This material likely represents soil that has been smeared by the backhoe bucket from adjacent material. After the smeared material has been scraped off, the original stainless steel scoop is removed and a clean stainless steel scoop is placed on the bracket. The clean scoop can then be used to remove sufficient volume of soil from the excavation wall to make up the required sample volume.

8.3 Direct-from-Bucket Method

It is also possible to collect soil samples directly from the backhoe bucket at the surface. Some precision with respect to actual depth or location may be lost with this method but if the soil to be sampled is uniquely distinguishable from the adjacent or nearby soils, it may be possible to characterize the material as to location and depth. In order to ensure representativeness, it is also advisable to dress the surface to be sampled by scraping off any smeared material that may cross-contaminate the sample.

8.4 Special Considerations When Sampling with a Backhoe

- Do not physically enter backhoe excavations to collect a sample. Use either procedure 8.2, Scoop-and-Bracket Method, or procedure 8.3, Direct-from-Bucket Method to obtain soil for sampling.

- Smearing is an important issue when sampling with a backhoe. Measures must be taken, such as dressing the surfaces to be sampled (see Section 2.3), to mitigate problems with smearing.
- Paint, grease and rust must be removed and the bucket decontaminated prior to sample collection.
- Observe precautions for volatile organic compound and PFAS sample collection found in Section 3.

9 Incremental Sampling Method

9.1 General

ISM is a structured composite sampling and processing protocol that reduces data variability and provides an unbiased estimate of mean contaminant concentrations in the area targeted for sampling. ISM provides representative samples of specific soil volumes defined as decision units (DUs) by collecting numerous increments of soil (typically 30–100) that are combined, processed, and subsampled according to specific protocols. Triplicate samples are collected to measure and evaluate the reproducibility of the sample data.

Like all sampling approaches, ISM should be applied within a systematic planning framework. The size, orientation, and location of a DU is site-specific and represents the smallest volume of soil about which a decision is to be made (USEPA 1999, Ramsey and Hewitt 2005, HDOH 2008a, ADEC 2009). DUs are based on project-specific needs and site-specific DQOs. More detailed information on conducting sampling using ISM can be found in the Interstate Technology and Regulatory Council's *Incremental Sampling Methodology* (ISM-1).

9.2 Field Implementation, Sample Collection, and Processing

9.2.1 Introduction

The goal of most sampling efforts is to collect a sample that is representative of the target area (or DU). ISM is designed to collect representative and reproducible soil data. To help ensure data quality, all field sampling and field processing activities should be performed and supervised by personnel trained in ISM implementation

9.2.2 Sampling Tools

The selection of the appropriate sampling tool for collecting an ISM sample depends on the cohesiveness and composition of the soil substrate. The sampling tool should obtain cylindrical or core-shaped increments of a constant depth from the presented surface so that each increment collected is the same approximate volume and mass.

See Figures 1 and 2 for examples of sampling tools for nonvolatile ISM sample collection. Various other hand augers, core sampling tools, step probes, etc., are available from environmental or agricultural suppliers and are applicable to ISM if the specifications meet project DQOs. It is highly recommended that the proposed sampling tool is tested at the sample location prior to full mobilization to ensure that the sampling tool is appropriate for site conditions. If a pilot sampling effort is not possible, a variety of tools to address different soil types or site conditions should be taken into the field.

Note: Volatile ISM sample collection should follow Method 5035 recommendations. See Section 3 of this SOP.

9.2.3 Field Collection

Incremental soil samples are prepared by collecting multiple increments of soil (typically 30 or more) from a specified DU and physically combining these increments into a single sample, referred to as the "incremental sample." Samples are collected in triplicate from different locations within the same DU. Sample increments locations can be selected by a random number generator or evenly spaced across the DU to ensure that the incremental sample is representative of the DU. Survey flags or other markers can be helpful in identifying increment collection locations prior to beginning sample location.

The number of increments to be collected from each DU of a site investigation should be evaluated during systematic planning as part of the DQO process and documented in the sampling and analysis plan (SAP).See section 5.3.2 of ISM-1 for subsurface ISM sample collection.

9.2.4 Field Handling of ISM Samples

ISM samples collect a larger volume of soil than discrete samples and will require a larger collection container than may be specified by the laboratory or that is typically used. For example, a gallon-sized sealable plastic bag or a liter glass jar may be used depending upon the suspect analytes. When building the incremental sample by collecting increments, it may be more practical to collect the sample in an aluminum pan, plastic bucket, stainless-steel bowl, or other easily transported

container until the entire sample has been collected. The final sample can then be processed in the field or transferred to a container for shipment to a laboratory for sample processing and analysis.

Processing of ISM samples is ideally performed in a laboratory. However, subsampling, disaggregation, drying, and sieving are some processing steps that may be required to be performed in the field. Field processing may be necessary if field analysis will be performed on the samples of if the laboratory is unable to perform the sample processing steps required. Any field processing steps should be rigorously performed to ensure that the sample representativeness is maintained through analysis. To ensure proper sample size reduction and representative subsampling, they should be performed using a 2-D Japanese slab cake and specialized subsampling tool, a riffle splitter, rotary cone sample splitter, or similar. Sample volume reduction of ISM samples should not be conducted with a stainless-steel spoon and a stainless-steel bowl. All sample processing equipment should be appropriately decontaminated between sample stations.

9.3 Special Considerations When Using Incremental Sampling Methods

- Selection of an appropriately sized and positioned Decision Unit is important to ensuring quality data and useful results
- Steps should be taken throughout the sampling effort to ensure that the representativeness of the sample is maintained from collection through analysis
- Advance coordination with the laboratory is necessary to ensure that the laboratory has the capability and capacity to conduct any sample processing that may be necessary. If the lab cannot complete the required processing steps, the sampling team may need to perform the sample processing steps in the field.

Figure 1

Figure 2

10 References

International Air Transport Authority (IATA). Dangerous Goods Regulations, Most Recent Version

LSASD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, Most Recent Version

LSASD Operating Procedure for Field Equipment Cleaning and Decontamination at the FEC, SESDPROC-206, Most Recent Version

LSASD Operating Procedure for Field Sampling Quality Control, SESDPROC-011, Most Recent Version

LSASD Operating Procedure for Field X-Ray Fluorescence (XRF) Measurement, SESDPROC-107, Most Recent Version

LSASD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

LSASD Operating Procedure for Sample and Evidence Management, SESDPROC-005, Most Recent Version

Title 49 Code of Federal Regulations, Pts. 171 to 179, Most Recent Version

US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846, Most Recent Version (Method 5035)

US EPA Region 4 Safety and Occupational Health Manual. Region 4 LSASD, Athens, GA, Most Recent Version

ITRC (Interstate Technology & Regulatory Council). 2012. Incremental Sampling Methodology. ISM-1. Washington, D.C.: Interstate Technology & Regulatory Council, Incremental Sampling Methodology Team. www.itrcweb.org.

ITRC (Interstate Technology and Regulatory Council) April 2020 Fact Sheets: *Site Characterization Considerations, Sampling Precautions,* and *Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)*, and *Environmental Fate and Transport for Per- and Polyfluoroalkyl Substances*

11 Revision History

The top row of this table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the LSASD Quality Assurance Coordinator (QAC) on the LSASD local area network (LAN).

History	Effective Date
LSASDPROC-300-R4, *Soil Sampling,* replaces SESDPROC-300-R3Added Section 3.3. Soil Samples Collected for PFAS Analysis. Added Section 9, Incremental Sampling Method including Figures 1 and 2. **General:** Throughout the document, mention of SESD was replaced with LSASD as appropriate. Mention of Document Control Coordinator changed to Quality Assurance Coordinator. **Cover Page:** Changed Kevin Simmons, Environmental Scientist to Life Scientist. Changed Acting Chief, John Deatrick of the Enforcement and Investigations Branch to Chief, Applied Science Branch. Changed Acting Chief, Laura Ackerman, Ecological Assessment Branch to Chief, Hunter Johnson, Superfund Section. Changed Bobby Lewis, Field Quality Manager, Science and Ecosystem Support Division to Stacie Masters, Quality Assurance Coordinator, Laboratory Services and Applied Science Division.	June 11, 2020
SESDPROC-300-R3, *Soil Sampling*, replaces SESDPROC-300-R2. **General:** Corrected any typographical, grammatical and/or editorial errors. **Title Page:** Updated the author from Fred Sloan to Kevin Simmons. Updated the Enforcement and Investigations Branch Chief from Archie Lee to Acting Chief, John Deatrick. Section 1.5.1: Added "The reader should" to last sentence of the paragraph. Section 1.5.2: Omitted "When sampling in landscaped areas," from first sentence of eighth bullet. Section 3.2.4: In the first paragraph, first sentence, added "(rapidly form bubbles)." Omitted "(rapidly form bubbles)" from second paragraph, second sentence. Any reference to "Percent Moisture and Preservation Compatibility (MOICA)" or "Percent Moisture" was changed to "Percent Solids", both in the text and in Table 1.	August 21, 2014
SESDPROC-300-R2, *Soil Sampling*, replaces SESDPROC-300-R1.	December 20, 2011

SESDPROC-300-R1, *Soil Sampling*, replaces SESDPROC-300-R0.	November 1, 2007
SESDPROC-300-R0, Soil Sampling, Original Issue	February 05, 2007

APPENDIX G

Corrective Action Flow Chart

CORRECTIVE ACTION PROCESS